

Financial Cost of Packaging Litter – Phase 2 – Final Report

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E.1.0 Executive Summary

Proposed amendments to current UK extended producer responsibility (EPR) obligations would broaden the scope of EPR to include litter clean-up in its obligations on cost coverage. This report and the accompanying model are intended to support the development and implementation of these amendments by providing indicative information on the nature and scale of those costs at national level.

The report features:

- Commentary on the scope of current reporting of costs through local authority revenue outturn reporting, variation in the provision of street cleansing across different types of UK local authorities (LAs), the perceived adequacy of street cleansing budgets to meet statutory minimum requirements, and the impacts of COVID-19. (Section 2.0).

The information on which commentary is provided was obtained through a combination of on-line surveys and interviews.

- An estimate of the costs of litter clean-up across the UK, with breakdowns presented for various classes of items which may be subject to EPR obligations and/or DRS (deposit return systems) in upcoming EPR reform:
 - Packaging
 - Within which, groups of items which are under consideration for inclusion in future deposit return schemes, to contribute to understanding of potential impact of scheme introduction, as follows –
 - DRS Class 1 (glass, metal, plastic beverage containers);
 - DRS Class 2 (cartons and pouches); and
 - DRS Class 3 (cups); and
 - Non-packaging
 - Within which, cigarette butts and chewing gum

Commentary on the key findings is also provided (Section 3.0).

This was modelled by using publicly reported street cleansing revenue outturn data as a starting point. Disaggregation and attribution to litter was done on the basis of previous research with local authorities and duty bodies in Scotland, as well as desk-based research, on-line surveys and interviews with LAs and duty bodies across the UK, conducted for this study. Costs associated with the specific compositional fractions of litter listed above were modelled on the basis of the available litter composition data, as well as, for chewing gum, interview questions about cost of chewing gum staining cleaning.

- The contribution that fly-tipped packaging waste makes to clean-up costs is considered in Section 4.0.

This was explored using national fly-tipping statistics for England and Wales, an estimate of the proportion of this that was most likely to be similar to household waste, commercial, construction or bulky waste, and composition data for the most relevant waste streams respectively.

- The potential impact of the introduction of a deposit refund system (DRS) for beverage containers on clean-up costs and their estimation is considered in Appendix 0.

This was explored on the basis of discussion with local authorities and analysis of illustrative composition scenarios.

Key findings

Total cost of litter clean-up

Local authorities incur costs for meeting their statutory duties regarding litter clean-up. This includes, manual sweeping and picking, provision and servicing of litter bins, mechanical sweeping, management of the service, and may also include litter-related education and enforcement. Total local authority street cleansing costs also include a variety of activities which are not litter-related, such as cleaning of detritus, graffiti, fly-tipping and removal of abandoned vehicles. The exact scope of the activities varies between local authorities. Costs modelled include staffing (including for admin, management, education, enforcement and monitoring), vehicles, equipment, facilities, and disposal. It is estimated that litter clean up by street cleansing departments ("primary" departments) amounts, on average, to 58% of the total street cleansing costs reported in local authority financial outturn data. This amounts to £586m.

In addition, other departments within most authorities incur costs for clearing litter. They include departments servicing parks, grounds and cemeteries, highway verges, or coastal areas. We refer to these as 'non-primary departments'. Additional expenditure by non-primary departments on litter is estimated to account for 10% of local authority expenditure on litter or £66m.

Other bodies who have a statutory duty to clear litter include transport authorities. We refer to them as 'other duty bodies'. They incur estimated costs of approx. £10m.

The total estimated cost of litter for UK local authorities and other duty bodies is summarised in table E1.

Table E1: UK Litter Costs,¹ Primary Local Authority Street Cleansing Departments,² Non-primary Local Authority Departments³ and Other Duty Bodies⁴

	Cost (£m)
Street Cleansing Department Litter Costs	586 <i>(of 1,013 total outturn – 58%)</i>
Non-primary Department Litter Costs	66
Other Duty Bodies' Litter Cost	10
Total	662

Total cost of the packaging element of litter

Overall, it is estimated that packaging accounts for 58% of the total cost of litter, amounting to £384m (Table E2). This reflects that although packaging makes up a majority of litter by volume (~85%), when count (~42%) and weight (~40%)⁵ are used to attribute cost for different components of litter provision, this brings the relative contribution down; as staff time for picking ground litter is the largest fraction of cost (attributed on the basis of count) this leads to count-based composition influencing the percentage attribution more than the other units.

Table E2: Percentage costs of packaging and its streams, all LA costs and duty bodies

	UK Cost, £m	Proportion of Total Litter Cost (%)
All Litter	662	100%
Non-packaging	278	42%
<i>Of which: Cigarette Butts</i>	46	7%
<i>Chewing Gum</i>	7	1.0%
Packaging	384	58%
<i>Of which: DRS 1</i>	172	26%
<i>DRS 2</i>	5	0.7%
<i>DRS 3</i>	42	6%

DRS Class 1 (glass, metal, plastic beverage containers); DRS Class 2 (cartons and pouches); DRS Class 3 (cups)

¹ The most recent available street cleansing cost data for each nation was used within the model, and is as follows:

- England: 2018/19
- Wales and Scotland: 2017/18
- Northern Ireland^d: 2016/17

² "Primary departments" are those such as Street Cleansing departments, that have most of the responsibility for litter clean-up in a local authority. However other departments, such as those caring for Parks and Grounds, will also be undertaking litter clean-up. These are referred to throughout the report as "non-primary departments".

³ Additional to those already included in street cleansing outturn costs.

⁴ For the duty bodies for which it was possible to determine costs. In the present study, costs were determined for road agencies, agencies for railways, and navigable waterways; it was not possible at this time to determine costs for other duty bodies such as Transport for London, educational establishments or Crown authorities.

⁵ Composition for England used as an illustration as influences overall UK composition most.

Costs of clearing ground litter v. litter bins

The majority of costs associated with packaging litter streams stem from ground litter clearance rather than installing, maintaining and emptying bins (Table E3). Based on estimates of proportion of staff time spent on different litter related activities, as well as allocation of all other components of cost such as equipment and vehicles to different litter streams, using information obtained from the interviews and surveys, we estimate that almost 65% of the litter expenditure is for ground litter, amounting to £381m, mainly due to the number of staff involved in the activity. The general current assumption is that ground litter accounts for approximately 45% of the material by volume (based on interviews with local authorities). This highlights the financial benefits that could potentially be seen from shifting ground litter into litter bins.

Table E3: Estimated Cost of Ground and Bin Litter, Primary Local Authority Departments

Stream	UK Spend (£m)	UK Spend, %
Ground	381	65%
Bin	205	35%
Total	586	100%

Clean-up costs for fly-tipped packaging items

The tonnage of fly-tipped packaging was estimated to be 4,166 tonnes out of a total of 94,430 tonnes of fly-tipped material. This is equivalent to 0.9% by weight of all litter (480,732 tonnes) and 1.9% by weight of all littered packaging (217,612 tonnes). A range of total costs of fly-tipping have been estimated by previous studies at £57.7m⁶ - £149m.⁷ A midpoint of £103m gives a cost per tonne of £1,091. Applying this to the packaging tonnage gives an estimate of £4.5m in costs. This is equivalent to 0.7% of all litter costs. Better information on incident type, size, composition and clean-up cost would be necessary to provide more certainty around this very indicative, initial estimate.

Adequacy of street cleansing budgets

The majority of authorities believe their budget is adequate to perform their statutory duties, but not to exceed these duties. 25% said that they struggle to meet requirements, while 12.5% occasionally or regularly fail to meet statutory requirements; this is a significant minority (37.5%) of authorities having difficulty meeting or failing to meet their statutory requirements owing to budgetary constraints. This may still be an underestimate, given the likely unwillingness of local authorities to state they are unable to meet statutory requirements.

⁶ Department for Environment Food and Rural Affairs (2017) Fly-tipping statistics for England, 2015/16, March 2017, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/595773/Fly-tipping_201516_statistical_release.pdf

⁷ Eunomia Research & Consulting (2017) Rethinking Waste Crime, April 2017, <https://www.eunomia.co.uk/report-category/topic/waste-recycling/waste-crime-3/>, (2014) Waste Crime: Tackling Britain's Dirty Secret, Report for ESA Education Trust, March 2014, http://www.esauk.org/esa_reports/ESAET_Waste_Crime_Tackling_Britains_Dirty_Secret_LIVE.pdf

Impacts of COVID

Increased cost

52% of local authorities surveyed said that costs of dealing with litter had already increased due to COVID-19. 40% stated that costs had remained the same and the remaining 8% had observed a decrease in cost. The increased cost is mainly attributed to increase in litter quantity. PPE has caused an additional expense, as well as increased administration and supervisory needs as teams must be managed in 'bubbles', with fewer crew members able to travel in vehicles together.

Changes in litter quantities

Although several authorities stated litter had reduced owing to the reduced footfall in town centres during the lockdown, many pointed out that there had been displacement of litter to green spaces, due to their increased use in the first full lockdown (March – May 2021), and that in fact this had driven an overall increase in litter.

Meeting statutory requirements

In some cases, furloughed or self-isolating staff members and the need for crews to operate in smaller 'bubbles' has made it more difficult to meet statutory requirements. There were several examples of local authorities moving resources between activities and departments in order to meet the needs of litter provision in green spaces and also household waste collection, which has kept expenditure stable overall, despite a mixture of positive or negative factors influencing cleansing requirements.

Recommendations

- The cost attributed to items of different types is highly sensitive to litter composition. It is important that composition of *collected* (rather than *in situ*) ground and bin litter is obtained for all the nations, according to a standard method (with appropriate and standardised item/group categories), which measures units in terms of count, weight and volume. This should also take into account seasonal variation to give a robust annual estimate for composition.
- In order improve the accuracy of the national cost estimates, and, perhaps more significantly, to move to a point where the model could determine cost for individual local authorities more accurately, for the purpose of allocating of EPR funds, the scope of financial reporting on litter, i.e. local authority revenue outturn, should be made more explicit in guidance, standardised across nations, and compliance with reporting convention improved by working with local authorities. It is recommended that the following costs for litter be reported together with Street Cleansing:
 - Costs for non-primary departments dealing with litter (such as parks and grounds, or beaches)
 - Central services, admin and strategy
 - Education and enforcement

Disposal costs, as they can be modelled fairly easily, are not *as* critical to include; but it is critical that they are reported consistently either together with Street Cleansing outturn, or with the rest of waste disposal.

- This model focusses on estimating cost at one point in time. In order to estimate costs over time as littering changes (i.e. anticipated reductions), whether local authorities would

either: reinvest saved resources and raise litter cleanliness standards, or reduce expenditure in response to reduced littering, or reallocate resources to different parts of the street cleansing service, an approach could be to monitor litter tonnage as well as litter composition, regularly, for a representative sample of places and times of year, and couple this with the outputs of a primary research task, to understand fixed and variable costs for a set of representative local authorities in order to obtain an estimate of marginal cost per tonne for different litter categories. Alternatively variable costs could be indexed to some measure of littering – like *in situ* counts with a purposely developed methodology – however methods for doing so that are robust enough to reliably detect change over time are undeveloped, with relevant methods at a very early stage of development and highly subject to methodological issues or incomparabilities (such as inability to standardize to last cleansing time, unknown variance (“noise”) and hence necessary sample size, or bias for items that accumulate, *inter alia*).

- EPR fees could cover cost of improvements in data collection that would facilitate the determination of costs.

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Glossary

DRS – Deposit return system
 DRS Class 1 (glass, metal, plastic beverage containers)
 DRS Class 2 (cartons and pouches)
 DRS Class 3 (cups)
 EPR – Extended Producer Responsibility
 LA – Local Authority

Acknowledgements

We would like to thank all the local authority street cleansing services and other duty bodies who gave their time to speak to us about their litter provision.

1.0 Introduction

Eunomia Research & Consulting Ltd. (Eunomia) is pleased to present this report on the financial cost of packaging litter to the Waste and Resources Action Programme (WRAP). WRAP have commissioned this work following a number of policy developments. In particular, following the publication of the National Litter Strategy in 2017, Defra indicated in the Waste and Resources Strategy (2018) that it will take the following actions of relevance:

- Increase the costs covered by existing EPR for packaging to include “full costs of disposal”; rather than a proportion of the costs for collection and recycling, as it currently stands – by 2023. This may however only include collection, recycling, disposal, reduction of littering and communications related to littering “subject to consultation”.
- Bring other product types into the scope of EPR.

Following the consultation on the reform of the UK Packaging Producer Responsibility System in February 2019, the government stated its intention to include in the definition of “full costs” all litter clean-up, collection, transport and disposal costs, as well as the cost of providing anti-littering information to consumers and additionally the collection and reporting of litter waste management data. The consultation paper also states that:

“Further work would be required to determine these costs and would need to take account of the introduction of any DRS [deposit return scheme].”

The implication of this is that if costs are estimated before items are significantly removed from the litter waste stream, as might be expected to result from inclusion in a DRS scheme, they will be overestimated. Therefore, understanding the cost attributed to items that could be subject to DRS – predominantly drinks containers of different types – and what the implications might be of their reduction in the litter waste stream, is addressed in this report.

The report and accompanying modelling are intended to contribute to the development and implementation of any amendments to current UK extended producer responsibility (EPR) obligations that broaden the scope of EPR to include litter clean-up in its obligations on cost coverage, by providing indicative information on what those costs are.

1.1 Approach

This study has integrated information from multiple sources. This includes:

- Local authority and duty body interviews (from previous studies, on-line surveys and telephone interviews), on service structure for litter provision, cost breakdowns, and attribution to different litter streams
- Desk based research on quantity and composition of litter and fly-tipping; as well as duty body costs for litter.

The information was input into a model to produce costs for litter of different types, with the main division being packaging versus non-packaging. Within these categories, costs have been disaggregated for different groups of beverage containers that may be subject to a deposit refund system, as well as cigarette butts and chewing gum.

The model provides disaggregation by UK nation, and also, for primary department costs,⁸ local authority.

1.1.1 Online survey

The aim of the online survey was to better understand areas identified previously as particularly lacking in information and/or affecting total cost attribution the most. These areas were:

- the scope of reported revenue outturn for street cleansing;
- the proportion of litter of different origin (bin or ground litter);
- the level of resources (staff, equipment and vehicles) involved in litter removal and fly-tipping as a proportion of the whole; and
- the level of resources allocated by non-primary departments that clear litter.

In order to better understand whether the level of resourcing is adequate to maintain an acceptable cleanliness level, authorities were asked the extent to which funding levels allowed them to meet statutory requirements. The question was carefully designed to try to account for predicted council reticence in saying they could not meet statutory requirements, by giving an option for them to state that they met these with difficulty. To understand the effects of the ongoing COVID-19 pandemic, questions were included inquiring about the effects it may have had or will continue to have on litter collection costs for local authorities.

The careful design of questions was important for eliciting useful information. Asking direct cost information is often not productive as authorities simply do not record the information of the right scope and unless engaged further, will not provide a response with this type of engagement (i.e. online survey by mailshot). Therefore, the questions were asked in terms of staffing or vehicle numbers and attribution to litter as well as the scope of the existing street cleansing outturn figures. For example, the survey inquired about the number of staff tasked with litter-related work and the number and type of vehicles rather than cost numbers. This is usually easier for heads of service to find out/report on without requiring too much investigation on their part. This is complemented by the quantitative information derived from in-depth interviews; in the online survey the aim was to strike a balance between accuracy and response rate. Respondents were asked to be proactive in seeking out information from other colleagues, as the information requested does not usually lie with one person (especially on e.g. non-primary departments, or indeed, underlying finances and reporting). In order to provide a quick and concise survey, in an effort to maximise responses, some explanation of the questions was provided but some components of cost (such as education) were not fully defined, as they were judged at least risk of misinterpretation. In addition, as few councils collect data on some of the elements interrogated, such as proportion of ground litter to bin litter, it was highlighted that their estimate/best guess was still valuable insight in the absence of hard data.

The questions therefore included:

The scope of reported revenue outcome for street cleansing

- The most recent total gross expenditure for street cleansing
- The proportion of expenditure related to litter removal
- The proportion of street cleansing costs related to staff, vehicles, facilities, equipment, disposal, enforcement and education

⁸ "Primary departments" are those such as Street Cleansing departments, that have most of the responsibility for litter clean-up in a local authority. However other departments, such as those caring for Parks and Grounds, will also be undertaking litter clean-up. These are referred to throughout the report as "non-primary departments".

- The extent to which non-primary department litter removal activities, general litter and fly-tipping disposal, enforcement and education and central services/overheads are included in costs

Litter quantity

- The total tonnage of litter collected
- The proportion of ground litter to bin litter collected

The level of resources involved in litter removal and fly-tipping

- The number of frontline staff and management/admin staff in the street cleansing department
- Staff time allocation to different activities: bin litter removal, ground litter removal, mechanical sweeping, fly-tipping removal and other non-litter and non-fly-tipping related activities
- The number of staff involved in litter removal related activities in non-primary departments, i.e. not the street cleansing department
- Non-primary staff time allocation to litter removal related activities and other activities
- The number and type of vehicles the street cleansing department has at their disposal (assignment to litter made using vehicle type and Phase I information)
- The number and type of vehicles belonging to non-primary departments that are used for litter removal activities (in order, amongst other things, to make a general assessment of the relative size of primary and non-primary departments)

The sufficiency of current budgets

- To what extent street cleansing departments are able to meet statutory requirements with their current budget
- The impact of the COVID-19 pandemic on litter collection costs at present and in the near future

The online survey was deployed via SurveyMonkey and disseminated to local authorities and their contractors through a link to the survey sent by email. The email included a description of the aims of the survey, a pdf copy of the survey and an official letter of introduction to the work from Dr Peter Maddox, director of WRAP. This was sent to the 53 local authorities (LAs) for which we had existing contacts from previous research, in England, Northern Ireland, Scotland and Wales and to nine other organisations including private commercial waste management companies and also to environmental charities involved in litter (Tidy Group organisations), for distribution via their channels. Additionally, parallel channels for promoting the survey were leveraged via WRAP (292 LAs for which contacts were available), CIWM, LARAC and the Parks Management Forum who shared a link to the survey on their websites and in their newsletters. When the survey closed, 22 completed surveys had been submitted. A summary of the types of local authorities contributing to the dataset as a result of the online survey and all in-depth interviews is made in Section 3.2.2. The sample size remains small and not all local authority types are proportionally represented with regard to both rurality and affluence. As with all things litter-related, responses are highly variable; this is the nature of the both the waste stream and provision of its clean-up. This increases the sample size that would be needed to provide statistically robust results; however larger sample sizes could only be obtained with more extensive contact building efforts; as Street cleansing services are not represented by a dedicated professional body much foundational work would be needed to remedy this that would benefit from focussed effort; carrying this out is beyond the scope of this study. Duty bodies were not engaged via the online survey as

previous efforts to obtain contacts have been difficult; instead contacts were obtained for use during the in-depth survey stage.

1.1.2 Interviews

We conducted in-depth interviews with authorities from across the rurality and deprivation spectrum in the four UK nations. In total, we approached just over 100 authorities, as well as making attempts to contact Network Rail and Highways England. Our contact attempts prioritised first authorities with which we had previously had some engagement, either through completing or viewing the online survey, and authorities highlighted as having recently undertaken litter studies. Many authorities declined our invitation, stating an interest in the research but a lack of resources given the present situation with COVID-19. In addition, due to the COVID-related project delays most contact attempts were made during the summer months, when annual leave puts further pressure on resources. In total, we were able to speak with 16 authorities across England and Wales, representing a fair mix across the scales of rurality and deprivation for the size of sample. An estimate of costs was obtained for Network Rail however attempts to contact Highways England were not successful. A full list of authorities that participated in the online survey and interviews is given in Section 3.2.1 and assessed for type coverage in Section 3.2.2.

Our aim was to speak to multiple local authority staff members so as to locate all the information needed – from finance, street cleansing teams and non-primary departments. We put together an interview question template which highlighted all of the (largely quantitative) information we needed to gather from the interviews to inform our modelling. This template accompanied the interview invitation that was sent out to local authorities, with the hope that they would have time prior to the interview to gather the information from relevant colleagues and invite them to join the call. Questions were asked for primary and non-primary departments on the following categories:

- General service structure
- Staff
- Equipment and External Services
- Fleet
- Facilities
- Monitoring, Education and Enforcement
- Disposal
- Waste Data

In addition, we had non-quantitative discussions with authorities on the impact of COVID-19 on their service and Deposit Return Schemes (DRS). These conversations have not formed part of our modelling, but are discussed in Sections 1.2 and A.3.0. We also questioned them about spend on chewing gum; this was used to inform cost estimated for chewing gum cleansing (Section 3.2.9)

1.1.3 Composition

In the compositional analysis, data from recently conducted litter composition studies in England, Wales, and Northern Ireland was used to compile compositional proportions in each country for different categories of litter. We aimed to use studies that assessed primarily collected rather than *in situ* litter, both ground and bin litter, using multiple units (count, weight and volume), with appropriately detailed breakdown (litter was assigned as either packaging or non-packaging as well as 3 groups of potential DRS items, cigarette butts, and chewing gum). This was not found for Scotland, with separate datasets conducted years apart available only for *in situ* counts or collected litter weights (of uncertain scope) with only very broad material based categories. Item category weights and counts were provided in the Welsh dataset. Volume has been modelled for all datasets according to the method

used in the dataset for England (applying volume conversion factors based on average item volumes). Weight has also been modelled for England and Northern Ireland based on weight conversion factors (for count to weight) derived from other waste composition datasets. Composition was calculated by item count (i.e. how many items of each litter type were present in the study samples), item weight (how much did those items weigh), and item volume (how much volume do those items take up in litter collection systems). It was also possible to distinguish between litter found on the ground and in bins in England and Wales, and separate composition has been calculated for each in these countries.

1.1.4 Modelling

The model's general approach is to take the total street cleansing costs reported by each local authority⁹, split the costs between eight components of cost according to the responses, and then estimate how much of each component is used for litter related activities; and then costs are attributed to specific litter categories, based on composition data. A diagram of the model structure can be found in the methodology, in Section 3.1.

The modelled components that have costs associated with litter are:

- People;
 - Equipment;
 - Vehicles;
 - Facilities;
 - Other (mainly monitoring);
 - Disposal;
 - Enforcement; and
 - Education and Communications.
- The total cost of litter is split into the following streams, representing various classes of items which may be subject to EPR obligations and/or DRS (deposit return systems) in upcoming EPR reform:
 - Non-packaging, split by:
 - Chewing gum;
 - Cigarette butts; and
 - Packaging, further split by:
 - DRS Class 1 (glass, metal, plastic beverage containers);
 - DRS Class 2 (cartons and pouches); and
 - DRS Class 3 (cups).

Splitting service provision in this way allows different assumptions on how much of each is attributable to litter and litter of different categories to be applied in each case, increasing the accuracy of the model.

The cost of disposal is determined by calculating the tonnage of 'managed' litter (i.e. litter that is collected and requires disposal) and multiplying it with regional costs per tonne of different disposal routes, i.e. for litter, mostly landfill and incineration.¹⁰

Once the modelled disposal costs are subtracted from the total street cleansing expenditure, the remaining costs are split between the other seven components listed. However, some of the components' costs are not associated with litter. (For example, street washing and fly-

⁹ See section 3.2.3 for details on sources and years of data used.

¹⁰ Tonnage calculations are described in more detail in Section 3.2.5 and disposal cost calculations in Section 3.2.7.

tipping are other sources of cost.) The portion spent on litter is calculated firstly, based on previous interview-based work with local authorities in Scotland,¹¹ as well as the survey and interviews carried out across the UK specifically for this project. This includes the influence of authority characteristics, as follows:

- Deprivation;
- Rurality; and
- Presence of amenity beaches.

Authorities were classified on a scale of 1-3 for both index of multiple deprivation (IMD) and rurality. More detail on how these classifications were assigned can be found in Section 3.2.1 and Appendix A.1.0.

The litter cost is split by ground and bin litter, and then by the different categories of litter types (packaging, non-packaging, DRS classes etc. listed above). For People, the split between ground and bin litter costs is based on estimated staff time allocated. For the other components, the litter tonnage is split into the two according to estimated proportion of litter collected from the ground versus bins on the basis of weight, with different proportions applied depending on the rurality and deprivation of each authority. The cost associated with specific fractions of litter (packaging, potential future DRS categories, etc.), derives from the composition of the litter in bins and on the ground. However, composition can be assessed in multiple ways – by the count of individual litter items, the volume or the weight of collected litter. These different types of units result in very different compositions. For each component of cost, the most appropriate type of composition (by count, volume or weight) was used. For example, staff litter picking time is assumed to be most proportionate to item count, while disposal costs are assumed to be most proportionate to item weight.

The cost associated with litter for each component (People, Equipment etc.) are then summed to produce the total costs associated with litter, for all litter, packaging litter and DRS litter streams, chewing gum, and cigarettes.

1.2 Structure of this Report

The remainder of the report is structured as follows:

Section 2.0 describes some of the general trends observed through the results of the online survey and in-depth interviews. This section also provides some commentary on the topics related to litter that were not quantified through the modelling, such as opinions on DRS, activity relating to chewing gum, and the impact of COVID-19 on street cleansing services.

Section 3.0 details the results of the modelling undertaken to estimate the costs of cleaning up packaging litter to local authorities and duty bodies. The results primarily focus on the costs to local authority primary departments, but other litter clean-up costs – such as those associated to non-primary departments and duty bodies – are investigated as distinct aspects within the modelling. Litter composition are also discussed in this section. The section concludes with recommendations for future research and actions to be taken in order to gain a better understanding of the costs of cleaning up litter.

Section 4.0 examines whether fly-tipped packaging waste makes a significant contribution to packaging clean-up costs using national fly-tipping statistics for England and Wales, and composition data for the most relevant waste streams that could be found.

¹¹ *Eunomia Research & Consulting (2013) Direct Costs of Littering, Report for Zero Waste Scotland, 2013*

In **Section 5.0** we conclude by summarising the key results from each section.

Appendix A.3.0 discusses the potential impact of the introduction of a deposit refund system (DRS) for beverage containers on clean-up costs on the basis of discussion with local authorities and analysis of illustrative composition scenarios.

Appendix A.4.0 discussed the issues around including marginal costs, cleansing efficacy and efficiency, as it pertains to both the estimation of required litter clean-up costs and in understanding changes in cost over time.

2.0 General trends and commentary

This section discusses some of the general trends observed in the online survey and interviews. This includes topics that were not quantified in our modelling, such as views on sufficiency of budgets and the impact of COVID-19.

2.1 Scope of street cleansing outturn reporting

According to guidance for reporting revenue outturn from the Ministry of Housing, Communities and Local Government, street cleansing expenditure should be reported in 'Revenue outturn cultural, environmental, regulatory and planning services' (RO5). This includes general litter and fly-tipping "cleaning", "removal" and "collection" costs in line 270 and enforcement in line 222. There are no specific lines or indications given for central services/overhead costs or education costs. However, line 285 includes the costs of initiatives to prevent/reduce waste through consumer purchasing and line 340 includes environmental education, although these don't mention litter specifically. There is a specific line for waste disposal costs (line 282) however litter and fly-tipping are not specifically indicated for inclusion. Line 122 indicates that street cleansing activities as part of foreshore expenditure (beach and associated amenity cleansing) should be reported in Line 270. The lines on expenditure on open spaces (line 130) and cemeteries and churchyards (line 210) do not mention litter at all. Highways expenditure in general is reported in Group RO2 (including litter remove where it presents a hazard) but it is indicated that routine litter clearance for environmental purposes on highways should be reported in RO5 Line 270.¹² For Scotland, the relevant guidance states that 'support costs' (i.e. central services such as admin) are included and reported separately within Local Financial Returns reporting on Street Cleansing (within LFR 06), while expenditure by non-primary departments should be included, aside any cleansing that relates to keeping carriageways free of litter for road safety purposes (i.e. not routine litter clean-up) is excluded, (similarly to England). The guidance states that street cleaning "should relate" to expenditure on sweeping (manual or mechanical), street washing and emptying of litter receptacles, but there is no indication of where expenditure for other non-litter activities are reported.¹³ For Wales, the relevant guidance states that Street Cleansing costs (RO5 Line 8) should "include the sweeping and removal of litter from land, litterbins, etc. that is required to comply with the Environmental Protection Act 1990"; no explicit indication is given of where expenditure for other non-litter activities should be reported. Cleansing that relates to keeping carriageways free of litter for road safety

¹² Ministry of Housing, Communities and Local Government (2019) *Specific guidance notes for completing the REVENUE OUTTURN (RO) suite of forms*, accessed 13th august 2020, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/888061/General_fund_revenue_account_outturn_2019_to_2020_specific_guidance_notes_v2.pdf

¹³ <https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2019/09/local-financial-return/documents/local-financial-return-guidance/local-financial-return-guidance/govscot%3Adocument/2019-20%2BLFR%2B-%2BGuidance.pdf>

purposes (i.e. not routine clean-up) is also excluded.¹⁴ Guidance is not available for the expenditure statistics for Northern Ireland.

In both the interviews and the online survey, authorities were asked to describe the aspects of their street cleansing service that are included in the gross street cleansing budget reported in RO5 line 270. Table 2-1 shows the numbers of authorities that do or do not include the activities listed within their street cleansing budget.

Table 2-1: The number of authorities surveyed that include specified items in gross street cleansing costs

Activity/service	% (No.) that include the service in gross costs
Non-primary departments that carry out litter removal activities	16% (5 of 32)
General litter and fly-tipping <i>disposal</i> costs	45% (14 of 31)
Enforcement and education costs relating to litter and fly-tipping	35% (11 of 31)
Central services/overheads	65% (20 of 31)

Of the respondents, the majority reported costs for non-primary departments that carry out litter-related activities separately, with only 16% of respondents stating these costs are included in gross street cleansing costs. Such departments might include those responsible for parks and other open spaces, those responsible for areas around social housing, and those responsible for 'education land' (such as schools and colleges). A number of authorities interviewed also mentioned that they are not responsible for litter removal on housing estates where the developer maintains control of the land. Of the 27 local authorities who stated non-primary department costs were not included in gross street cleansing services, 19 estimated staff numbers for these non-primary departments, confirming that there were such resources for litter clean-up in other departments; only three local authorities stated explicitly that there were no resources allocated to departments under this definition (i.e. zero FTEs, effectively meaning they did not have non-primary departments), while 5 provided no response in terms of the number of FTEs, leaving this distinction (between unknown resource allocation and no non-primary departments) unclear.

Just under half of the respondents stated that litter and fly-tipping disposal costs are included in gross street cleansing costs (the implication being that the remainder, as per the guidance report the disposal cost with the rest of waste).

Many authorities have a separate department within which responsibility for enforcement and education lies, from which a portion of the resource is allocated to litter and fly-tipping. This is likely to map onto to the 65% of local authorities who do not include these costs in gross street cleansing outturn, to some extent. Most local authorities do include central services and overheads in their gross street cleansing costs, however there are a fair proportion who do not.

These results help to indicate areas and the extent to which the cost of litter clean-up may be underestimated by relying on disaggregation of street cleansing outturn alone. It is clear from this that there is a lot of variation in where such costs are reported and due to the small sample size, it is not possible to perceive any trends in which types of local authorities include or exclude these costs in gross street cleansing expenditure. This highlights the

¹⁴ <https://gov.wales/sites/default/files/statistics-and-research/2019-07/revenue-outturn-2018-19-notes.pdf>

potential benefit of making the scope of reporting of litter costs more explicitly defined and improving compliance with reporting conventions in the future.

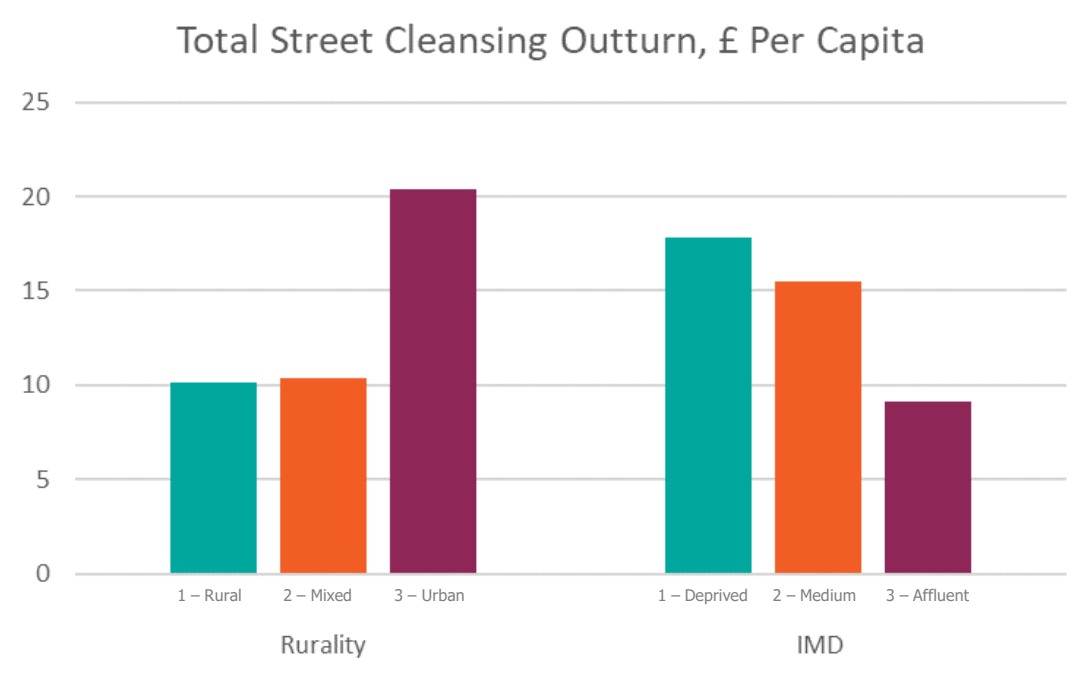
2.2 Variation between local authorities of different types

A number of distinctions between authorities of different types (urban/rural; affluent/deprived) emerged from the interviews and online survey. These are detailed in the sub-sections below. It is of note that most authorities were unaware of the litter service structure of other authorities and felt unable to comment directly on differences between different types of local authority regarding service provision for this reason. Across all sections, authorities are classified on a scale of 1 to 3 from 'rural' to 'urban' on the 'rurality' scale, and authorities are classified on a scale of 1 to 3 from 'deprived' to 'affluent' the IMD (index of multiple deprivation) scale.¹⁵ Throughout the sections, it is important to note that authorities with an IMD classification of 1 are underrepresented (only 3 were successfully engaged by the survey/interviews); therefore, any overall averages discussed for rurality are more representative of medium to more affluent authorities.

2.2.1 Gross Street Cleansing Costs

For rurality there is a significant difference between the gross street cleansing costs per capita reported, which averaged approximately £20 per capita for urban authorities compared to £10 per capita for both rural and mixed authorities (Figure 2-1). Along the deprivation index, the street cleansing spend averaged £18 per capita for the most deprived areas, £16 per capita for medium deprivation and £9 per capita for the most affluent areas. A respondent from a major city stated that core cities are a class apart in terms of street cleansing expenditure because of the expense of 24hr service provision in city centres. This aligns with the rurality/deprivation trends in per capita street cleansing outturn observed.

Figure 2-1 Relationship between total street cleansing outturn, rurality and deprivation

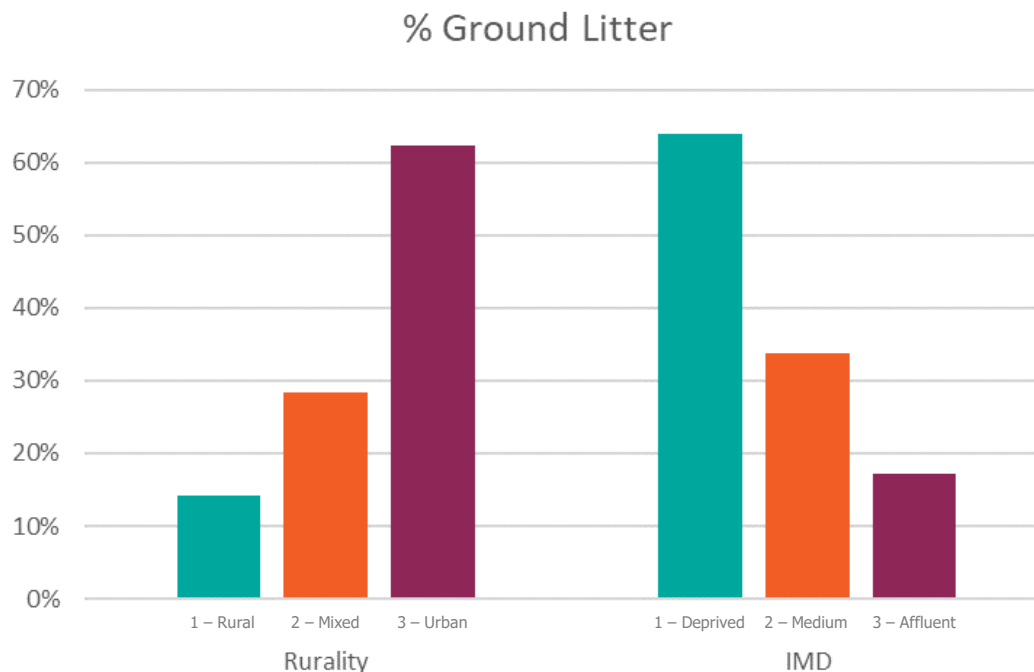


¹⁵ For more detailed information on this simplified classification scheme derived from national indices, see Section 3.2.1.

2.2.2 Bin versus Ground Litter

For the reported split of bin versus ground litter (collected, by volume, based on the rough estimate of operational staff), there is again a clear difference between urban and rural authorities (Figure 2-2), with responses averaging 62% ground litter in the former compared to 14% in the latter. In affluent authorities, an average of 17% was reported to be ground litter, compared to 64% in deprived authorities.

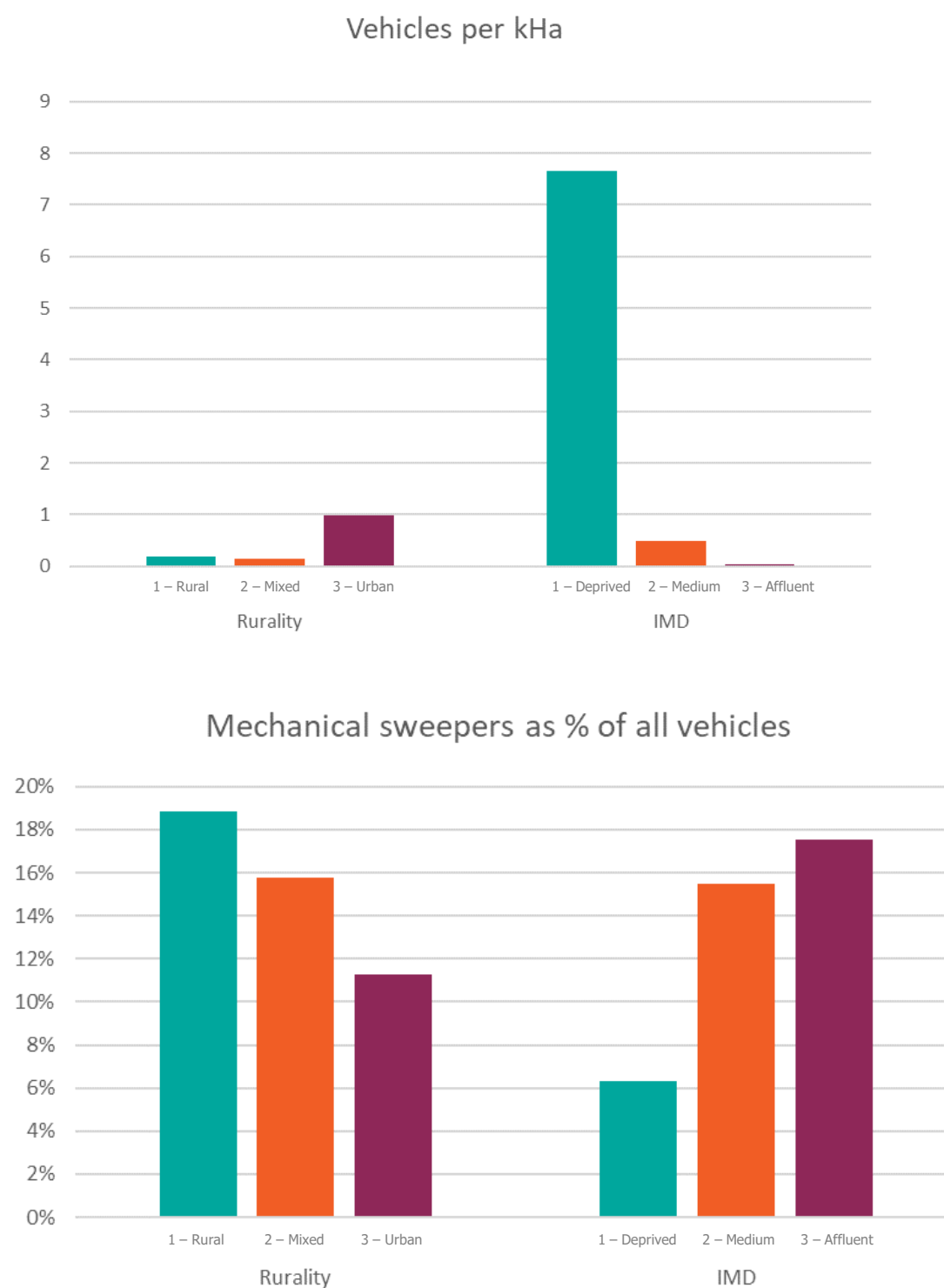
Figure 2-2 Relationship between proportion of ground litter, rurality and affluence



2.2.3 Vehicle fleet

On average, fleets with fewer vehicles for street cleansing are used in rural areas (21.7; 0.2 per kHa) and affluent areas (16.8; 0.4 per kHa) than they are in urban areas (39; 5.4 per kHa) and deprived areas (46.3; 7.7 per kHa) (Figure 2-3). It is notable that this trend is despite the larger area covered in rural areas. However as a proportion of the fleet, there were more large mechanical sweepers in rural areas and more affluent areas (19% of the fleet and 18% of the fleet respectively); in urban and more deprived areas the proportion was 11% and 6% respectively. The proportion of total street cleaning spend spent on vehicles was generally similar amongst most types of local authority (17-22%) with no trends easily perceptible; aside the more affluent areas spending the most on vehicles as a proportion of the total street cleansing budget (25%)

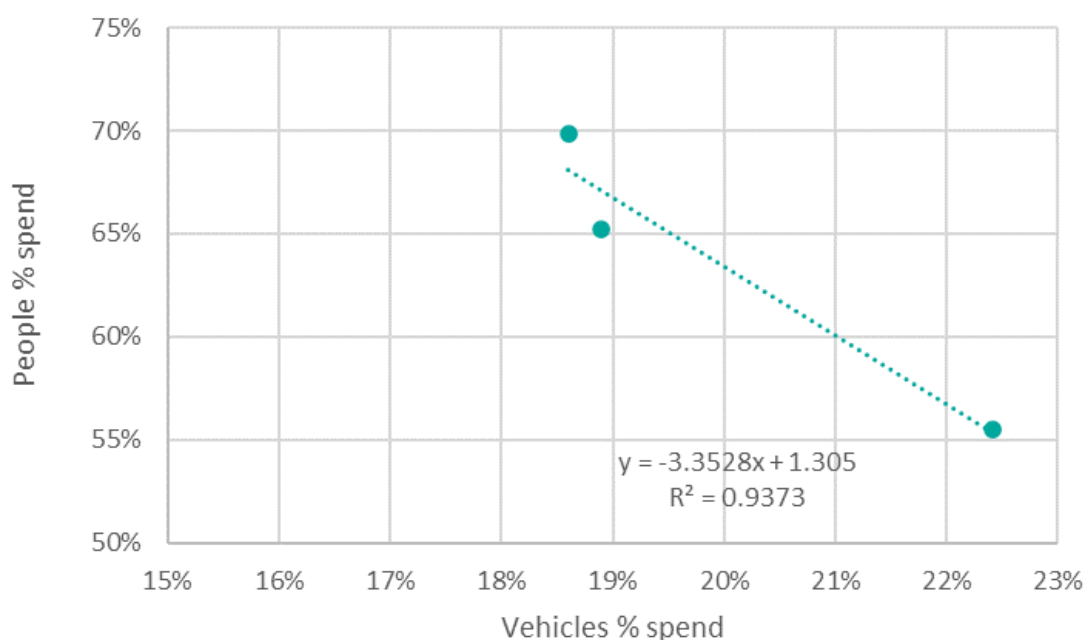
Figure 2-3 Relationship between vehicle provision, rurality and deprivation



2.2.4 Staff

The proportion of street cleansing outturn spent on staff ranged between 55%-70% across different types of local authority with no trends easily distinguishable by rurality or affluence. There was a weak negative correlation between proportion of street cleansing outturn spent on staff versus vehicles across the rurality index (Figure 2-4).

Figure 2-4 Proportion of expenditure for staffing versus rurality



2.3 Adequacy of budgets

Each authority was asked about the adequacy of its budget in the online survey, with some local authorities providing further commentary at interview. Overall, the majority (62.5%, n=24) of respondents stated that their budget allows them to meet statutory requirements, though none said that their budget allows for exceeding requirements. 25% said that they struggle to meet requirements, while 12.5% occasionally or regularly fail to meet statutory requirements, totalling 37.5% of authorities having difficulty meeting their statutory requirements owing to budgetary constraints. This may still be an underestimate, given the likely unwillingness of local authorities to state they are unable to meet statutory requirements. Some cited COVID-19 as a reason for struggling at present. Roadside litter was also quoted as a particular problem by two local authorities, especially along major roads, and two LAs found it difficult to deal with the amount of detritus. The LA that reported that it regularly falls short of requirements quoted a 55% decrease in budget since 2010 which they said has impacted significantly on every area of street cleansing. A number of authorities stated that if they were to receive additional budget, it would best be spent on education around littering in order to bring ground litter costs down. Others stated they would increase the frequency of cleanings.

2.4 Impacts of COVID-19

Authorities were asked about the impacts of COVID-19 on a quantitative basis in the online survey, and more qualitatively during the interviews. Of those that responded, 52% said that costs had already increased due to COVID-19 and 58% expected costs to increase over the next few months. 40% stated that costs had remained the same and 33% anticipated that costs would remain the same over the next few months. The remaining 8% had observed a decrease in costs, and 8% expected costs to decrease in the coming months. Some authorities reporting no change in cost still noted that their ability to carry out street cleansing activities was negatively impacted due to staff being furloughed or self-isolating, as well as an increase in fly-tipping.

Several authorities mentioned the need for an increase in Personal Protective Equipment (PPE) due to the pandemic. Other impacts mentioned include:

- Litter hotspots moving away from traditional urban areas towards parks and open spaces;
- An increase in visitors to the region over the summer compared to a typical year resulting in increased street cleansing needs;
- An increase in ground litter, resulting in a need to re-deploy staff from other council departments to deal with litter;
- Increased pressure on services due to not being able to utilise the number of community volunteers or community service workers that normally help to clean up litter;
- A decrease in litter in urban areas corresponding to a decrease in town centre footfall during lockdown;
- An increase in fly-tipping, attributed to HWRC closure;
- Increased administration and supervisory needs as teams must be managed in bubbles, with fewer crew members able to travel in vehicles together.

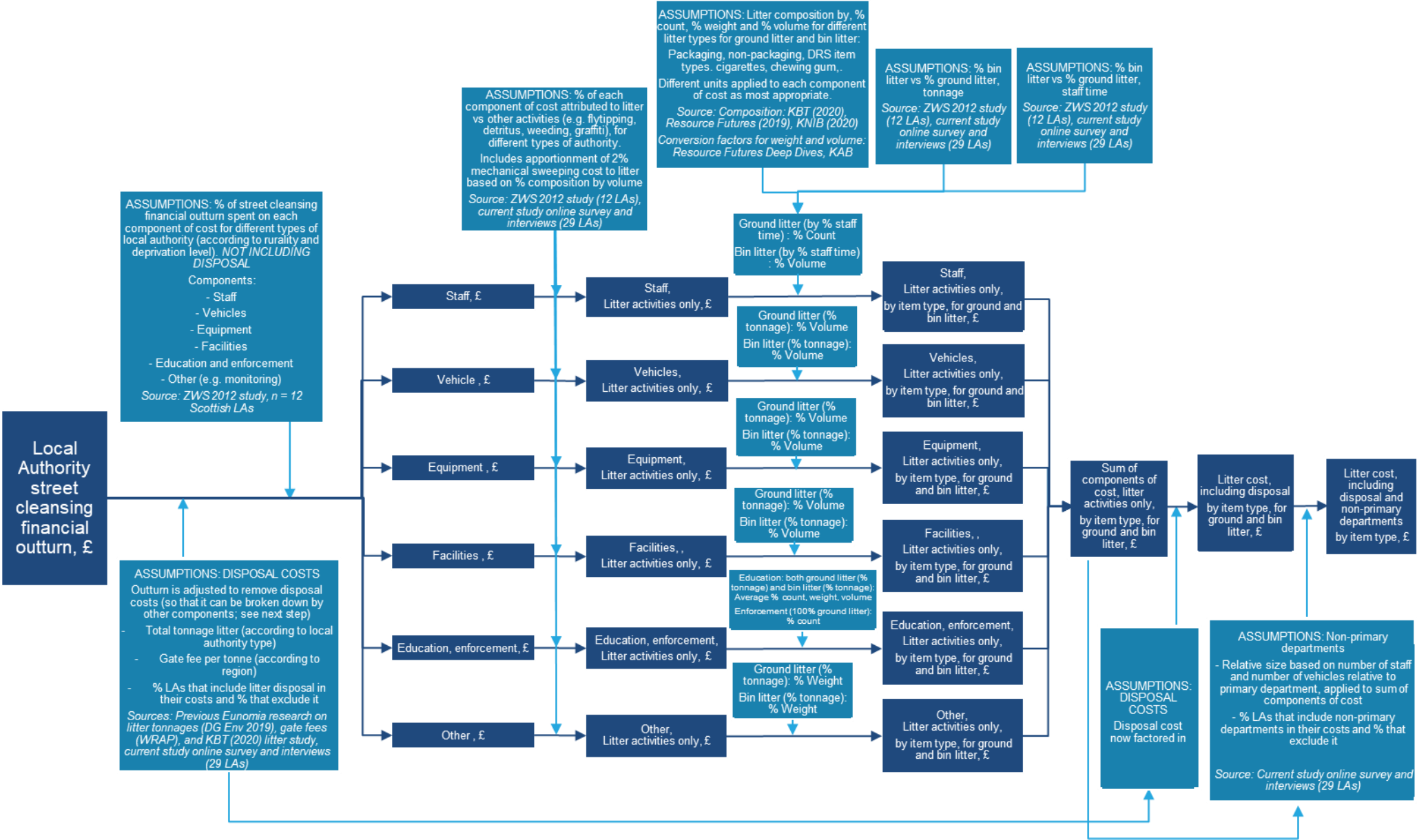
It is of note that several authorities stated that costs had been stable despite the above impacts owing to staff being redeployed from other departments (e.g. closed leisure centres) to street cleansing or from street cleansing to waste and recycling to deal with the greater volume of household waste.

3.0 Estimating the cost of litter clean-up

3.1 Model design

The model's structure is shown in Figure 3-1. It shows how the total street cleansing costs reported by each local authority are split between different components of cost, and then apportioned to litter, and then particular litter categories. Disposal and non-primary departmental costs are then factored in.

Figure 3-1 Model design



3.2 Data and Assumptions

The approach here focuses mainly on the primary departments' litter clean-up costs, while other litter clean-up costs – such as those associated with non-primary departments (see Section 3.2.11) and duty bodies (see Section 3.2.12) – are investigated as distinct aspects by the modelling. The results using the data and assumptions outlined in this section, are shown in the following section (Section 3.3).

3.2.1 Local Authority Classification

Many of the input assumptions vary based on rurality and deprivation; each local authority is ranked between 1 and 3 for both variables, resulting in the spread of all authorities across nine potential categories for the total set of 391 UK authorities defined in the model. The number of authorities falling under each classification is shown in Table 3-1.

Table 3-1: Classification of Local Authorities (*n*=391)

Rurality → IMD ↓	1 (Rural)	2	3 (Urban)	Total
1 (Deprived)	1	16	26	43
2	57	111	83	251
3 (Affluent)	36	51	10	97
Total	94	178	119	391

For deprivation, local authorities have been grouped utilising the Index of Multiple Deprivation (IMD) decile system, in which, the most and least deprived are divided into 10 equal groups. For the purpose of modelling, deciles 1-4, 5-7 and 8-10 have been allocated flags of 1, 2 and 3 respectively i.e. it is assumed the littering behaviours of the most deprived and least deprived authorities are the same irrespective of country. Similarly, each nation has a Rural Urban Classification method, by which local authorities have been allocated a rurality score of either 1, 2 or 3, with 1 corresponding to more rural authorities, 2 identifying authorities which display mixed characteristics and 3 for more urban authorities. East Lindsey is, for example, the only authority to rank as rural and deprived (1x1) in the UK. An additional categorisation is whether the authority has a coastline, thus doubling the categorisation options (to 18 category combinations). For more details on this, please see Appendix 1.

3.2.2 Spread and Quantity of Data Analysed – All Interviews and Surveys

Alongside existing available data – such as street cleansing outturn data and indices of multiple deprivation – interviews and a survey were conducted to obtain further detailed information from local authorities. The 32 local authorities that participated in the surveys and/or interviews are as follows:

Table 3-2: Authorities that participated in a Phase 2 interview or the online survey

Authority	IMD	Rurality	Survey Response	Interview
Ashford	2	2	Yes	Yes
Basildon	2	2		Yes
Bradford	1	3		Yes
Caerphilly	2	3		Yes
Camden	2	3	Yes	Yes
Cardiff	2	3		Yes
Cheshire East	3	2	Yes	
Cornwall	2	1	Yes	Yes
Craven	3	1	Yes	
Fenland	2	1		Yes
Harrogate	3	2	Yes	Yes
Manchester	1	3	Yes	Yes
Medway	2	2	Yes	
Newcastle-under-Lyme	2	2		Yes
Newham	1	3	Yes	
Northampton	2	2	Yes	
Oadby & Wigston	3	2	Yes	
Peterborough	2	2	Yes	
Sefton	2	3	Yes	
Sevenoaks	3	1	Yes	Yes
South Gloucestershire	3	2		Yes
South Lakeland	3	1	Yes	
South Northamptonshire	3	1	Yes	
South Oxfordshire	3	1	Yes	
South Staffordshire	3	2	Yes	
Stevenage	2	2	Yes	
Stratford-on-Avon	3	1	Yes	
Swansea	2	3		Yes
Vale of White Horse	3	1	Yes	
Wakefield	2	2		Yes
Wealden	3	1		Yes
West Lothian	2	3	Yes	

In addition to these 32, historic interview data from 12 Scottish local authorities (including West Lothian) was used.¹⁶ This results in a total of 43 authorities contributing towards the modelling assumptions, spread across the classifications identified in Table 3-3. With data from 28 English authorities, 12 Scottish authorities and 3 Welsh authorities, Scottish authorities are particularly overrepresented and Northern Irish particularly underrepresented at present. As we have not come across evidence that local authorities in Scotland have very differently structured services with respect to Street Cleaning from the other nations, this is not considered to influence the model unduly. However it is a limitation that should be kept in mind should new evidence come to light with improved reporting of costs and any new research.

¹⁶ Eunomia Research & Consulting (2013) Direct Costs of Littering, Report for Zero Waste Scotland, 2013

Table 3-3: Spread of Contributing Authorities (*n*=43) (out of total number of authorities of that type)

Rurality → IMD ↓	1 (Rural)	2	3 (Urban)	Total
1 (Deprived)	0 of 1	0 of 16	3 of 26 (12%)	3 of 43 (7%)
2	3 of 57 (5%)	13 of 111 (12%)	10 of 83 (11%)	26 of 251 (10%)
3 (Affluent)	8 of 36 (22%)	5 of 51 (10%)	1 of 10 (10%)	14 of 97 (14%)
Total	11 of 94 (12%)	18 of 178 (10%)	14 of 119 (11%)	43 of 391 (11%)

The interviews and surveys contributed to updating a range of assumptions, as follows:

- Section 3.2.6: Tonnage and staff time split between ground and bin litter
- Section 3.2.7: Proportion of disposal costs included within Street Cleansing Outturn
- Section 3.2.3: Split of cost between litter components
- Section 3.2.11: Cost of non-primary departments

3.2.3 Split of costs between components and activities

The percentage splits between components of cost, shown in Table 3-4 **Error! Reference source not found.**, are based on data from the survey and interviews. Relative to the total number of authorities in the UK (391), there are still relatively few datapoints, particularly for certain classifications of authorities. Of the nine classification types, two have no data points (*n*=0), and a further four types are based on less than four datapoints. For example, the most urban and affluent (3x3) authorities' activity split is based on only one authority's input, which, unlike all other types, places significant emphasis on vehicles rather than people. The accuracy of this – as well as all of the percentage splits with low levels of contributing authorities – is an uncertainty that would require further data gathering in the future for confirmation. Averages of local authority responses within local authority type categories were used to form the assumptions for applying to local authorities of similar categories.

Table 3-4: % Outturn spent on different components of cost (*n*=33)

Rurality	1	1	1	2	2	2	3	3	3
IMD	1	2	3	1	2	3	1	2	3
People	49%	49%	75%	57%	57%	55%	45%	69%	31%
Equipment	3%	3%	2%	6%	6%	2%	39%	3%	2%
Vehicles	37%	37%	18%	20%	20%	31%	11%	18%	62%
Disposal¹	0%	0%	0%	0%	0%	0%	0%	0%	0%
Enforcement	0%	0%	0%	3%	3%	0%	0%	3%	4%
Education & Comms	0%	0%	0%	3%	3%	1%	2%	1%	1%
Facilities	9%	9%	1%	8%	8%	11%	2%	5%	1%
Other	1%	1%	3%	3%	3%	0%	2%	0%	0%
<i>n</i>	0	2	3	0	10	5	2	10	1

* Italics – gap filled according to trend of authorities of same rurality

¹Accounted for at another stage of the model

The components of cost are scoped as follows, according to the interviews conducted:

- Staff costs include full employment costs in addition to salary; this generally includes frontline staff, managers and admin staff.

- Equipment includes uniforms, PPE and non-mechanical equipment such as bags, orderly carts and litter pickers and for bins (the latter, where reported, as revenue costs).
- Vehicle costs are those for supervisor vehicles and vehicles for collection, and includes fuel and maintenance, based on average costs; mechanical sweepers are included but the majority of their cost (98%) is attributed to detritus based on staff's estimates of detritus:litter collected.
 - Of vehicle costs, maintenance and fuel was included; where omitted it was modelled based on average costs.
- Facilities refers to depots for storage of vehicles and equipment, at times this also includes central services which might include some admin staff included here rather than staff costs.
 - Vehicles and facilities often appear as 'leased' items from other departments (such as central council services) in revenue cost, in which case costs were already annualised, so taking into account depreciation; otherwise a vehicle lifespan of 7 years was used to create an annualised cost.
- Enforcement activities include patrolling and issuing fines or contracting people to do so
- Education and communications generally included participation in Ecoschools and public engagement such as anti-litter campaigns or clean-ups.
- "Other" costs are generally those incurred from litter monitoring.

3.2.4 Total Costs: Litter versus other Activities within Street Cleansing Outturn

The main source of the cost of litter is street cleansing data. The most recent available street cleansing cost data for each nation was used within the model, and is as follows:

- England¹⁷: 2018/19
- Wales¹⁸ and Scotland¹⁹: 2017/18
- Northern Ireland²⁰: 2016/17

However, street cleansing data includes many activities that are not litter clean-up (such as graffiti clearance, weed control, dealing with fly-tipping and abandoned vehicles).^{21, 22} As a breakdown by activity is not available for any country, estimates have been derived using figures obtained from a previous study for Zero Waste Scotland,²³ which consisted of interviews with 12 Scottish local authorities regarding the breakdown of their street cleansing expenditure, as well as quantitative information obtained at interview for this study. From this, average values have been obtained for a spectrum of rurality types and deprivation ranks. These values have been sense checked where possible, using qualitative information obtained at interview for this study, and applied to similar authority types in the model.

Litter clear-up is also carried out by other local authority departments such as parks and grounds, where litter costs are an even smaller proportion of the total activities. Furthermore, litter clear-up is carried out by other duty bodies such as transport authorities, highways agencies, educational institutions, and the Crown Estate, amongst others. These

¹⁷ Ministry of Housing, Communities and Local Government (RO5 Local Authority Expenditure - Local authority revenue expenditure and financing)

¹⁸ StatsWales (RO5 Local Authority Expenditure - Revenue outturn expenditure summary)

¹⁹ Scottish Local Government Benchmarking Framework (Indicator ENV3a – numerator)

²⁰ Keep Northern Ireland Beautiful (NI National Benchmarking Report 2016-17) – in which data collated from individual council financial statements

²¹ HM Government (2017) Litter Strategy for England, April 2017, <https://www.gov.uk/government/publications/litter-strategy-for-england>

²² CIWM Scotland (2011) Street Cleansing - a forgotten service, 2011 <https://businessdocbox.com/Government/127550208-Ciwm-scotland-status-report-street-cleansing-a-forgotten-service-november-executive-summary.html>

²³ Eunomia Research & Consulting (2013) Direct Costs of Littering, Report for Zero Waste Scotland, 2013

additional litter costs are captured separately, and are detailed later in the report (see sections 3.2.12 and 3.3).

3.2.5 Total Managed Litter

Litter tonnage is used to calculate disposal costs by applying a gate fee assumption per tonne (see Section 3.2.7 for explanation of the approach). This is because disposal cost was rarely available from interview data (variously figures provided of unknown scope, reported by other departments rendering an estimate unavailable, or not possible to disaggregate from other street cleansing waste streams such as fly-tipping and mechanical sweeping). Using an estimate of litter tonnage to model disposal cost was considered to be a more consistent approach. In the absence of data on litter generation for local authorities of different types, to support the creation of a reasonable modelling assumption, the tonnage was calculated for each authority by initially scaling up kilogram per capita assumptions for ground (3.76kg) and bin (3.69kg) litter (i.e. a total of 7.45kg per capita managed litter), by population, within each authority to get baseline amount of managed litter as a starting estimate, based on a review of litter generation conducted in a previous study.²⁴ The baseline amount is then weighted to account for different characteristics of each authority: based on the KBT litter study.²⁵ The study confirmed that poorer urban have higher litter counts than average, while richer rural areas lower litter counts. Although this may reflect cleaning efficiency in part, this is assumed to also reflect baseline litter generation owing to consumption habits associated mainly with urbanisation (owing to nightlife and commuting) but also on-the-go consumption habits in general, and the tendency of litter to encourage littering behaviour; all perception confirmed by local authorities interviewed. The weighting was calculating by determining the proportion of the average transect litter counts for the three urban/rural categories and three IMD percentile categories (the first, middle and last of the five IMD percentile categories defined in the study), relative to the score for the "Urban with City and Town" and the 3rd IMD category (5+6 Decile), representing a central estimate. The finalised weightings of the total managed litter are shown in Table 3-5.

Table 3-5: Managed Litter Weightings

Rurality → IMD ↓	1 (Rural)	2	3 (Urban)
1 (Deprived)	104%	113%	142%
2	88%	100%	108%
3 (Affluent)	43%	54%	42%

These amended weightings result in modelled litter tonnages per authority that reflect the KBT trends. However, the KBT litter report showed this trend was not present in more affluent areas. This aligns to some extent with the few tonnage estimates provided by surveyed authorities. However, this trend is not fully observed within the online survey results in particular, due limited responses and inclusion of detritus from mechanical street sweeping in some of the litter tonnages. The modelled tonnages were therefore preferred for inclusion in the model.

3.2.6 Split between Ground and Bin Litter: Tonnage and Time

The contributing authorities were asked to estimate a split for the amount of litter they collect between ground and bin litter, producing the results shown in Table 3-6, for those

²⁴ Eunomia Research & Consulting (2018) [Plastics: Reuse, recycling and marine litter – Impact assessment of measures to reduce litter from single use plastics](#). Report for DG Environment, 2018, Annexes p55. Bin litter figure from unpublished research for the study.

²⁵ p 12 - Keep Britain Tidy (2020) Litter Composition Analysis - Summary Report

authorities which were able to provide a response. The average (unweighted) split between volume of ground versus bin litter is 40% ground litter to 60% bin litter across all local authorities of different types. This increases to 46% ground litter once weighted by total managed litter tonnage (i.e. taking into account complete representation of UK local authority types in terms of both litter generation and ground:bin litter split).

Table 3-6: % Split of the amount of ground and bin litter by volume (*n*=33)

Rurality	1	1	1	2	2	2	3	3	3
IMD	1	2	3	1	2	3	1	2	3
Ground litter	29%	20%	11%	39%	32%	25%	64%	62%	30%
Bin litter	71%	80%	89%	61%	68%	75%	36%	38%	70%
<i>n</i>	0*	3	3	0*	10	4	3	9	1

* Italics – gap filled according to trend of authorities of same rurality

The amount of time staff spent on the two litter streams (ground and bin) is used to better quantify the cost of staff spent on each stream. Table 3-7 shows the varied split of staff time, producing different trends: Aside from more rural affluent areas (Rurality x IMD: 1x3 & 2x3), significantly more time is spent on ground rather than bin litter – 71%-89%.

Table 3-7: Time Spent on Ground vs Bin Litter (*n*=31)

Rurality	1	1	1	2	2	2	3	3	3
IMD	1	2	3	1	2	3	1	2	3
Ground litter	89%	74%	40%	86%	71%	40%	82%	79%	74%
Bin litter	11%	26%	60%	14%	29%	60%	18%	21%	26%
<i>n</i>	0*	2	6	0*	9	4	3	5	1

* Italics – gap filled according to trend of authorities of same rurality

3.2.7 Disposal

All managed litter – the tonnage estimation of which is detailed in Section 3.2.5 – must be disposed of in some form – either landfill or incineration. 46% of litter is assumed to be sent to landfill and the remaining 54% is incinerated, based on previous research conducted by Eunomia.²⁶ The cost of landfill and incineration per tonne of litter is applied by national region, based on gate fee data from WRAP,²⁷ and a landfill tax of £91.35/t.²⁸ Applying these per tonne costs to the litter tonnage results in an initial disposal cost per authority.

The disposal cost is then compared to the authority's reported street cleansing outturn. Local authorities include different types of costs in the scope of their headline street cleansing cost. Some include the cost of disposal while others do not. 45% of survey and interview responses indicated disposal costs are included within their street cleansing outturn. Therefore, it is assumed that 55% of the total disposal cost is additional to the total street cleansing cost. This additional cost is distributed across every local authority, as the model adds 55% of the disposal cost to each authority's outturn and results in an increased revised street cleansing cost. Whilst in practice this distribution is not realistic, the revised total cost

²⁶ Eunomia Research & Consulting (2017) *Residual Waste Infrastructure Review (12th Issue)*
<https://www.eunomia.co.uk/reports-tools/residual-waste-infrastructure-review-12th-issue/>

²⁷ WRAP (2018) *Gate Fees Report 2018: comparing the costs of waste treatment options* <http://www.wrap.org.uk/content/gate-fees-report-2018-comparing-costs-waste-treatment-options%20%20>. Regions are: North East, North West, Yorkshire & Humberside, East Midlands, West Midlands, South West, South East, East of England, Wales, Northern Ireland, Scotland and London

²⁸ <https://www.gov.uk/government/publications/increase-of-the-landfill-tax-rates/landfill-tax-increase-in-rates>,
<https://gov.wales/landfill-disposals-tax-rates>, <https://www.gov.scot/policies/taxes/landfill-tax/#targetText=Landfill%20Tax,tonne%20in%202019%20to%202020>

aims to provide a more accurate account of the costs on a national and UK basis. (This limitation is touched upon in Section 3.4). There is at present no way of determining *a priori* which local authorities include disposal in the scope of their street cleansing outturn or not.

The modelled disposal costs are subtracted from the revised total street cleansing expenditure and the remaining expenditure is split between the five other components (People, Vehicles, etc.), based on assumptions outlined in Section 3.2.7.

3.2.8 Attribution of costs to litter of different types

By extracting data from recently conducted litter composition studies we have been able to form updated estimates of litter quantities falling into the categories of packaging and non-packaging, as well as 3 groups of potential DRS items;²⁹ additionally, we have estimated quantity for cigarette butts and chewing gum. This has been conducted for England, Wales & Northern Ireland, using litter composition studies in each country.^{30 31 32 33} The proportions are presented according to three units: item counts (i.e. how many items of each litter type were present in the study samples), item weights (how much did those items weigh), and item volumes (how much volume do those items take up).

No litter composition data relevant to Scotland was identified that relied on collected samples with enough disaggregation for the present study item categories; only *in situ* count data which inflates smoking litter (as it tends to accumulate). In addition to the regional differences in litter composition between the countries, there were variations in the methodologies employed in the surveys. Both the Keep Britain Tidy and Keep Northern Ireland Beautiful surveys assessed composition by item count. In Wales, two studies on litter were identified, collecting data by both count and weight. For surveys that used count, in order to calculate equivalent weight and volume compositional factors, conversion factors were used for each litter category.

Volume conversion factors were derived from the KBT England composition study, which took average volume per item from a Keep Australia Beautiful Study which measured both count and volume of specific item type litter fractions. We note that volume conversion factors are highly influential on the composition results, and we note that some of the Australian data may not be as representative of the UK context than would be ideal (for example, the volume of coffee and soda cups).

Weight conversion factors were derived from the Welsh Resource Futures studies that assessed both weight and count of particular waste fractions. An additional municipal waste compositional analysis for England was also used to identify unit weights for the required litter types.³⁴ In the future, weight data maybe be available for the Keep Northern Ireland

²⁹ Group 1: glass, metal and plastic bottles, group 2: beverage cartons, group 3: cups

³⁰ Keep Northern Ireland Beautiful (2019) Litter Composition Report 2019/20, accessed 13 August 2020, <https://keepnorthernirelandbeautiful.etinu.net/keepnorthernirelandbeautiful/documents/blog-000968-20200228111517.pdf>

³¹ Keep Britain Tidy (2020) Litter Composition Analysis - Summary Report

³² Resource Futures (2019) Composition Analysis of Litter Waste in Wales 2019, Report for Welsh Government, 2019, <https://gov.wales/sites/default/files/publications/2020-01/composition-analysis-of-litter-waste-in-wales.pdf>

³³ Resource Futures (2018) The Composition of Litter in Wales, 2017, Report for WRAP Cymru, 2018, <http://www.wrapcymru.org.uk/sites/files/wrap/Litter%20composition%20FINAL%20technical%20report%20WRAP%20Cymru%2020180607.pdf>

³⁴ WRAP (2020) Compositional analysis of LA collected and non-LA collected non-household municipal waste (England).pdf, accessed 24 September 2020, <https://wrap.org.uk/sites/files/wrap/Compositional%20analysis%20of%20LA%20collected%20and%20non-LA%20collected%20non-household%20municipal%20waste%20%28England%29.pdf>

Beautiful dataset, but it is not known when or if this might be released; at present this is only published for higher level material categories rather than item categories.

The KBT England composition study excluded putrescibles (such as food waste) from the analysis, making the datasets non-comparable. This was rectified by adding in a standard proportion for putrescibles by count, by volume and by weight, based on the average between the Northern Ireland and Welsh datasets. It is important to note however the wide range between these studies. In the Welsh datasets putrescibles (largely food waste, dog fouling) composed of between 35% and 40% of overall litter composition by weight, whilst in Northern Ireland these items composed of less than 8%. From these, an average putrescibles composition was calculated to be 21% by weight and this was applied to England.

Attribution to packaging or non-packaging for generic material categories (such as, "other paper and card", "other paper", "unsure" or "other (all materials)") was made, in general, using the split between identifiable *non-DRS* packaging versus non-packaging (non cigarette butt) items. It was assumed that no DRS category items were included in these generic categories, as they all had their own specific categories and would have been recognized as such and included in these during the empirical work. Cigarette butts were also not included in the split for the same reason. Items attributed in this way were a generally a small percentage of the total. All of the KNIB (NI) data categories were already assigned to packaging vs non-packaging and only 9% of the RF (Wales) data had to be assigned.

An important exception however stems from the KBT dataset, where by count, 27% of items surveyed were classed as 'Other General Litter'. This category was defined specifically in the KBT report, as 'items that do not fall within the other litter type categories and include items such as pens/pen lids, batteries and elastic bands'. As such, 'Other General Litter' was assigned *in its entirety* to the 'non-packaging' category, being deemed most like to be products or hard to classify items rather than identifiable packaging. The size of this large general category however introduces a large element of uncertainty regarding the composition which has a large effect on the attribution of cost.

Table 3-8: England, Composition by count, volume and weight, all litter (bin and ground)

	% by Count	% by Volume	% by Weight
Non-Packaging	58%	15%	61%
<i>Of which: Cigarette butts</i>	13%	0%	0%
<i>Chewing gum</i>	1%	0%	0%
Packaging	42%	85%	39%
<i>Of which: DRS 1</i>	11%	43%	20%
<i>DRS 2</i>	0%	1%	0%
<i>DRS 3</i>	3%	12%	3%

DRS Class 1 (glass, metal, plastic beverage containers); DRS Class 2 (cartons and pouches); DRS Class 3 (cups)

Table 3-9: Wales, Composition by count, volume and weight, all litter (bin and ground)

	% by Count	% by Volume	% by Weight
Non-Packaging	69%	34%	64%
<i>Of which: Cigarette butts</i>	10%	0%	0%
<i>Chewing gum</i>	0%	0%	0%
Packaging	31%	66%	36%
<i>Of which: DRS 1</i>	7%	35%	17%
<i>DRS 2</i>	0%	2%	0%
<i>DRS 3</i>	2%	11%	2%

DRS Class 1 (glass, metal, plastic beverage containers); DRS Class 2 (cartons and pouches); DRS Class 3 (cups)

Table 3-10: Northern Ireland, Composition by count, volume and weight, all litter (bin and ground)

	% by Count	% by Volume	% by Weight
Non-Packaging	33%	5%	21%
<i>Of which: Cigarette butts</i>	10%	0%	0%
<i>Chewing Gum</i>	0%	0%	0%
Packaging	67%	95%	79%
<i>Of which: DRS 1</i>	38%	70%	53%
<i>DRS 2</i>	1%	7%	3%
<i>DRS 3</i>	4%	4%	3%

DRS Class 1 (glass, metal, plastic beverage containers); DRS Class 2 (cartons and pouches); DRS Class 3 (cups)

The features of the composition studies used are summarised in Table 3-11

Table 3-11 Methodological Features of Studies Used in Compositions

	KBT - 2020	RF – 2017, 2019	KNIB – 2020
Date of survey	2019/20	March 2017	January - March 2019
Data by weight	No	Yes	No – Not in the main (weight provided for overall material categories but not individual item categories)
Data by count	Yes	Yes (2019), No (2017)	Yes
Data by volume	No (Volume conversion factors used in the study)	No	No
Bin vs ground litter	There were on average 0.25 bins surveyed per transect, data available separately for each stream	11 batches of ground litter, 28 batches bin litter, data available separately for each stream.	There were on average 0.25 bins surveyed per transect; but results only present as an overall composition
Number of transects	3,360	N/A - waste composition analysis only	1,108
Cigarettes by count (%)	52%	No data available by count – included with category of ‘fines’	37%
Putrescibles by weight (%)	0% - excluded from the analysis	35%	8%
Coverage	14 local authority areas	4 local authority areas	84% of Super Output Areas

For each component of cost, the most appropriate type of composition (by count, volume or weight) was used to apportion costs to specific litter fractions, as shown in Table 3-12.

Table 3-12: Method for cost attribution to litter type

Activity	Units used to attribute cost to litter type	
	Bin	Ground
People	By Volume	By Count
Equipment	By Volume	By Count
Vehicles	By Volume	
Facilities	By Volume	
Other	By Count	
Disposal	By Weight	
Enforcement	N/A*	By Count
Education and Communications	By Average of volume, weight and count**	

* All enforcement costs relate to ground litter.

** Averaged on the basis that different litter attributes are associated with different environmental impacts, so composition was equally apportioned between the three.

3.2.9 Chewing Gum

Chewing gum costs in the model are derived from two different sources; the information below on chewing gum staining, and also costs incurred during regular litter picking and bin emptying, from attribution via litter composition (Section 3.2.8). These are summed to provide a total.

Thirteen authorities were asked about chewing gum during the interviews on an informal basis if time permitted. Around half of local authorities (54%, n=7) stated they had some regular provision for chewing gum staining, with two more stating they had occasional provision (total of 69% regular or occasional provision). Most authorities stated that chewing gum staining is not a priority relative to litter, and is cleansed sparingly, at most a few times per year; another authority had provision in alternate years. One authority stated that it cleans areas on rotation, with the aim of cleansing each area at least once every five years. A small number of authorities include chewing gum removal as part of the role of the graffiti removal teams and so could not disaggregate. Others contracted the service out and increased provision if there were particular large events such as conferences taking place. In some cases – typically the more rural authorities – it was stated that chewing gum removal is not really necessary as town centres are generally free of chewing gum. Some authorities stated that they are more concerned about cigarette butts than chewing gum.

The amount spent ranged from £500-£50,000; with an average of approximately £8,500. As an illustration, if this was applied to 54% of all urban UK local authorities (of which there are 199), it would total £3.3m

Where there are Business Improvement Districts (BIDs) in the area, chewing gum and street washing is typically dealt with by the BID, which might spend in the region of £25,000 per year on this. As an illustration, there are 251 town centre BIDs in the UK;³⁵ if 54% spent this much on chewing gum staining, it would total £3.4m.

As BIDs are not duty bodies but private entities, this cost has not been included in the totals, however if this task was not undertaken by BIDs it would fall upon public authorities to undertake this, which would drive up the costs incurred. In principle, these costs could be included within an EPR scheme although it is understood that it is not the present intention to do so.

3.2.10 Mechanical sweeping

We have found two composition analysis studies for mechanical street sweepings.^{36, 37} Assuming that anything attributed to plastic, metal, glass, textile, paper and non-detritus putrescibles is litter, the proportion of the litter fraction by weight was 1.73% and 2.75% in urban and residential Buckinghamshire (samples taken in autumn) and 0.4% in Wales (samples taken in summer and winter). These figures were averaged and uplifted using a volume conversion factor for packaging, as this is at present deemed to be the most appropriate unit for the attribution of litter costs to vehicles, leading to the adoption of the

³⁵ <https://britishbids.info/services/bid-index?keywords=&bidType=Town+Centre>

³⁶ *Resource Futures (2007) Waste Partnership for Buckinghamshire Street Sweepings and Litter Analysis, Report for Waste Partnership for Buckinghamshire, October 2007*

³⁷ *Resource Futures (2016) National municipal waste compositional analysis in Wales, 2015-2016, Report for WRAP Cymru, 2016, <http://www.wrapcymru.org.uk/sites/files/wrap/Wales%20Municipal%20Waste%20Composition%202015-16%20FINAL.pdf>*

assumption in this build of the model that 2% mechanical sweeper costs are attributed to litter.

3.2.11 Non-primary departments

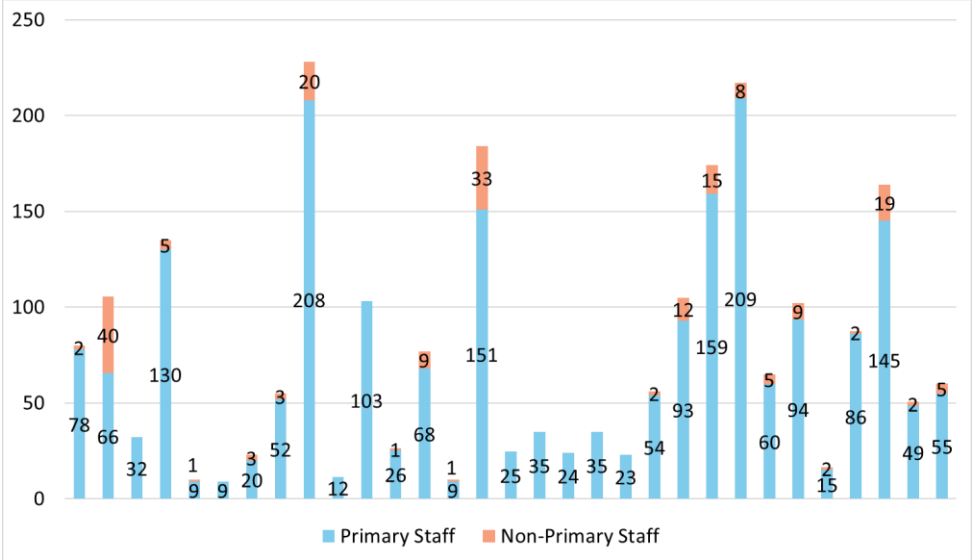
In the survey, primary departments were defined as the main department that carries out litter removal; in most cases this is the street cleansing department. This includes frontline staff involved with direct street cleansing activities, as well as management and admin staff, and staff who are involved with enforcement and education. Non-primary departments were defined as other departments that also undertake litter removal activities, e.g. parks, recreation grounds, cleansing works on highways, motorways and verges, where not carried out by the primary department.

Survey and interview responses included:

- The proportion of authorities that include non-primary departments’ litter clean-up cost within their street cleansing outturn (16%, *n*=32); and the proportion of authorities that do not have resource allocated in non-primary departments, estimated to be 12%.
- Staff and vehicle numbers of their primary street cleansing departments (*n*=31 for staff, *n*=30 for vehicles);
- Number of FTEs (or equivalent) and vehicles involved to any extent in litter cleansing activities in their LAs in non-primary departments (*n*=23 for staff, *n*=11 for vehicles).

It is unclear whether by not answering this question, respondents were indicating that the data was not available or whether no FTEs from non-primary departments are involved in street cleansing activities; we do not use these lack of responses to contribute to the estimate of the size of non-primary departments. The reported staff numbers are shown in Figure 3-2. To better understand the total cost of litter for non-primary departments, an estimation per nation was conducted based on these assumptions stemming from the surveys and interviews. A key caveat here is that all bar one of the participating authorities were English, so for Scotland, Wales and Northern Ireland, the assumptions are inherently less robust than they are for England.

Figure 3-2: Number of staff in primary and non-primary departments undertaking street cleansing and litter removal activities in different local authorities



It was estimated that 16% of local authorities include non-primary costs in their outturn figures; 73% do not include it and 12% do not have non-primary departments. It was determined that on average, the relative size of a non-primary department’s allocation to

litter was equivalent to 15% of the primary department's staff and about 16% of the primary department's vehicles. Of the local authorities that include non-primary costs in their outturn figures (16%, equivalent to £91m of street cleansing litter costs), the average of the non-primary staff and vehicles – 15% - was applied to the street cleansing cost to demonstrate the amount of the street cleansing outturn associated to non-primary departments (£12m, see Table 3-13) – this is *already included* in street cleansing litter costs. 12% of local authorities (equivalent to £67m of street cleansing litter costs), were estimated to have no non-primary department and no adjustment is therefore made.

To understand the additional cost non-primary departments may incur, the same apportionment for non-primary departments (based on FTEs and vehicles) was applied to the remaining street cleansing cost - £425m (73%). This results in a potential further cost of £66m for non-primary departments, which would be *in addition* to the reported street cleansing costs. Table 3-13 shows the costs for non-primary departments included within street cleansing data, alongside the additional costs and the total of the two.

Table 3-13: Costs Associated with Non-Primary Departments (£m)

	UK	England	Wales	Scotland	Northern Ireland
Non-Primary Dept. Litter Cost <i>included</i> in Street Cleansing	12.2	9.8	0.7	1.1	0.6
Non-Primary Dept. Litter Cost <i>not</i> included in Street Cleansing	65.7	52.8	4.0	5.8	3.2
Total Cost of Litter for Non-Primary Dept.	77.9	62.5	4.7	6.9	3.8

3.2.12 Duty bodies

Of the authorities we spoke to, none are primarily responsible for cleaning up litter around rivers and other waterways. In England and Wales, the Canals and Rivers Trust undertake most of this spending £9.1m on vegetation and environmental management in 2018/19.³⁸ Although some local authorities do have responsibility for some waterways. Emptying of litter bins – of which there are over 900 under their remit – came at a cost of £204,000, while fly-tipping cost £215,000. In Scotland, Scottish Canals are responsible for litter management on their five canals, with litter costs of almost £50,000, plus £465 for fly-tipping, quantified in 2013.³⁹ In Northern Ireland, local councils are responsible for the majority of 'non-obstructive' litter in canals and rivers, meaning litter which does not cause a major blockage in the flow of the waterway. Unfortunately, we were not able to speak to any LAs in Northern Ireland, so do not have any understanding of these costs.

Network Rail are responsible for litter management on almost all of the UK's railways. A report from 2014 stated that fly-tipping, (rather than littering) cost Network Rail over 2.3m a year.⁴⁰ With respect to littering, in 2019/20, based on the number of hours spent litter

³⁸ Canal and River Trust (2019) Annual Report & Accounts 2018/19

³⁹ Eunomia Research & Consulting (2013) Quantifying Direct Costs of Litter to Scottish Local Authorities and other Duty Bodies, 2013

⁴⁰ Keep Britain Tidy (2014) Which side of the fence are you on?, 2014, <http://www.keeppbritaintidy.org/Documents/Files/Campaigns/WSOTFAYO-report-web.pdf>

picking, an estimate of £520,107 staff costs was made.⁴¹ Although a tonnage was not available for disposal cost estimation, based on the number of personnel hours, we have assumed an indicative tonnage of 500 tonnes of litter to have been collected and assigned an average gate fee based on the proportion of landfilled and energy recovery in the UK of £92 to give a disposal cost of £46,000.

For highways, costs incurred for litter by the various agencies responsible for the UK's nations were found of £8m for England (2015); £600,000 in Wales (2017); and £514,692 in Scotland (2013).^{42,43,44} No data was found for Northern Ireland.

The cost of cleaning up litter in two of England's National Parks was found through internet research. The Peak District National Park Authority estimates its cost of cleaning up litter at almost £37,000 per year, while the Dartmoor National Park Authority says that it spends £20,000 per year on litter management, plus they rely on a large number of volunteers to pick up litter.^{45,46} National Parks are not duty bodies but are responsible for large areas of land.

Although National Parks are not duty bodies, they do undertake some litter activities, included here for information only – they are not included in the estimate of litter clean-up costs made in the report (Table 3-14).

Table 3-14: Litter Costs of National Parks

National Park	Reported Costs (per annum)	Cost Details
Peak District National Park	£37,000	for 'dealing with litter'
Dartmoor National Park	£20,000	for litter disposal
Loch Lomond and the Trossachs National Park	£27,695	for clearance and education
Cairngorms National Park	£32,182	for clearance and education
Scottish Forestry Commission	£15,955	for clearance and education

3.3 Results

The total cost of litter for primary departments, non-primary departments and other duty bodies is summarised for the UK as a whole in Table 3-15. At present, given the available data, it is estimated that litter clean up amounts to 58% of the total street cleansing outturn reported in local authority accounts. Additional expenditure by non-primary departments on litter is estimated to account for 10% of all local authority expenditure on litter.

⁴¹ Network Rail, personal communication

⁴² Highways England (2015) Litter on England's major roads, accessed 23 September 2019, <https://www.gov.uk/government/collections/litter-on-englands-major-roads>; £6m uplifted for increase in litter collection from 150,000 sacks to 200,000 since costing originally published

⁴³ Keep Wales Tidy (2017) Tackling Litter on our Roads, March 2017, <https://www.keepwalestidy.cymru/Handlers/Download.ashx?IDMF=6adb74d9-b76b-4477-88a3-9b04ecb0dbdf>

⁴⁴ Fulford, J., Coulthurst, A., and Darrah, C. (2013) Quantifying Direct Costs of Litter to Scottish Local Authorities and other Duty Bodies, 2013

⁴⁵ Peak District National Park (2019) National Park visitors urged to 'take it home' as litter and rubbish collection costs hit £37,000 per year, accessed 23 September 2019, <https://www.peakdistrict.gov.uk/learning-about/news/current-news/national-park-visitors-urged-to-take-it-home-as-litter-and-rubbish-collection-costs-hit-37,000-per-year>

⁴⁶ National Parks UK (2018) Dartmoor Rangers ask people to 'Love Moor Life', accessed 23 September 2019, <https://nationalparks.uk/ranger-room/ranger-diaries/dartmoor-rangers-ask-people-to-love-moor-life>

Table 3-15: UK Litter Costs, Primary Local Authority Street Cleansing Departments, Non-primary Local Authority Departments and Other Duty Bodies

	Cost (£m)
Street Cleansing Department Litter Costs	586 <i>(of 1,013 total outturn – 58%)</i>
Non-primary Department Litter Costs¹	66
Other Duty Bodies' Spend²	10
Total	662

¹ Additional to those already included in street cleansing outturn costs.

² For the duty bodies for which it was possible to determine costs. In the present study, costs were determined for road agencies, agencies for railways, and navigable waterways; it was not possible at this time to determine costs for other duty bodies such as Transport for London, educational establishments or Crown authorities.

The total cost of litter for primary and non-primary departments, by country, is summarised in Table 3-16, in both absolute numbers and per capita costs. The UK's cost per capita is most similar to that of England, as England accounts for 80% of the litter costs. Northern Ireland spends the most per person on litter and England spends the least. It is not possible to determine whether this is a reflection of littering baselines, standards or service efficiency. Duty bodies are not included here as it was not possible to disaggregate canal or rail network costs fully by nation.

Table 3-16: Cost of Litter for Primary Local Authority Street Cleansing Departments and Non-primary Departments, by Country

	Total (£m)	Proportion of UK cost	Proportion of UK Population	Cost per capita (£)
UK	649	100.0%	100.0%	9.77
England	521	80.3%	84.3%	9.31
Wales	39	6.1%	4.7%	12.52
Scotland	57	8.8%	8.2%	10.54
Northern Ireland	32	4.9%	2.8%	16.77

Table 3-17 shows the cost and percentage split of costs for each component of street cleansing in the UK. The majority of litter costs are spent on staff, followed by vehicles and disposal. The predominance of staff costs is in line with other surveys (such as those conducted by APSE), and reflects the intensiveness of resource required for manual picking and sweeping.

Table 3-17: Primary Local Authority Departments' Litter Collection and Disposal Costs by Component of Cost (UK)

UK	Cost (£ m)	Proportion of total
People	337	58%
Equipment	87	15%
Vehicles	57	10%
Disposal	45	8%
Enforcement	12	2%
Education & Communications	9	2%
Facilities	24	4%
Other	12	2%
<i>Total</i>	583 ¹	100%

¹ Does not include chewing gum staining (~£3m) as is included post-hoc this modelling stage

With respect to how much of each component of cost can be attributed to litter, the overall proportions are presented in Table 3-18. Disposal is attributed 100% to litter so it is not included.

Table 3-18: Attribution of Components of Primary Department Street Cleansing Cost to Litter

UK	Cost (£m)	Attribution to litter
People	570	59%
Equipment	104	83%
Vehicles	191	30%
Enforcement	22	52%
Education & Communications	12	59%
Facilities	55	45%
Other	13	45%
(Street Cleansing Total without Disposal)	968	-

Overall, packaging accounts for 58% of the total modelled cost of litter (Table 3-19). 7% of costs are attributed to cigarette butts, whilst chewing gum represents very close to 1% of all litter costs.

Table 3-19: Percentage costs of packaging, non-packaging, and other specific litter types, all LA costs and duty bodies

	UK (£m)	Proportion <i>of total</i>
Total (packaging and non-packaging litter)	662	100%
Non-packaging	278	42%
<i>Of which: Cigarette butts</i>	46	7%
<i>Chewing Gum</i>	7	1.0%
Packaging	384	58%
<i>Of which: DRS 1</i>	172	26%
<i>DRS 2</i>	5	0.7%
<i>DRS 3</i>	37	6%

'DRS 1' - beverage containers made of plastic, metal or glass.

'DRS 2' - cardboard cartons and plastic pouches

'DRS 3' - coffee cups.

This reflects that although packaging makes up a majority of litter by volume (~85%), when count (~42%) and weight (~40%)⁴⁷ are used to allocate costs for different components of litter provision (e.g. staff, vehicles etc., as per Table 3-12), this brings the cost attributed to managing littered packaging down. This is because the cost of staff time for picking up ground litter is the largest contributor to the overall cost, and is calculated on the basis of item counts not volume.

Table 3-20 shows the split of litter costs between ground and bin litter for each waste stream. This helps to highlight the implication and potential benefits of preventing litter from being disposed of improperly. The majority of costs associated with litter stems from ground litter, not bins: 65% of litter expenditure is for ground litter. This is to be expected as on average, 70% of staff time is spent manual sweeping and picking ground litter, while the remaining time is spent emptying bins.⁴⁸

Table 3-20: Cost of Ground and Bin Litter of Primary Departments only

Stream	UK Spend (£m)	UK Spend, %
Ground	381	65%
Bin	205	35%
Total	586	100%

For typical beverage containers (DRS 1), the costs are more 50:50 (Table 3-21), because of their particularly large volume:count ratio meaning a smaller proportion of staff time is required for litter picking. This makes ground litter costs less for DRS1 items than they otherwise would be.

⁴⁷ Composition for England used as an illustration as influences overall UK composition most.

⁴⁸ An outcome of the percentages within Table 3-7

Table 3-21: Cost of Ground and Bin Litter of UK Primary Departments, split by item types

	Ground Litter	Bin Litter	Total Cost, £m, (100%)
All Litter	65%	35%	586
Non-packaging	83%	17%	246
<i>Of which: Cigarette butts</i>	<i>98%</i>	<i>2%</i>	<i>40</i>
<i>Chewing gum</i>	<i>99.7%</i>	<i>0.3%</i>	<i>6</i>
Packaging	52%	48%	341
<i>Of which: DRS 1</i>	<i>50%</i>	<i>50%</i>	<i>153</i>
<i>DRS 2</i>	<i>47%</i>	<i>53%</i>	<i>4</i>
<i>DRS 3</i>	<i>40%</i>	<i>60%</i>	<i>37</i>

'DRS 1' - beverage containers made of plastic, metal or glass.

'DRS 2' - cardboard cartons and plastic pouches

'DRS 3' - coffee cups.

3.4 Main sensitivities and methodological limitations

This section describes the key modelling sensitivities and limitations regarding litter costs. It outlines the main data caveats and any dependence on assumptions based on limited information.

Throughout the modelling process assumptions were made and variables created based on limited information. The lack of quantitative estimates was in part due to local authorities not monitoring the activities required to produce the core assumptions over time, accounting systems and reporting functions not being disaggregated by the required activities, or being of variable scope and disaggregation within national statistics. Rough sensitivity analyses were conducted for some of these assumptions (where possible) to illustrate the potential impact on the results by altering these variables. The main limitations, accompanied by a brief explanation of the sensitivity analyses where conducted, are as follows:

- **Staff time spent on litter as a proportion of all staff costs**

This proportion was obtained simply from the rough estimates of authorities interviewed. There is no primary data collection conducted by local authorities. Therefore, there is some uncertainty about the accuracy of this proportion, which contributes most to the litter cost estimate and hence exerts the most influence on it. The average staff time spent on dealing with all litter (not just packaging) as a proportion of all staff costs was 54% in the model, with a cost for primary department staff modelled at £337m. The lower quartile was 38% and the upper quartile was 65%. If all councils were like the lower quartile, this would equate to £122m less cost modelled (Figure 3-3). Taking just the costs associated with the packaging element (58% of the total) equates to £71m less cost. If all were like the upper quartile, this would be £31m more cost associated with this component; for packaging it equates to approximately £18m more cost. Given the current total costs for all departments and duty bodies and all litter estimated at £662m and for packaging at £384m, this is one of the biggest sensitivities associated with the model.

- **Vehicle cost attributed to litter as a proportion of all vehicle costs**

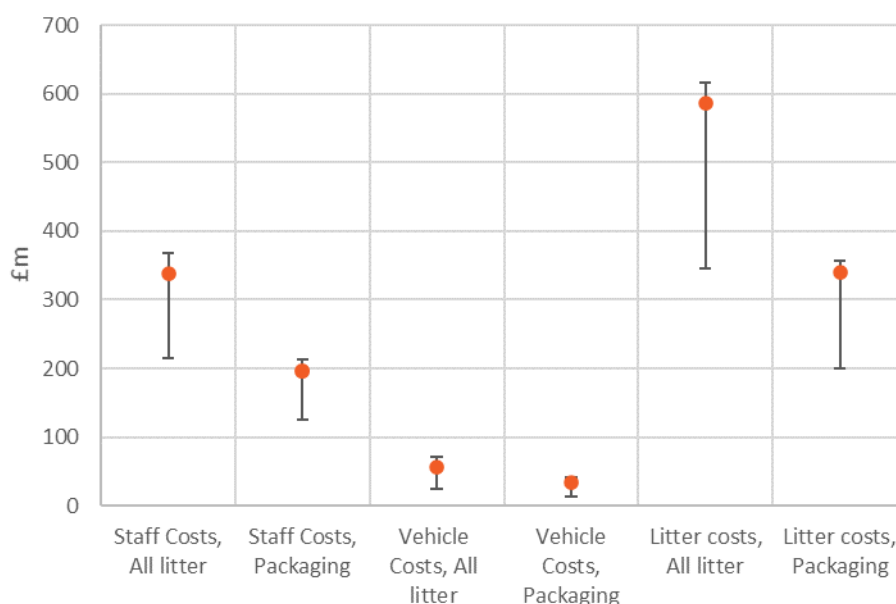
The average proportion of vehicle cost attributed to litter was 27%, with a cost for primary department vehicles modelled at £57m. The lower and upper quartiles were 12% and 37% respectively. If all council street cleansing departments were structured like the lower quartile, spend would be £23m, £33m less than the currently modelled average (Figure 3-3). If all councils resembled the upper

quartile in this value, spend would be £70m, £13m more than currently modelled. For packaging this would equate to £20m lower and £8m higher respectively for the lower and upper quartiles.

- **Spend on litter as a proportion of total street cleansing spend**

The proportions associated with staff time spent on litter, vehicle used to collect litter, and all the other components of cost are input into the model. The influence of the other components however is smaller and we have discussed the main two individually above. Together they produce an estimate of the average spend on litter as a proportion of the total street cleansing spend for primary departments – this was 58%, with a cost of £586m currently estimated; the lower quartile, amongst all the local authorities, was 34% and the upper quartile was 61%. If all councils spent 34% of their primary department street cleansing budget on litter, this would equate to £242m less than currently estimated (Figure 3-3). If 58% of this cost were attributable to packaging as estimated it would equate to ~£140m less than currently modelled. If all councils spent 61% of their street cleansing budget on litter, this would equate to approximately £616m, £30m more than estimated. If 58% of this were attributable to packaging as estimated, this would equate to ~£20m more than estimated.

Figure 3-3 Costs as modelled and range if lower quartile and upper quartiles applied to all local authorities for staff costs, vehicle costs, or total litter costs as indicated; for all litter and, packaging litter. All primary department costs only.



- **Composition**

Composition is hugely influential on cost estimates for particular groups of items. Although the composition studies used are the most appropriate currently available, they have significant issues in terms of incomparability owing to different methods, with significant data gaps resulting, that have been filled using assumptions. It is imperative therefore that composition of *collected* (rather than *in situ*) ground and bin litter is obtained for all the nations, according to a standard method (with appropriate and standardised item/group categories), which measures units in terms of count, weight and volume. This should also take into account seasonal variation to give a robust annual estimate for composition.

- **Disaggregation of costs by local authority**

A limitation surrounds using the model to obtain individual local authority costs for litter. There are two significant assumptions, namely 1) the proportion of disposal cost included within total street cleansing outturn, and 2) the proportion of non-primary department cost included within total street cleansing outturn. The assumptions lead to adequate estimation of national-level costs but do not represent each authority accurately. If this model were to be used to determine fees due to individual local authorities, the disposal is underestimated for authorities that do not include disposal costs in their outturn and overestimated for authorities that do include it. At national level, the disposal costs are slightly underestimated because of the inability to completely disaggregate disposal costs at the start of the attribution of street cleansing outturn to litter costs (though this is not the biggest sensitivity and is not discussed separately here). Meanwhile, the non-primary department costs are not disaggregated at this level at all. They can be approximated by adding 11% onto the litter cost for the main street cleansing outturn – however this will overestimate costs for authorities that do not have resource for litter in non-primary departments and for those who do include this in their outturn already. These types of assumptions are unavoidable at present until reporting requirements and compliance are improved.

- **Expenditure on different components of cost and attribution to litter, and litter generation, according to rurality and deprivation**

The impact of these variables is significant between local authorities, as they dictate many aspects of the model, including total litter tonnage and percentage splits between components of cost (people, vehicles, etc.). However, *en masse* the impact was thought to be minimal compared to other sensitivities discussed. This is because, as rurality and deprivation categories change, the component of cost, litter attribution, and litter generation variables as a default assumption either gradually increase or decrease. So, the authorities in higher and lower categories – to a certain extent – averaged out. Therefore, when considering the UK as a whole, the total litter costs would not be expected to dramatically change if the range of the assumptions on components of cost, litter attribution and litter generation, according to rurality and deprivation, changed somewhat. If the nature of the relationship changed (e.g. from linear to curved), this could affect the totals. However it is not possible to understand how big this effect could be if data were to improve and the assumptions became more accurate.

3.5 Recommendations for future research and actions necessary to support determination of EPR costs for street cleansing

3.5.1 Composition

Further primary research on the composition of litter across the UK is necessary. The results of the model are highly sensitive to the composition of litter, and as such it is critical that the methodologies used in litter composition studies are uniform and robust. The following recommendations are made:

- Litter categories in the study should map uniquely to either packaging or non-packaging, so that assumptions do not have to be made about what proportion of a particular category maps to packaging versus non packaging.
- The use of terms like “other”, “general”, and “unsure” should be kept to a minimum when describing litter, to avoid large unattributed categories. Where it cannot be

avoided, any general categories should be split into “packaging general” and “non-packaging general” categories, as per the above recommendation.

- Key categories of interest as necessary for the EPR scheme under consideration should be defined as separate categories within a study, so that it is possible to directly take them or sum them from the dataset with minimal assumptions on what proportion of an aggregated category is in scope; these categories should be kept consistent between studies, such as beverage containers relevant to DRS, cigarette butts, and chewing gum.
- Putrescibles should be included. However, putrescibles in litter do not always occur in discrete units that can be counted. Where they cannot be counted a typical food waste portion weight and volume should be determined and used to attribute count.
- In order to provide an accurate and more standardised reflection of the composition of litter collected by local authorities, samples should be taken from litter collected by councils, rather than litter being directly collected from the ground by the researchers themselves, or by *in situ* counts. This avoids the results being impacted by the accumulation of specific items, often missed by routine cleaning but recorded with great accuracy by researchers, such as cigarette butts. The data otherwise do not reflect the flow of litter into the environment or the cleansing effort of local authorities – the latter being the most appropriate here, as EPR costs cover clean-up, not unmanaged litter.
- Studies should sample and report litter collected from the ground and from bins separately. This may mean changes in operational practice are required for the duration of the study, which relies on ensuring litter operatives are informed about the study, its purpose and the need for them not to combine the two streams.
- Units should be recorded by count, by weight, and by volume. Conversion factors for specific categories (like “cups”) vary around the world depending on what products are typically popular or marketed and hence what the typical make-up of the category is. They also can be inaccurate because they do not take into account real-world contamination (waste products or water, dirt) and they should do so, as this also reflects the effort and resource utilised by cleansing effort. The point at which volume is measured should be kept consistent and made clear. Bulk density changes throughout the litter’s journey but it is likely to be cost-prohibitive to measure this at multiple junctures. Once it arrives at a transfer station should be convenient.
- Enough research on composition should be conducted so as to understand seasonal variation. After this has been understood better, standard factors could be developed and applied to account for this.

3.5.2 Reporting

In terms of reporting, we would suggest improving existing guidelines to support the standardisation of street cleansing outturn reporting. The ambiguity surrounding how different aspects of the service are reported has caused difficulties with modelling which could have been avoided if authorities were required to follow clearer reporting guidelines and compliance were improved. Either A) the scope of reporting would need to be reported for each and every local authority – there is no local authority characteristic according to which this can be determined *a priori* as things stand, or preferably, B) reporting should be standardised; either would mean that generalisations are no longer necessary.

Additionally, in cases where authorities out-source their street cleansing service, there should be a requirement for the company running the service to provide the authority with a breakdown of its spending. This was a significant barrier to obtaining the necessary information during the research.

4.0 Fly-Tipping

4.1 Data and Assumptions

This section outlines the calculations for the weight of fly-tipping incidents within England and Wales in 2018/19, and the proportion of packaging they are estimated to contain. A discussion of the limitations to the data is followed by a description of the methodology used and assumptions made in the calculation and finally high-level estimations for the overall tonnages of fly-tipping incidents and the quantity of that which is packaging are displayed.

4.1.1 Weight of Fly-Tipping Incidents

The number of fly-tipping incidents for England and Wales was obtained from WasteDataFlow, via Defra (2018/19)⁴⁹ and Statistics Wales (2018/19).⁵⁰ The WasteDataFlow guidance sheet contains definitions for each of the categories used by Local Authorities to record incidents of fly-tipping.⁵¹ The definitions of categories by fly-tip size contain a description of the approximate size of the incident. A qualitative description of the range of sizes for each category is given and the middle of this range was the assumed weight for each incident size category. To calculate the weight for each incident size category, the volume was converted into weight by calculating a density from a 0.125 m³ bin bag weighing 7 kg.⁵² The descriptions, weights, and volumes for each fly-tipping size category are shown in Table 4-1. By combining these weights with the number of incidents by type, the overall weight of fly-tipping incidents could be estimated.

4.1.2 Fly-Tipping Incidents Containing Packaging

In order to calculate the quantity of packaging contained within these fly-tipping incidents, a separate dataset was used. In addition to categorising incidents by size, within WasteDataFlow, incidents are also categorised by Waste Type, such as 'White goods', or 'Black bags – commercial', alongside a description of each category. Using the description, each category was first defined to either likely contain packaging or not contain packaging. Subsequently, each category was assigned to one of the following waste types:

1. Household waste;
2. Commercial waste; or
3. Construction waste.

Using this categorisation, for each of the three waste types, the percentage of the overall incidents likely to contain packaging was calculated.

⁴⁹ <https://www.gov.uk/government/statistical-data-sets/env24-fly-tipping-incidents-and-actions-taken-in-england>

⁵⁰ <https://stats.wales.gov.wales/Catalogue/Environment-and-Countryside/Fly-tipping/recordedflytippingincidents-by-size>

⁵¹ WasteDataFlow (2016) GN64 - Fly-Tipping Module, accessed 12 August 2020, https://www.wastedataflow.org/documents/GuidanceNotes/Fly-tipping/GN64_WDF_Fly-tipping_modulev1.0q.pdf

⁵² Zero Waste Scotland (2013) Scotland's Litter Problem: Quantifying the scale and cost of litter and fly-tipping, 2013, <http://www.zerowastescotland.org.uk/sites/default/files/Scotland's%20Litter%20Problem%20-%20Full%20Final%20Report.pdf>

4.1.3 Fly-Tipping Composition

Using publicly available data on the composition of each waste type as a general waste stream (as composition of fly-tipping waste is not available),^{53 54} the proportion of packaging by weight and volume was calculated. By combining these factors with the overall weights by incident size from Section 4.1.1, the weight of packaging within fly-tipping incidents can be estimated.

Table 4-1: Weight and Volume of Incident Size Categories

Waste Data Flow Category	Definition	Assumed weight per incident (kg)	Assumed volume per incident (m3)
Single Black Bag Incidents	A single bin bag containing waste. Cost of removal/disposal will be entered for you based on national average costs	7	0.125
Single Item Incidents	One piece of furniture or equipment. There may also be a few small items that would not on their own constitute a fly-tip. Cost of removal/disposal will be entered for you based on national average costs.	7	0.125
Car Boot or Less Incidents	The rubbish could be broken down and squeezed into a large boot of a car. About 1 cubic metre maximum. Up to 5 large bin bags. Cost of removal/disposal will be entered for you based on national average costs.	21	0.375
Small Van Load Incidents	Bigger than the car boot load but that the rubbish could be broken down and squeezed into an Astra size van. About 4 cubic metres. Between 6 and 15 bin bags. Cost of removal/disposal will be entered for you based on national average costs.	77	1.375
Transit Van Load Incidents	Bigger than the small van but that the rubbish could be broken down and squeezed into a transit size van. About 10 cubic metres. A large 3-piece suite of furniture would fall into this category. Between 16 and 30 bin bags. Cost of removal/disposal will be entered for you based on national average costs.	168	3.000
Tipper Lorry Load Incidents	A single load from an 8-wheeled tipper truck. You will need to enter your estimated or actual cost of removal and disposal.	728	13.000
Significant / Multi Loads Incidents	A multiplicity of the above. You will need to enter your estimated or actual cost of removal and disposal.	1456	26.000

⁵³ Natural Resources Wales (2012) *Survey of Construction & Demolition Waste Generated in Wales 2012*, p.44

⁵⁴ WRAP (2020) Quantifying the composition of municipal waste, accessed 12 August 2020, <https://wrap.org.uk/content/quantifying-composition-municipal-waste>

4.1.4 Results

By applying the factors of 4.1.2 and 4.1.3 with the overall weights and volumes calculated in 4.1.1, the weight and volume of packaging contained within fly-tipping incidents was estimated. The outputs of these calculations are shown in Table 4-2.

Table 4-2: Weight of Fly-Tipping Incidents, England and Wales, 2018/19

	Weight (tonnes)
Fly-tipping - total	94,430
Fly-tipping - packaging	4,116
Packaging (%)	4.4%
Fly-tipping – total per incident	0.0088
Fly-tipping – packaging per incident	0.004

A range of total costs of fly-tipping have been estimated at £57.7m (2016/2017, Defra estimate based on modelled costs)⁵⁵ - £149m (based on data for Scotland, 2012/13 prorated to the UK as a whole).⁵⁶ Clearly better data is needed on costs, given the wide range of current estimates and the question around the applicability of national statistics UK wide.

Comparing the tonnage of fly-tipped packaging (4,166 tonnes), with the overall estimate for littered packaging of 217,612 tonnes (~45% by weight of a total of 480,732 tonnes), it is equivalent to 0.9% by weight of all litter and 1.9% by weight of all littered packaging. Taking a midpoint for the above estimate of cost of £103m for fly-tipping clearance, this gives a cost per tonne of £1,091. Applying this to the packaging tonnage gives an estimate of £4.5m in costs. This is equivalent to 0.7% of all litter costs. This estimate is highly approximate, given the uncertainty around fly-tipping costs and tonnages.

4.1.5 Limitations

The national waste data system, WasteDataFlow, captures the number of fly-tipping incidents by land-type, waste type, and size, as reported by Local Authorities. The data used here is limited to Local Authorities within England and Wales, and no data is available for Scotland and Northern Ireland. Additionally, the data does not include any fly-tipping incidents occurring on private land, or very large incidents that were handled by the Environment Agency.

There are also limitations in the way data is collated and inputted into WasteDataFlow. No data is recorded on the tonnage and composition of fly-tipping incidents and hence in order to calculate the overall tonnage and composition, assumptions on the weight and waste type of incidents are required. Furthermore, whilst data is captured by land-type, waste-type and

⁵⁵ Department for Environment Food and Rural Affairs (2017) Fly-tipping statistics for England, 2015/16, March 2017, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/595773/Fly-tipping_201516_statistical_release.pdf

⁵⁶ Eunomia Research & Consulting (2017) Rethinking Waste Crime, April 2017, <https://www.eunomia.co.uk/report-category/topic/waste-recycling/waste-crime-3/>, (2014) Waste Crime: Tackling Britain's Dirty Secret, Report for ESA Education Trust, March 2014, http://www.esauk.org/esa_reports/ESAET_Waste_Crime_Tackling_Britains_Dirty_Secret_LIVE.pdf

size, these categorisations are not linked together and as such, amount to separate datasets. For example, the number of fly-tipping incidents involving household black bags is recorded (i.e. a relevant waste type for packaging) but no data is available on the range of sizes of these incidents. With these limitations in mind, it was necessary to make many assumptions to calculate the overall weight and composition of fly-tipping incidents.

5.0 Conclusions

The total street cleansing expenditure was determined to be £1,013m, of which £586m (58%) is attributable to litter (Table 5-1).

On a per capita basis England has the lowest cost of all four nations and Northern Ireland has the highest – almost double that of England (Table 5-2).

The litter cost attributed to packaging is estimated to be £341m UK-wide (59% of all litter costs) (Table 5-3). £153m was the cost attributed to beverage containers (DRS 1), i.e. 26% of all litter clean-up costs.

Table 5-1: UK Litter Costs,⁵⁷ Primary Local Authority Street Cleansing Departments,⁵⁸ Non-primary Local Authority Departments⁵⁹ and Other Duty Bodies⁶⁰

	Cost (£m)
Street Cleansing Department Litter Costs	586 <i>(of 1,013 total outturn – 58%)</i>
Non-primary Department Litter Costs	66
Other Duty Bodies' Spend	10
Total	662

⁵⁷ The most recent available street cleansing cost data for each nation was used within the model, and is as follows:

- England: 2018/19
- Wales and Scotland: 2017/18
- Northern Ireland⁶⁷: 2016/17

⁵⁸ "Primary departments" are those such as Street Cleansing departments, that have most of the responsibility for litter clean-up in a local authority. However other departments, such as those caring for Parks and Grounds, will also be undertaking litter clean-up. These are referred to throughout the report as "non-primary departments".

⁵⁹ Additional to those already included in street cleansing outturn costs.

⁶⁰ For the duty bodies for which it was possible to determine costs. In the present study, costs were determined for road agencies, agencies for railways, and navigable waterways; it was not possible at this time to determine costs for other duty bodies such as Transport for London, educational establishments or Crown authorities.

Table 5-2: Cost of Litter for Local Authority Street Cleansing Departments and Non-primary Departments, by Country

	Total (£m)	Proportion of UK cost	Proportion of UK Population	Cost per capita (£)
UK	649	100.0%	100.0%	9.77
England	521	80.3%	84.3%	9.31
Wales	39	6.1%	4.7%	12.52
Scotland	57	8.8%	8.2%	10.54
Northern Ireland	32	4.9%	2.8%	16.77

Note: the values above omit chewing gum costs (UK £3m).

Table 5-3: Cost of Ground and Bin Litter and percentage costs of packaging and its streams, (all LA costs and duty bodies)

	Ground Litter	Bin Litter	Total Cost, £m, (100%)	Proportion of Total Litter Cost
All Litter	65%	35%	662	100%
Non-packaging	83%	17%	278	42%
<i>Of which: Cigarette butts</i>	<i>98%</i>	<i>2%</i>	<i>46</i>	<i>7%</i>
<i>Chewing Gum</i>	<i>99.7%</i>	<i>0.3%</i>	<i>7</i>	<i>1.0%</i>
Packaging	52%	48%	384	58%
<i>Of which: DRS 1</i>	<i>50%</i>	<i>50%</i>	<i>172</i>	<i>26%</i>
<i>DRS 2</i>	<i>47%</i>	<i>53%</i>	<i>5</i>	<i>0.7%</i>
<i>DRS 3</i>	<i>40%</i>	<i>60%</i>	<i>37</i>	<i>6%</i>

Regarding packaging and fly-tipping, a small proportion of costs may be missing from the current estimate of general litter collection costs - the estimate obtained was 0.7% - owing to the exclusion of fly-tipped packaging from the current analysis. Better information on incident type, size, composition and clean-up cost would be necessary to provide more certainty around this very indicative, initial estimate.

Recommendations

- Primary research is required to provide a reliable composition dataset for cost allocation to different types of litter. It should assign items uniquely to either packaging or non-packaging, avoid bias caused by items such as cigarette butts in the sampling strategy by sampling local authority *collected* litter only (rather than *in situ* counts), and include all categories of litter including food waste. Seasonal variation should be taken into account. All units (count, weight and volume) should be measured.

- In order improve the accuracy of the national cost estimates, and, perhaps more significantly, to move to a point where the model could determine cost for individual local authorities more accurately, for the purpose of allocating of EPR funds, the scope of financial reporting on litter, i.e. local authority revenue outturn, should be made more explicit in guidance, standardised across nations, and compliance with the reporting conventions improved by working with local authorities. It is recommended that the following costs for litter be reported together with Street Cleansing:
 - Costs for non-primary departments dealing with litter (such as parks and grounds, or beaches)
 - Central services, admin and strategy
 - Education and enforcement

Disposal costs, as they can be modelled fairly easily, are not *as* critical to include; but it is critical that they are reported consistently either together with Street Cleansing outturn, or with the rest of waste disposal.

- In order to estimate costs over time as littering changes (i.e. anticipated reductions), whether local authorities would either: reinvest saved resources and raise litter cleanliness standards, or reduce expenditure in response to reduced littering, or reallocate resources to different parts of the street cleansing service, an approach could be to monitor litter tonnage as well as litter composition, regularly, for a representative sample of places and times of year, and couple this with the outputs of a primary research task, to understand fixed and variable costs for a set of representative local authorities in order to obtain an estimate of marginal cost per tonne for different litter categories. Alternatively variable costs could be indexed to some measure of littering – like *in situ* counts with a purposely developed methodology – however methods for doing so that are robust enough to reliably detect change over time are undeveloped, with relevant methods at a very early stage of development and highly subject to methodological issues or incomparabilities (such as inability to standardize to last cleansing time, unknown variance (“noise”) and hence necessary sample size, or bias for items that accumulate, *inter alia*).
- EPR fees could cover cost of improvements in data collection that would facilitate the determination of costs for litter.

A.1.0 Appendix 1 – Local Authority Classification

Assumptions regarding UK authorities' litter collection expenditure have been derived giving consideration to various characteristics which are thought to impact littering behaviours and service provision within the respective authority, those characteristics being:

- Population;
- Index of Multiple Deprivation (IMD);
- Rurality; and
- Coastal features and amenity beaches.

Population

For the majority of UK authorities, population values have been obtained using ONS 2018 mid-year estimates⁶¹. In some instances, ONS report population at county level rather than providing a breakdown by unitary authority population within the county. Where this is the case, Population City⁶² has been used as an alternative source and values clearly highlighted within the model. These population estimates have subsequently been utilised to perform per capita calculations.

Index of Multiple Deprivation

IMD is a comparative measure which assesses the relative deprivation of a neighbourhood, or Lower Layer Super Output Area (LSOA) compared with other neighbourhoods LSOAs within the same country. IMD offers multidimensional information on living conditions and basic necessities in an area, taking into account components such as income, employment, education, health and crime. It should be noted that, although similar approaches to determining IMD scores are employed by each country, slight variations exist meaning there is no UK wide approach. As a result, it would be inaccurate to compare directly the IMD rank of an authority within a country to the rank of an authority from a different country.

Instead, local authorities have been grouped utilising the IMD decile system, in which, the most and least deprived are divided into 10 equal groups. LSOAs in decile 1 fall within the most deprived 10% of LSOAs while LSOAs in decile 10 fall within the least deprived 10% of LSOAs. As IMD data is provided at LSOA level, an average value for all LSOAs within a respective authority has been taken to obtain an IMD score at local authority level.

For the purpose of modelling, deciles 1-4, 5-7 and 8-10 have been allocated flags of 1, 2 and 3 respectively i.e. it is assumed the littering behaviours of the most deprived and least deprived authorities are the same irrespective of country. These scores have been used to apply different multipliers to an authority's litter expenditure depending on IMD category.

The following sources have been used to obtain IMD data:

61 *Office for National Statistics (2019)* Estimates of the population for the UK, England and Wales, Scotland and Northern Ireland, <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalescotlandandnorthernireland>

62 *Population City (2019)* United Kingdom Population, accessed 1 August 2019, <http://population.city/united-kingdom/>

Country	Year	Source
England	2015	https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015
Wales	2014	https://statswales.gov.wales/Catalogue/Community-Safety-and-Social-Inclusion/Welsh-Index-of-Multiple-Deprivation/Archive/WIMD-2014
Scotland	2016	https://www2.gov.scot/Topics/Statistics/SIMD
Northern Ireland	2017	https://www.nisra.gov.uk/publications/nimdm17-soa-level-results

Rurality

Similarly to IMD, each nation has a unique Rural Urban Classification method. Datasets with different six category classification approaches were found for England, Wales and Scotland whereas Northern Ireland utilise a three category classification approach i.e. 'Rural', 'Mixed' and 'Urban'. For this reason, preliminary interpretation and grouping of the six categories has been performed.

Data is provided at LSOA level thus rurality scores have been derived using an average value for LSOAs within an authority. Subsequently, authorities have been allocated a rurality score of either 1, 2 or 3 with 1 corresponding to more rural authorities, 2 identifying authorities which display mixed characteristics and 3 for more urban authorities. These scores have been used to apply different multipliers to an authority's litter expenditure depending on rurality.

The following sources were used to obtain data regarding the rurality of UK local authorities:

Country	Year	Source
England	2011	https://www.ons.gov.uk/methodology/geography/geographicalproducts/ruralurbanclassifications
Wales	2014	https://www.healthmapswales.wales.nhs.uk/IAS/linked-data/doc/dataview/5ADEE4F5-3A16-47B9-A26E-952E5B5D3B26
Scotland	2016	https://www.gov.scot/publications/scottish-government-urban-rural-classification-2016/
Northern Ireland	2015	https://www.nisra.gov.uk/support/geography/urban-rural-classification

Coastal Authorities and Amenity Beaches

An uplift has been applied to an authority's litter expenditure in instances where it contains an amenity beach, as it is assumed the footfall on these beaches and the provision of services to such beaches by a local authority means that additional resources are required for litter clean-up. This assumption is supported by previous research undertaken with

Scottish local authorities as well as existing literature.⁶³ ⁶⁴ For modelling purposes, these authorities have been identified as those that host a “Blue Flag” accredited beach. Blue Flag accreditation is awarded to beaches which employ a stringent series of environmental, educational, safety and accessibility criteria.⁶⁵

63 *Eunomia Research & Consulting (2013) Direct Costs of Littering, Report for Zero Waste Scotland, 2013*

64 *KIMO (2010) Economic Impacts of Marine Litter, 2010, http://www.kimointernational.org/wp/wp-content/uploads/2017/09/KIMO_Economic-Impacts-of-Marine-Litter.pdf*

65 *Blue Flag (2019) Blue Flag Beaches, accessed 1 August 2019, <https://www.blueflag.global/beaches2>*

A.2.0 Appendix 2 – Fly-tipping – Waste Data Flow Categories

Waste Data Flow Category	Definition	Contains Packaging	Waste Type
Animal Carcass Incidents	Any animals or parts of animals.	N	N/A
Green Incidents	Any vegetation/pruning's and clean soil including tree trunks and branches	N	N/A
Vehicle Parts Incidents	Any mechanical parts, components and panels of vehicles except tyres and batteries (see below)	N	N/A
White Goods Incidents	Fridges, freezers, washing machines and other kitchen appliances.	N	N/A
Other Electrical Incidents	TVs, computer equipment, vacuum cleaners, radios, fluorescent tubes, circuit boards and car batteries, etc.	N	N/A
Tyres Incidents	Vehicle tyres regardless of whether they are on the wheel rim or off the rim.	N	N/A
Asbestos Incidents	All forms of asbestos including cement- or other bonded asbestos	N	N/A
Clinical Incidents	Hospital or healthcare waste such as blood, tissue, needles, soiled dressings, drugs etc that is infectious or could cause harm in some way. It may be produced from hospitals, medical, nursing, dental, veterinary, pharmaceutical or similar practices or from home treatment e.g. home based dialysis machines	N	N/A
Constr / Demol / Excav Incidents	Waste from the construction, repair, maintenance and demolition of buildings and structures including roads. It means brick concrete, hardcore, soil, timber, plastics and occasionally hazardous waste. It also includes cement, sand, and other surplus building materials from builders or tradesmen. Include large-scale DIY waste e.g. complete kitchen units or household fittings	Y	Construction
Black Bags - Commercial Incidents	Waste from businesses particularly shops or traders which are not to be picked up by a trade waste collector. It may be difficult to differentiate between this and the next category without opening the bags. If necessary use your judgement based on proximity.	Y	Commercial
Black Bags - Household Incidents	Waste from householders bagged and dumped on the street. You will obviously need to exclude those bags where waste has been put out for collection by the	Y	Household

	<p>refuse service. You will need to exercise your judgement about when to include domestic waste that has been put out outside the time frame set by the council for collection. If this time frame is reasonable and has been notified to the residents, and providing the refuse service is operating normally, waste placed out outside this time frame should normally be treated as fly-tipping for the purposes of this database. However, local authorities may have circumstances when it would be inappropriate to do so</p>		
Chemical Drums, Oil, Fuel Incidents	Containers each with a capacity of 205 litres (45 gallons) or greater that appears to contain chemicals including oils and fuels	N	N/A
Other Household Waste Incidents	Any household waste not covered above and could include the results of house or shed clearances, old furniture, carpets and the waste from small scale DIY works.	N	Household
Other Commercial Waste Incidents	Any commercial or industrial waste not covered above and could include pallets, cardboard boxes, plastics, foam, and any other waste not contained in bags or containers and not due to be collected.	Y	Commercial
Primary Waste Type Measures Other (unidentified) Incidents	To be used if none of the above applies. Do not use this for mixed loads, try to identify the dominant waste type and use one of the above categories.	N	N/A

A.3.0 Appendix 3 – Considerations Regarding Impact of DRS on Litter Clean-up Costs

The impact of future potential DRS schemes on EPR costs is of interest to the UK Government, given upcoming plans to introduce them in England, Scotland and Wales. Here we provide some commentary on what the research conducted for this project can tell us about how costs might change if the number of littered DRS items falls dramatically over time, and how the model for attribution of expenditure to specific litter fractions behaves in response to changing composition that would be expected as a result. Implications for charges to obligated producers are discussed. As per the Terms of Reference and proposal, the research conducted in the main body of the report and resulting model is not able to fully account for marginal costs and change in cost over time. It provides a way of allocating cost at one point in time, and is principally intended to feed in to the forthcoming consultation on changes to EPR in the UK, by providing financial estimates for the accompanying impact assessment in the background paper. This discussion reflects on what the implications on using this model “as is” for allocation of costs to obligated producers, pre- and post- introduction of DRS, as an addendum to the original Terms of Reference.

Authorities were asked, in the in-depth interviews, about how they thought a DRS scheme would affect their service if it were to be brought in in England/Wales.

There was a general consensus among authorities that a DRS would likely decrease the tonnages of litter collected to some extent, with an associated reduction in disposal costs, and several authorities anticipated an improvement in the visual amenity of the area as a result of DRS.

However, most thought that it would not have an impact on the expenditure on the service. Perceived savings, such as those incurred through reduced cleaning requirement because of lower litter density, were described in terms of resources rather than cashable savings. This is because authorities would still be required to carry out their usual rounds to ensure bins were emptied and litter hotspots were kept free of litter. Moreover, many items which contribute to ground litter, such as cigarette butts and to full bins, like takeaway coffee cups and food boxes, would not be included in the DRS. Authorities envisaged the same number of teams would be used, and the resource saved on bin and ground litter as a result of a DRS could be redeployed elsewhere in the service or increase the frequency of cleaning in general, or the number of deep cleans.

One authority mentioned the need for additional education around DRS if it were introduced, which they were concerned would likely incur a higher cost than removing the litter. An anticipated increase in gate fees as a result of DRS was also mentioned, as the scheme would target the more valuable, recyclable materials leaving authorities with higher proportions of residual waste to dispose of. However revenue from recycling on-the-go is very small compared with household waste so in reality this is likely to be minimal. A small number of authorities thought that the reduction in volume in litter bins would eventually outweigh the loss of recycling revenue.

In the present cost model, because the cost estimation is driven by percentage composition(i.e. relative units), a reduction in one type of waste means that the percentage of other types of waste increases. As an illustration, we have looked at how costs would be reallocated between different groups of items littered under two litter reduction scenarios as a result of the change in composition, assuming there were no change in street cleansing

expenditure. Composition scenarios were devised to model a 50% and a 90% reduction in all DRS items being collected from bins and from the ground. The resulting impact on attribution of cost is shown in Table A3-1. As expected, the cost allocated to DRS items goes down when DRS items are removed from the litter stream. A 50% reduction entails an £85m reduction in costs attributed; while a 90% reduction a £177m reduction. For non-DRS packaging, however, an increase in cost attributed of £27m and £99m is seen respectively under 50% and 90% reduction scenarios. However as a group, obligated packaging producers would see a reduction of £78m in costs attributed, (from £384m to £306m) as the overall reduction outweighs the increase in costs attributed to non-DRS fraction. Attribution to non-packaging items would also see an increase, however this, if the items are not obligated within an EPR scheme (as expected), would be footed by local authorities and taxpayers.

Table A3-1 Costs attributed to different item types under different litter reduction scenarios for DRS items

	Cost litter (£m)					
	Non-packaging	Cigarettes	Chewing Gum	Packaging	Non-DRS packaging	DRS packaging
Current	278	46	6.5	384	165	219
50% reduction DRS items	336	48	6.7	326	192	134
90% reduction DRS items	357	52	6.9	306	264	42

For the purposes of discussion, if the marginal cost were linear on a 1:1 basis, and it was decided to estimate costs over time taking this into account, instead of only reallocating costs as a result of changing composition, Table A3-2 shows how DRS item litter cost attribution would change. The reduction would be great; costs attributed to all other items would remain the same (as in the top row of Table A3-1).

Table A3-2 Costs for DRS items if marginal costs were exactly proportionate to litter reduction

Cost litter (£m)	
	DRS packaging
Current	219
50% reduction DRS items - 1:1 marginal cost	110
90% reduction DRS items 1:1 marginal cost	22

Given that local authorities are more likely to reallocate resources in response to having to deal with less packaging litter rather than spend less, the first option for attribution of costs, though it is somewhat counterintuitive and may be perceived as unfair, is the best representation of how costs are in real terms distributed between different items as far as

litter clean-up activity is concerned, of the two approaches. It therefore does satisfy the primary purpose of EPR fees which is that, the clean-up costs incurred should be covered. Under the second option for attribution of costs, if for example, fees were set relative to a reference year, it is likely that eventually there would be a shortfall in terms of cost coverage.

Furthermore, many manufacturers, especially the major manufacturers, have product lines cutting across the DRS/non-DRS categories. The outcome in terms of financial incentivisation of litter reduction is therefore aligned, under the first option, even when relative proportions are used to set costs, and this may improve perceptions of fairness.

It is also worth considering that obligated producers who do nothing to reduce littering and/or improve collection rate are incentivised by the increasing cost allocated to their items that occurs when obligated producers do take action. This could be seen as akin to the bonus/malus concept within EPR fee modulation and provide some motivation to these producers to act and produce positive environmental outcomes. The overall effect is that obligated producers must act in concert to improve performance or be penalised, which is fully aligned with the principles of extended producer responsibility.

A.4.0 Appendix 4 – Efficiency and Marginal Costs

In interview work conducted in a preparatory phase of the current research, local authorities were asked questions to probe how adequate current litter service provision was. This was superseded by questions on ability to meet statutory obligations. However as it provides some insight into marginal costs, it is used to introduce this area of discussion. A small number of LAs interviewed believed that they were nearing the point of diminishing returns on their street cleansing spending, and therefore would see minimal gains for any further money spent, while the majority think standards would see significant improvement from additional funding. This is important because it must be decided whether EPR is to cover *current* costs or whether it should be used to fund a service that provides some 'acceptable' or some 'optimal' level of service with regard to cleanliness outcomes – e.g. with regard to statutory obligations. It also gives some insight into marginal costs – i.e. cost for each 'unit' of cleanliness improvement, or conversely, the savings per unit of decreased litter input. At present the marginal costs are such that for most authorities, each unit of expenditure on extra effort would see significant benefits. It also suggests that if littering tonnages were to go down through prevention, councils could keep the resourcing the same to increase cleanliness outcomes significantly. However it would be up to each council to decide whether they would instead choose to decrease the level of service and keep cleanliness outcomes the same, in this scenario, to respond to overall resource cuts for example; or to spend the resource on another element of the service (e.g. non-litter) or other non-streets area such as parks or beaches. Additionally, any given service is likely to be unable to respond to reduced litter input without a considerable time delay, given the general lack of litter monitoring, its poor resolution and high variation, and its generally annual frequency, as well as contractual arrangements which may be costly and take a long time to alter.

In the event that an EPR system was designed to modulate the fee according to clean-up spend, this saving should in theory be passed on to the producers for the purpose of incentivising litter prevention, though it could be difficult in practice to get the council to do this for the above-mentioned reasons. If the system modulated the fee according to littering amount (i.e. the quantity of material littered), it would be a more reliable mechanism for producers, though it would require a certain amount of monitoring effort (the cost of which the producers could also be liable for, regardless of who delivered it).

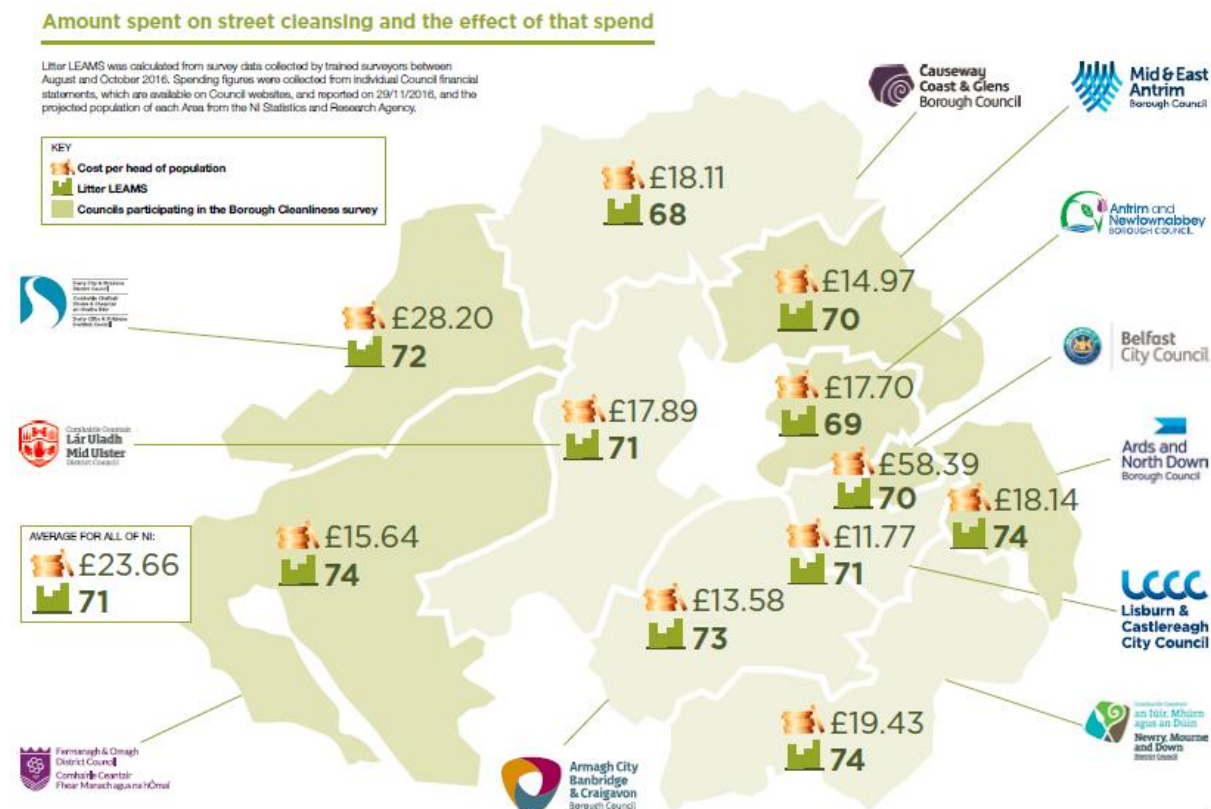
It was considered whether cleanliness standards and cost information could be used to understand:

- a) Marginal costs and
- b) Cleansing efficiency.

As a result of the different methods used to monitor performance, and the non-comparable metrics they produce, as well as the 8% of councils not conducting assessment at all (APSE research), assessing the relationship between local authority spend and outcomes, is no trivial task for the UK. However an example of where this has been done, in Northern Ireland, showed there was no correlation between cleanliness standard and spend per capita

(Figure A4-1).⁶⁶ This could be attributed to a) the lack of data to control for different littering rate baselines ('litter input') in different councils and b) the lack of resolution in the cleanliness data meaning scores are not adequately differentiated enough to produce a signal greater than the 'noise' in the dataset; and c) variation in the scope of street cleansing costs between local authorities would also confound any correlation.

Figure A4-1: Costs per capita and cleanliness for street cleansing services in Northern Ireland.



Reproduced from: *Keep Northern Ireland Beautiful (2017) National Benchmarking Report 2016/2017*

In theory, attempting to make such a correlation would be valuable if this would produce an understanding of the marginal costs of litter, to predict how much more resource would be required to bring local authorities up to a certain standard. However, the following issues make this an extensive undertaking not possible without extensive research focussed exclusively on the problem:

- lack of littering baselines (essential to distinguish between authorities that are less efficient vs those dealing with a bigger litter problem),
- lack of uniform cleanliness data of adequate resolution,
- the broad-brush nature of cost estimates possible at present, and
- the complexities around quantifying the marginal costs of litter (which is unlikely to be a linear relationship owing to fixed and variable elements of cost - and which will be different for different types of litter),

It may become possible to understand marginal costs if reporting is standardised in the future and the quality of data improves in each of these regards. On the other hand, it can be argued that this level of data is not required to drive improved efficiency and improved standards, which can be done by focussing on more operational measures on an individual

⁶⁶ *Keep Northern Ireland Beautiful (2017) National Benchmarking Report 2016/2017, 2017*, <http://www.KeepNorthernIrelandBeautiful.org/KeepNorthernIrelandBeautiful/documents/007134.pdf>

local authority basis, such as conducting efficiency reviews, ideally including assessment of standards and litter mass flow over time.

[www.wrap.org.uk/relevant link](http://www.wrap.org.uk/relevant-link)