



# **London Plan Waste Forecasts and Apportionments**

**Task 1 – GLA Waste Arisings  
Model Critical Friend Review**

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## 1.0 OVERVIEW

This paper presents findings from SLR's review of updated waste arisings forecasts prepared by the GLA for inclusion in the London Plan. Sections 2 and 3 respectively consider household waste forecasts, and commercial and industrial waste forecasts, including the following elements:

- SLR's comments on the GLA's updated in-house forecasts are set out in tabular form.
- Projections previously included in the Further Alterations to the London Plan (FALP), which utilised a similar methodology to the updated projections, are considered in light of the latest available data.
- Potential impacts of the GLA's circular economy objectives are explored.
- Modified waste arisings projections with proposed refinements to the GLA approach are presented. Updated projections are compared to previous FALP forecasts,
- Forecasts are also sensitivity tested accounting for uncertainties in underlying in the datasets, and variants on the forecasting approach.

## 2.0 HOUSEHOLD WASTE

### 2.1 Review of GLA In-house Forecasts

The GLA has prepared forecasts for future borough arisings of household waste, and commercial and industrial waste. Projections for both waste streams have been provided to SLR in the Excel spreadsheet file 'lprwasteproject.xlsx'.

Findings from SLR's review of the model are tabulated below in Table 2-1. Comments are provided on a number of aspects of the forecasts, a level of significance being indicated in each case.

Overall, SLR fully concurs with the forecasting methodology used by the GLA. However comments in Table 2-1 include a number of suggested refinements to the GLA projections. These refinements have been applied by SLR in developing projections presented in section 2.4.

**Table 2-1: SLR Comments on GLA In-house Household Waste Forecasts**

Forecast aspect	Model reference	SLR comment	Significance
Baseline household waste arisings	Worksheet 'HH', column B	We believe the borough tonnages currently included for 2015/16 may be local authority collected waste, rather than household waste. Tonnages therefore currently include non-household waste collected by local authorities (largely local authority trade waste collections), overestimating the household waste tonnage.	High
		We understand that Defra's commercial and industrial waste survey includes all C&I waste, including local authority trade waste. To avoid double counting, it may therefore be appropriate to consider only borough household waste tonnages (London total 3.1 Mt in 2015/16) as opposed to local authority collected waste in totality (London total 3.7 Mtpa in 2015/16).	
Household waste arisings per capita	Worksheet 'HH', columns C, D and E	The baseline arising of household waste per person is established on the basis of GLA household numbers, and average household size data for 2016.	Minor
		Since Defra household waste data used applies to financial year 2015/16, and noting that three of the quarters of financial year 2015/16 occur in 2015, it may be appropriate to establish per capital generation rates using GLA demographic data for calendar year 2015. This modification will not significantly impact on projections, but could be considered as a point of consistency.	
		We also note that taking the multiples of column C (household numbers in 2016) and column D (average household size) indicates a total London population of 8.628 million. Referring to the GLA's intermediate	Minor

		population projection (long term trend, 2015 round) <sup>1</sup> , this seems to indicate a population of 8.727 million in 2016. This issue could potentially be resolved by establishing per capita waste arisings on the basis of the GLA's population projection, rather household numbers / household size.	
		We understand that population projections used are taken from the published versions dated July 2016 <sup>2</sup> .	
Population projections	Worksheet 'HH', columns G to P	Our understanding is that this GLA population projection has been superseded by an updated version revised in October 2016 <sup>1</sup> .  We note that overall difference between the two projections is minor (a deviation of less than 1% in the total London population by 2026).	Medium
Waste reduction	Worksheet 'HH', columns G to P	Forecasts currently assume constant household waste generation per person up to 2041.  It is understood that the GLA is committed to circular economy objectives, and working actively in this area with LWARB. Under a circular economy scenario, levels of household waste generated per person may be reduced. This issue is explored further in section 2.3.	Medium

## 2.2 Evaluation of Previous Projections Against Outturn Data

Proposed updated GLA household waste forecasts adopt the methodology previously used for projections included in the Further Alterations to the London Plan (FALP). A simple test of this forecasting approach is to compare FALP projections for the total household waste arising in London to annual outturn data (now published for 2013/14, 2014/15, and 2015/16).

Under the GLA methodology, previously used for the FALP, future waste arisings are calculated for each borough as

- projected borough household waste arisings per person; multiplied by
- the forecasted borough population.

Developed in 2013 and published in 2014, FALP household waste arisings projections used tonnage data published by Defra for 2012/13 as a baseline. Household waste arisings in subsequent years were projected assuming that borough levels of waste generation per person remained constant at the 2012/13 level. For a comparison of this projection against historical outturn data, please refer to Figure 2-1 overleaf:

- The upper left plot compares the FALP projected total annual household waste arising for London (shown in blue) to outturn tonnage data published by Defra

<sup>1</sup> [https://files.datapress.com/london/dataset/2015-round-population-projections/2016-10-21T14:23:54/long\\_term\\_trend\\_2015\\_round.xlsx](https://files.datapress.com/london/dataset/2015-round-population-projections/2016-10-21T14:23:54/long_term_trend_2015_round.xlsx)

<sup>2</sup> <https://files.datapress.com/london/dataset/2015-round-population-projections/2016-07-04T14:14:21/2015%20trend%20projection%20results%20-%20tables%20and%20figures.xlsx>

(shown in grey). Outturn tonnages align closely with the FALP forecasts – deviations relative to FALP projections were limited to less than 0.5% for all years.

- The upper right plot of Figure 2-1 compares population projections adopted for the FALP (shown in blue) with the latest GLA population estimates (shown in grey). The latest GLA population projections indicate a lower outturn, though the difference is relatively small – 0.4% or less for all years.
- The lower left plot of Figure 2-1 then compares FALP projected waste generation per person (shown in blue) to outturn data (shown in grey). This comparison indicates some annual fluctuations in waste generation per person with the outturn data showing a 0.5% increase in waste arisings per person relative to the FALP 2012/13 baseline.
- Compared to FALP projections, outturn data gives a population marginally lower than the FALP case, while household waste generation per person is marginally increased – the net result is an outturn waste arising closely agreeing with FALP projections.

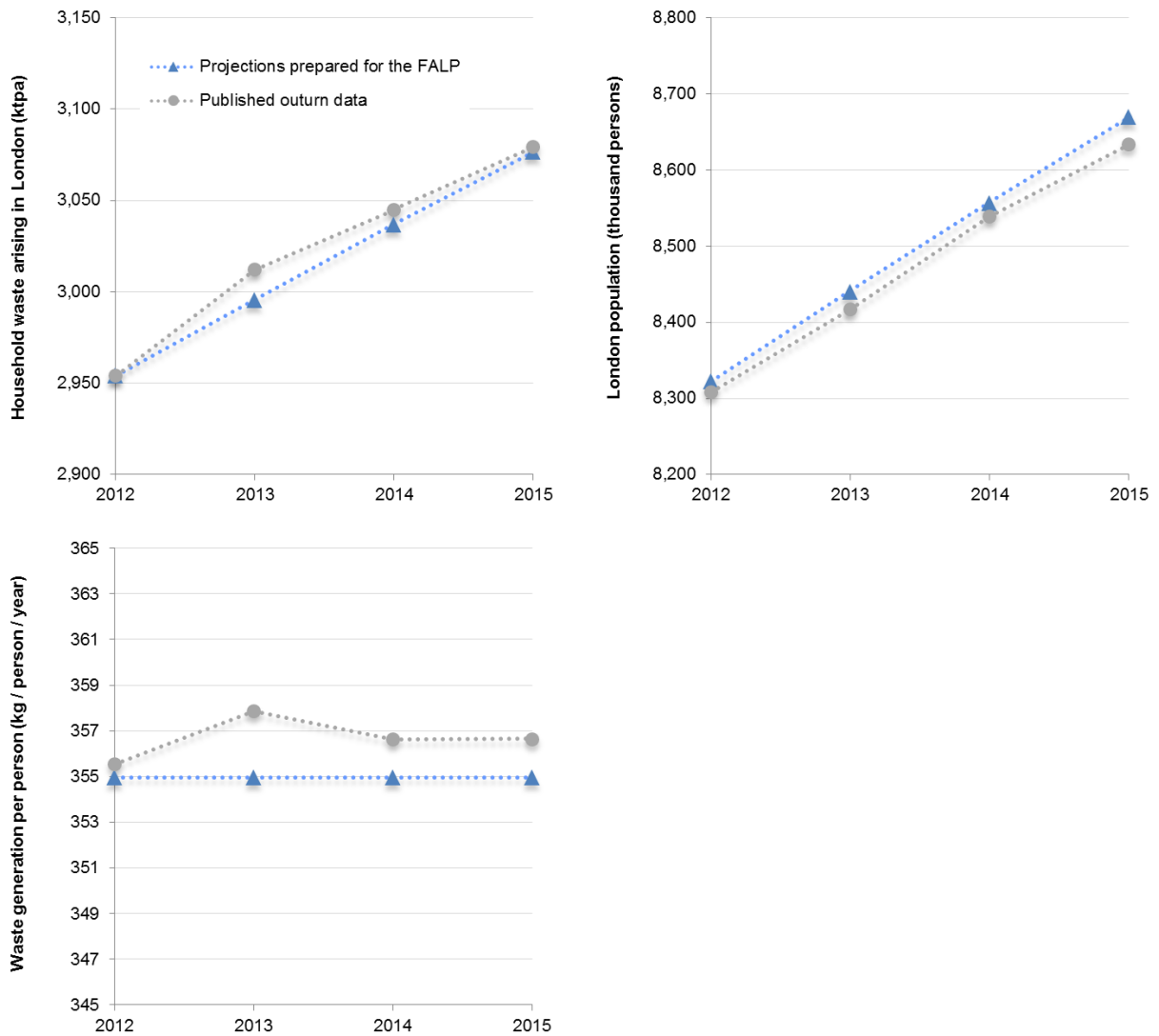
Further to this test of the projected total London household waste arisings, Figure 2-2 presents a borough level comparison of FALP forecasts against outturn data. While FALP projections agree well with total outturn data for London as a whole, outturns deviate from FALP forecasts at borough level in some cases. Annual fluctuations in LACW arisings may occur due to a range of factors which cannot be reliably predicted using a high level model. Such factors include, but are not limited to: changes to collection services, and modifications to practices in waste data reporting, and changes in levels of per capita consumption (which may for example reduce during economic recessions).

An alternative forecasting approach adopted by some planning authorities is to couple waste arisings with projected household numbers, rather than population. However due to the projected gradual reduction in numbers of persons per dwelling, this approach may arguably overestimate waste arisings.

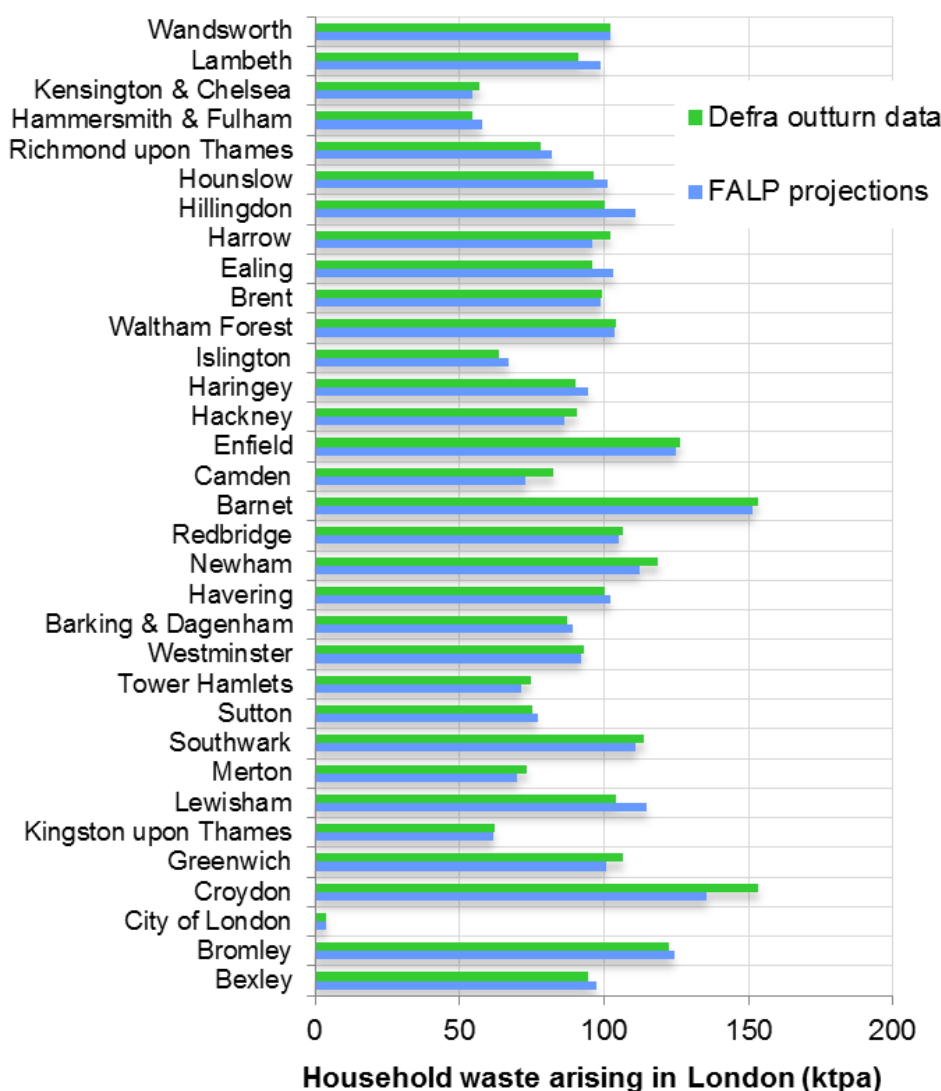
The existing projection methodology has previously been scrutinised by borough representatives during the FALP Examination in Public. Notably, in consulting on the FALP, no significant objections were raised by borough representatives. This could arguably be taken as an indication that the overall approach – coupling waste arisings with population – is considered appropriate by stakeholders.

Given these considerations it is proposed that the GLA's forecasting approach, which parallels that previously used for FALP forecasts, is retained in developing updated household waste arisings projections for the London Plan.

**Figure 2-1 – FALP London total Household Waste Arisings Projections vs. Outturn Data**



**Figure 2-2 – FALP Borough Household Waste Arisings Projections vs. Outturn Data**



### 2.3 Impact of Circular Economy / Waste Reduction

In collaboration with the London Waste and Recycling Board (LWARB), the GLA is developing a strategy for the transition to a circular economy. Some of this work is summarised in the LWARB report ‘Towards a circular economy – context and opportunities’<sup>3</sup>. The circular economy concept reinforces the need to apply the waste hierarchy, including waste reduction, reuse and recycling.

Of particular relevance to the projection of waste arisings is waste reduction (also referred to as prevention). Waste reduction initiatives have the potential to limit rates of household waste generation per capita, reducing London’s long term household waste arisings. This section explores assumptions for waste reduction through consideration of historical data, existing GLA waste strategy targets, and household waste material composition data.

<sup>3</sup>[http://www.lwarb.gov.uk/wp-content/uploads/2015/12/LWARB-circular-economy-report\\_web\\_09.12.15.pdf](http://www.lwarb.gov.uk/wp-content/uploads/2015/12/LWARB-circular-economy-report_web_09.12.15.pdf)

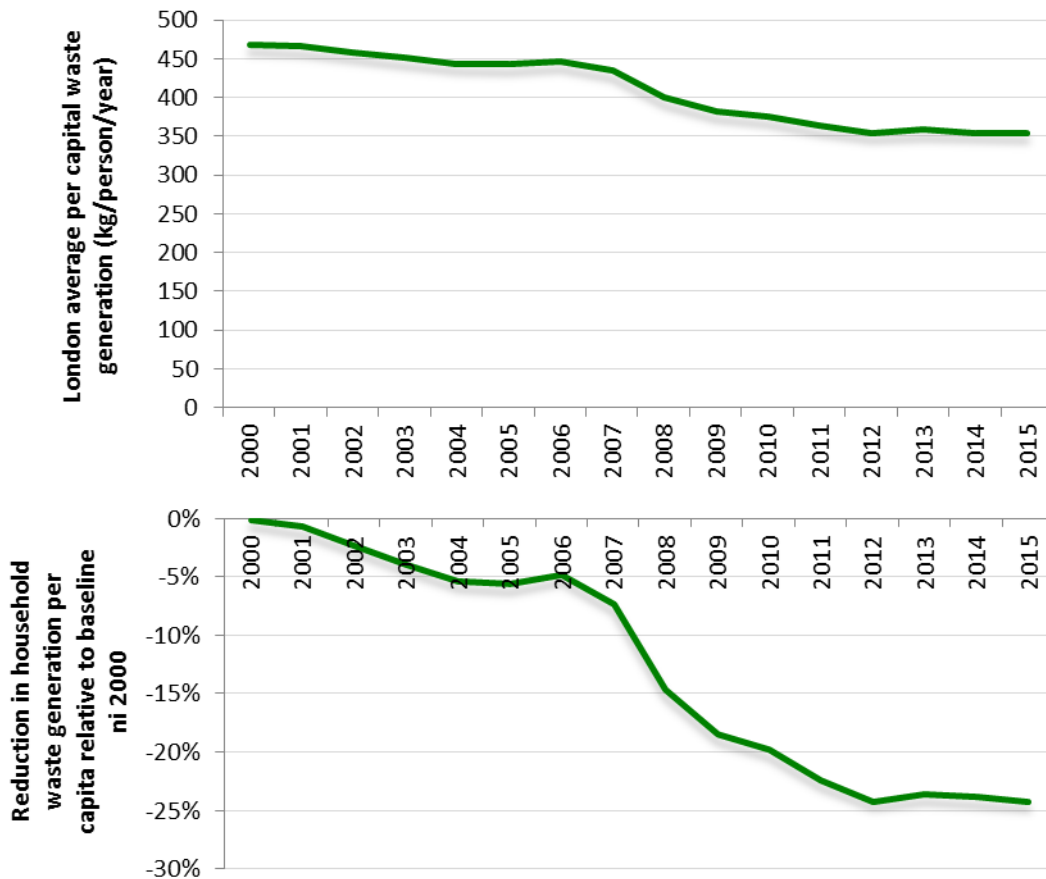


### 2.3.1 Historical Waste Generation per Capita

Historical data on household waste generation rates per capita, summarised in Figure 2-3, indicates that the London’s average per capita household waste generation rate has reduced dramatically over the last 15 years. From 468 kg/person/year in 2000, London’s average household waste generation rate reduced to 355 kg/person/year in 2015 – a 24% reduction over the period.

Figure 2-3 indicates a marked decline in per capital waste generation timed with the onset of the recession in 2008, indicating that a proportion of the observed reduction may be attributed to contraction in the economy. A fall in reported household waste per person may also be explained by changes in services, or reporting practices. Nevertheless, historical waste generation data shown in Figure 2-3 data indicates that the capital has already made substantial gains in waste reduction.

**Figure 2-3 – Historical Household Waste Generation per Person**



### **2.3.3 Waste Reduction Targets Set in the Municipal Waste Strategy**

Focussing on waste generation per household, the Major's Municipal Waste Management Strategy 'London's Waste Resource'<sup>4</sup> sets a target to reduce the waste generation rate from to 790 kg/household/year by 2031 (set as an approximate 20% reduction relative to the 2009/10 baseline).

Data for 2015/16 indicates a rate of 879 kg/household/year, suggesting a requirement for a 10% reduction in waste arisings per household in order to achieve the waste strategy target. GLA projections indicate a decline in the number of occupants per household in future years, falling from 2.44 persons/household in 2015 to 2.30 persons/household in 2031. Assuming that waste generation is proportionate to number of occupants, this trend alone can be expected to contribute to the achievement of the targeted 790 kg/household/year by 2031.

Accounting for this effect, a 5% reduction in household waste generation per person in 2031, relative to the 2015/16 baseline, is sufficient to achieve the targeted per household waste generation rate of 790 kg/household/year.

### **2.3.4 Waste Reduction Potential by Material**

A further approach in assessing the potential for waste reduction is to consider levels of waste reduction which may be achievable for each household waste material type. An estimate of waste reduction potential is developed in tabular format in Appendix A:

- Household waste composition is derived from composition survey work undertaken in Wales (no recent published London-specific composition data provide a composition for overall LACW arisings is known).
- For each household waste material type, potential for reduction is estimated including contributions from servitisation (i.e. adopting a rental/service model for provision of physical goods), lightweighting (specifically in relation to reduction of packaging per item), and reduced consumption (e.g. reduction in paper use with increasing use of electronic media). Reduction factors are expressed as the proportion of the material arising which may be reduced / prevented.
- For each material type, comments are included outlining the basis of reduction assumptions made.

Accounting for estimated waste reduction contributions from all material types, it is estimated conservatively that potential exists to reduce household waste arisings per capita by circa 6%. This finding confirms that the waste strategy's targeted 790 kg/household/year residual waste by 2031, translating to a 5% reduction in per capita waste arisings, is practically achievable.

In developing projections for the London Plan, a tension exists between the circular economy imperative of substantial waste reduction, and the requirement to ensure adequate provisioning for London's future waste arisings.

The level of reduction achieved will ultimately be contingent on resources allocated to this goal by the boroughs, the GLA, and national government, as well as decisions made by leaders in industry and commerce, and the consumption behaviour of householders. Dependent on these factors, waste reduction could substantially exceed 5% per capita. In

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<sup>4</sup> [https://www.london.gov.uk/sites/default/files/municipal\\_waste\\_final.pdf](https://www.london.gov.uk/sites/default/files/municipal_waste_final.pdf)

section 2.5, a more challenging case of 20% reduction in per capital household waste arisings is considered as a sensitivity test.

## 2.4 Updated Waste Arisings Projections

Above, section 2.1 proposes a number of refinements to GLA household waste arisings forecasts, waste reduction assumptions being further explored in section 2.3. Applying these refinements, SLR has developed suggested revised borough level forecasts for household waste arisings

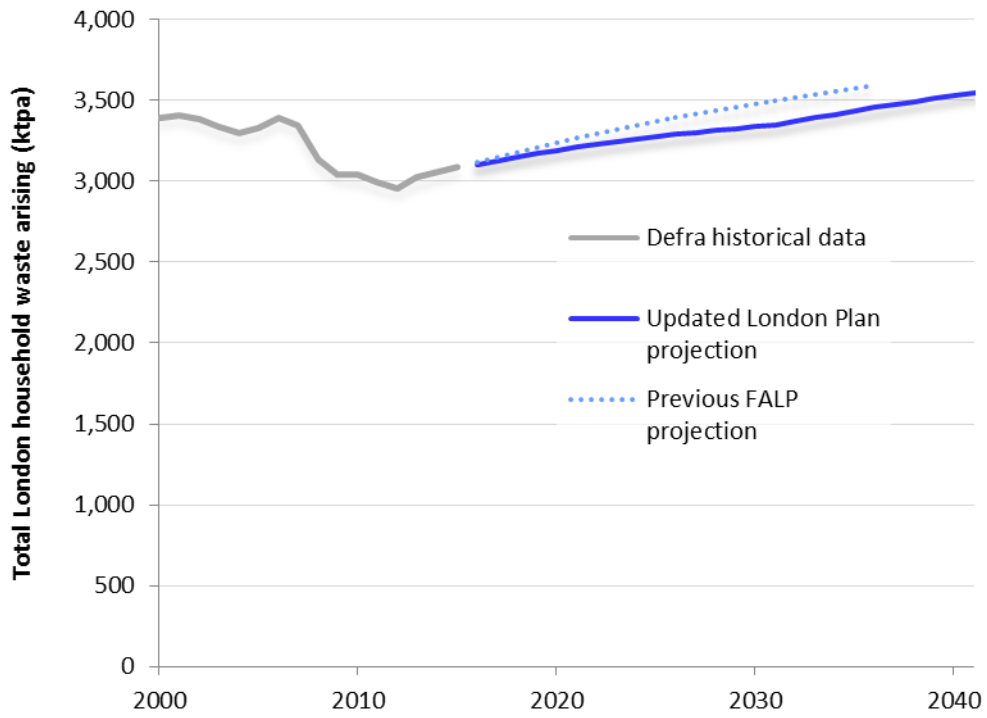
As per the GLA's approach, the proposed projection methodology estimates household arisings as the product of the per capita waste generation rate, and projected borough population:

- Borough per capita waste generation rates are extrapolated linearly from the baseline 2015/16 value to achieve a 5% reduction by 2031 (consistent with the GLA waste reduction target, as noted above).
- Population forecasts assume GLA Demography team's trend-based scenario using a long-term migration. This scenario is recommended by the GLA for longer-term strategic planning purposes, and is intermediate with respect to other published projections (for further detail, please refer to section 2.5 on sensitivity testing).
- For each forecast year, the projected household waste arising is calculated as the borough per capita waste generation rate, multiplied by the forecasted borough population.

Updated household waste arisings projections proposed for inclusion in the London Plan are summarised below in Figure 2-4, and Table 2-2:

- The projected total London household waste arising is illustrated in Figure 2-4. Further to the updated household waste arisings projection (solid blue line), Figure 2-4 also includes historical arisings reported by Defra (solid grey line), and the previous household waste forecasts published in the FALP (dotted blue line),
- Focussing on key London Plan target years, Table 2-2 details the projected household waste arisings by borough.

**Figure 2-4 – Projected total London Household Waste Arising**



**Table 2-2 – Projected Household Waste Arisings by Borough**

<b>Borough</b>	<b>2021</b>	<b>2026</b>	<b>2031</b>	<b>2036</b>	<b>2041</b>
Barking & Dagenham	92	95	98	101	104
Barnet	161	166	169	175	180
Bexley	98	100	103	107	110
Brent	104	106	108	111	113
Bromley	127	130	132	137	141
Camden	84	85	86	88	89
City of London	4	4	5	5	5
Croydon	159	163	166	171	176
Ealing	100	102	104	107	109
Enfield	132	136	139	144	149
Greenwich	112	116	119	123	127
Hackney	94	97	98	101	104
Hammersmith & Fulham	57	57	58	59	60
Haringey	94	96	97	100	102
Harrow	108	112	114	118	122
Havering	105	108	111	116	120
Hillingdon	105	108	110	114	117
Hounslow	101	103	105	108	111
Islington	65	65	66	68	69
Kensington & Chelsea	59	59	60	61	63
Kingston upon Thames	64	65	67	68	70
Lambeth	94	95	96	99	102
Lewisham	109	112	114	118	121
Merton	76	78	79	81	83
Newham	124	127	130	133	137
Redbridge	114	118	122	127	131
Richmond upon Thames	82	84	85	88	90
Southwark	118	120	122	125	128
Sutton	78	80	82	84	87
Tower Hamlets	78	79	81	83	85
Waltham Forest	110	114	116	120	123
Wandsworth	106	108	110	113	115
Westminster	95	97	97	100	102
<b>Total</b>	<b>3,207</b>	<b>3,287</b>	<b>3,348</b>	<b>3,453</b>	<b>3,546</b>

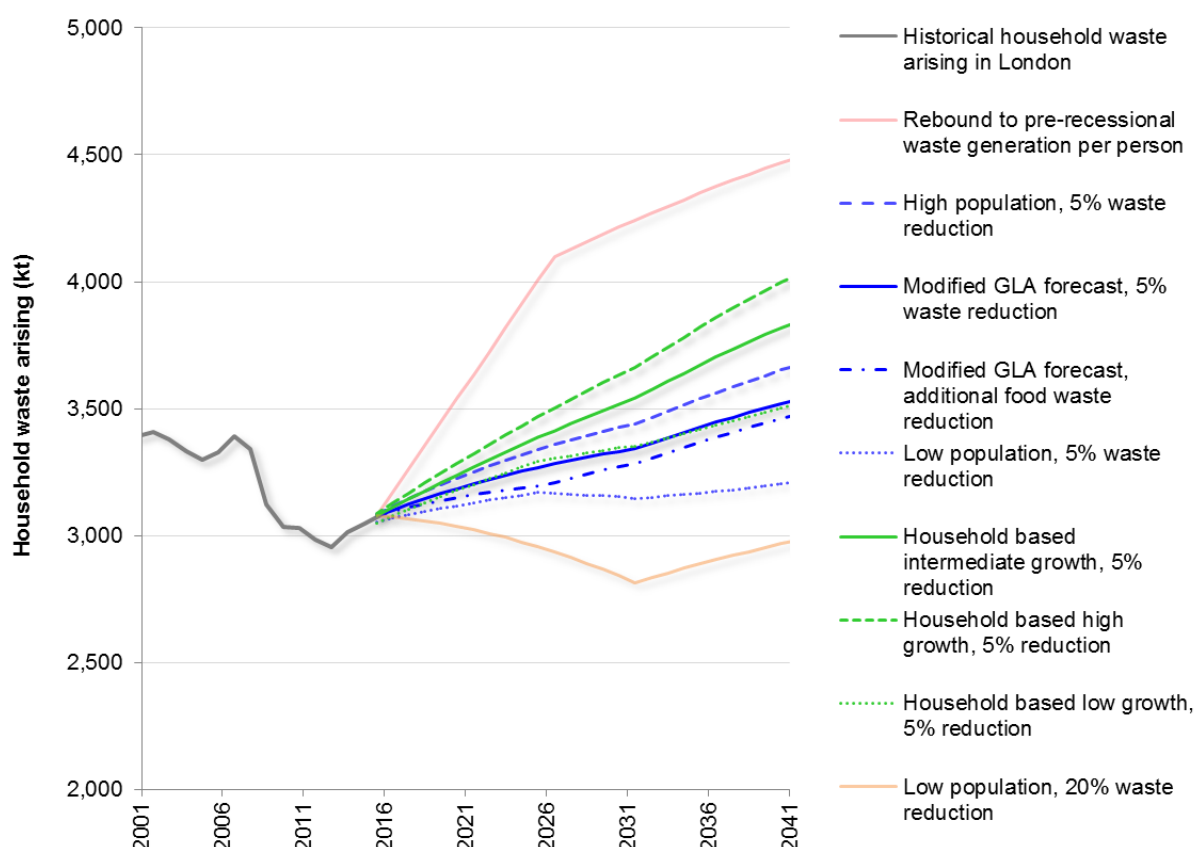
## 2.5 Sensitivity Testing

In reviewing GLA projections for household waste, and putting forward proposed modified forecasts for the London Plan, SLR has used its professional judgement to determine

forecasting assumptions. It should however be emphasised that many of these assumptions are inherently uncertain, leading to a range in potential waste generation scenarios.

To illustrate the forecast envelope (i.e. the potential range in future household waste arisings) SLR has modelled a number of alternative example scenarios. For a summary of scenario findings, please refer to Figure 2-5.

**Figure 2-5  
Modelled Household Waste Arising Scenarios**



The solid blue line shown in Figure 2-5 ('GLA intermediate population projections') illustrates SLR's modified version of the GLA's projection, recommended for inclusion in the updated London Plan. Utilising the GLA's long term trend 2015 round population forecasts (GLA Demographic's intermediate projection), gradual growth in household waste arising is projected up to 2041.

A variety of alternative scenarios are however possible, ranging from arisings of less than 3 Mtpa up to 2031 (under GLA Demographics' lower population scenario, with 20% waste reduction under the assumption of a strong circular economy) to an upper case where arisings reach c.4.5 Mtpa by 2041 (GLA Demographics' high population, with rebound in household waste generation to pre-recessional levels). Also shown for context is the historical arising of household waste in London from year 2000 up to 2012/13. For an overview of the assumptions underpinning each modelled scenario, please refer to Table 2-3 below.

**Table 2-3**  
**Household Waste Arising Scenario Assumptions**

Scenario	Summary
— Modified GLA forecast, 5% waste reduction	SLR's modified version of household waste arisings projections developed by the GLA. Waste generation per person is assumed to fall by 5% in 2031 relative to 2015 (sufficient to achieve the GLA waste generation target of 790 kg/household/year). GLA Demographics most recent population projection (long-term migration scenario <sup>5</sup> ) is then multiplied by this generation rate to give the overall waste arising.
- - - Modified GLA forecast, additional food waste reduction	As per 'Modified GLA forecast, 5% waste reduction', revised illustratively to account for compliance with the Courtauld commitment to 20% reduction in food waste arising by 2025.
— Rebound to pre-recessional waste generation per person	Assumes a return to pre-recessional levels of waste generation per person by 2026. The financial year 2007/8, during which London produced 430kg of household waste per person, is assumed to be representative of generation prior to the recession. This compares to 355 kg/person in 2012/13.
- - - High population, 5% waste reduction	Waste arisings are modelled on higher population projections developed by the GLA (short-term migration scenario <sup>6</sup> ). The methodology is otherwise the same as the 'Modified GLA forecasts, 5% waste reduction' scenario above, including the assumption of a 5% reduction in waste generation per person by 2031.
..... Low population, 5% waste reduction	As per the 'Modified GLA forecasts, 5% waste reduction' scenario, but based on lower population projections (SHLAA DCLG based projections <sup>7</sup> ).
— Household based intermediate growth, 5% reduction	An alternative forecasting approach is to link waste generation with growth in numbers of households, rather than population. Under this scenario the latest GLA Demographics household (long-term migration scenario <sup>8</sup> ) are adopted, coupled with an assumed 5% reduction in waste generation per household
- - - Household based high growth, 5% reduction	As per the 'GLA intermediate household projections' scenario, with the exception that high GLA Demographics household projections (short-term migration scenario <sup>9</sup> ) are assumed to apply.

<sup>5</sup> [https://files.datapress.com/london/dataset/2015-round-population-projections/2016-10-21T14:23:54/long\\_term\\_trend\\_2015\\_round.xlsx](https://files.datapress.com/london/dataset/2015-round-population-projections/2016-10-21T14:23:54/long_term_trend_2015_round.xlsx)

<sup>6</sup> [https://files.datapress.com/london/dataset/2015-round-population-projections/2016-10-21T14:24:12/short\\_term\\_trend\\_2015\\_round.xlsx](https://files.datapress.com/london/dataset/2015-round-population-projections/2016-10-21T14:24:12/short_term_trend_2015_round.xlsx)

<sup>7</sup> [https://files.datapress.com/london/dataset/2015-round-population-projections/2016-10-12T11:34:27/borough\\_SHLAA\\_DCLG\\_2015rnd.xlsx](https://files.datapress.com/london/dataset/2015-round-population-projections/2016-10-12T11:34:27/borough_SHLAA_DCLG_2015rnd.xlsx)

<sup>8</sup> [https://files.datapress.com/london/dataset/2015-round-household-projections/2016-10-21T14:34:34/households\\_long\\_term\\_trend\\_2015\\_round.xlsx](https://files.datapress.com/london/dataset/2015-round-household-projections/2016-10-21T14:34:34/households_long_term_trend_2015_round.xlsx)

<sup>9</sup> [https://files.datapress.com/london/dataset/2015-round-household-projections/2016-10-21T14:34:03/households\\_short\\_term\\_trend\\_2015\\_round.xlsx](https://files.datapress.com/london/dataset/2015-round-household-projections/2016-10-21T14:34:03/households_short_term_trend_2015_round.xlsx)

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Scenario	Summary
..... Household based low growth, 5% reduction	As per the 'GLA intermediate household projections' scenario, with the exception that low GLA Demographics household projections (SHLAA DCLG household formation based projections <sup>10</sup> ) are assumed.
— Low population, 20% waste reduction	In this scenario, strong adoption of the circular economy is assumed, waste generation per person being assumed to decrease to 20% below 2015/16 levels by 2031. The methodology is otherwise the same as the 'Modified GLA forecasts, 5% waste reduction' scenario above.

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<sup>10</sup> [https://files.datapress.com/london/dataset/2015-round-household-projections/2016-09-02T13:55:48/HH\\_SHLAA\\_DCLG\\_2015rnd.xlsx](https://files.datapress.com/london/dataset/2015-round-household-projections/2016-09-02T13:55:48/HH_SHLAA_DCLG_2015rnd.xlsx)



### 3.0 COMMERCIAL AND INDUSTRIAL WASTE

#### 3.1 Review of GLA In-house Forecasts

As for the case of household waste, the GLA has prepared in-house forecasts for future borough arisings of commercial and industrial waste (C&IW). GLA projections for C&I waste have been provided to SLR in Excel spreadsheet file 'lprwasteproj.xlsx'.

Findings of SLR's review of GLA C&IW projections are set out below in Table 3-1. For each SLR comment, a model reference is included, a level of significance being assigned in each case.

While SLR concurs with the overall forecasting approach adopted by the GLA, a number of potential refinements are detailed in Table 3-1. Accounting for these refinements, SLR has developed modified projections presented in section 3.4.

**Table 3-1: SLR Comments on GLA In-house Commercial and Industrial Forecasts**

Forecast aspect	Model reference	SLR comment	Significance
Commercial and industrial sectors	Worksheet 'C&I' rows 3 to 13.	C&I sectors considered appear to exclude Defra C&IW survey business category 'Machinery & equipment (other manufacture)'. Defra survey estimates indicate a waste arising of 98 kt for this sector in 2009, contributing circa 2% of London's total C&IW arisings. It would be helpful to understand whether the exclusion of this tonnage is intentional.	Medium
Rounding of tonnages / employment data	Worksheet 'C&I' rows 17 to 25, and 31 to 39	We note that baseline commercial and industrial waste tonnage data, and employee numbers, are rounded to the nearest thousand.  While this rounding will have no material impact on projections, it may prevent third parties from exactly replicating forecasts ultimately included in the London Plan.	Low
Rounding of borough proportions of London total	Worksheet 'C&I' cells B89 to B121	In rows 49 to 81, borough proportional contributions to London's waste arisings are determined on the basis of Defra 2009 C&IW survey tonnages.  Below, in cells B89 to B121, borough percentages are rounded to the nearest 1%. Taking this approach the sum of all borough percentages increases to 103%. As a result, the sum of borough C&IW contributions (row 122) exceeds the London C&IW tonnage projected from sector contributions (row 39).  To achieve consistency between the two totals, it is suggested that borough proportions in cells B89 to B121 are included to the full level of precision, rather than being rounded.	Medium
Waste reduction	Worksheet 'C&I', rows 31 to 38	Forecasts currently assume that per employee levels of waste generation remain constant up to 2041.	Medium

As for the case of household waste, given the GLA’s focus on the circular economy, it may be appropriate to assume some reduction in the rate of waste generation per person. Please refer to section 3.3 for further discussion of this point.

### 3.2 Review of the Forecasting Methodology

As for the case of household waste, the methodology used by the GLA in projecting commercial and industrial waste (C&IW) arisings is as per that used previously for the case of Further Alterations to the London Plan (FALP) forecasts. Key features of this are

- the use of Defra’s 2009 C&IW survey as a baseline for projections; and
- the assumption that for each commercial and industrial business sector, waste arisings are proportional to projected employment.

In developing C&IW projections for the updated London plan, SLR has reviewed potential alternative data sources characterising baseline arisings – please refer to Table 3-2 for details of sources considered. In quantifying C&IW arisings, all of the sources considered provide forecasts for England in totality, no tonnage estimates being developed by the English regions, or for London.

To give improved resolution for the specific case of London survey work undertaken in London as part of the Defra 2009 survey was co-funded by the London Waste and Recycling Board (LWaRB). The Defra 2009 survey quantifies C&IW arisings for each of London’s commercial and industrial sectors, as well as providing estimates of the borough level contribution to the C&IW total. As per findings of the previous review of C&IW data undertaken for the FALP, it is concluded that Defra’s 2009 C&IW survey remains the most robust and fit for purpose source of baseline waste data for London Plan forecasts.

**Table 3-2 – Review of CIW Data Sources**

Document name	Authors	Date published
Commercial and Industrial Waste in the UK and Republic of Ireland <sup>11</sup>	Developed on behalf of CIWM by Ricardo-AEA	October 2013
Forecasting 2020 Waste Arisings and Treatment Capacity (Revised February 2013 Report) <sup>12</sup>	Defra	October 2013
New Methodology to Estimate Waste Generation by the Commercial and Industrial Sector in England	Developed on behalf of Defra by Jacobs	August 2014

<sup>11</sup> [http://www.ciwm.co.uk/web/FILES/Technical/21st\\_oct\\_FINAL\\_CIWM\\_2013\\_President's\\_report.pdf](http://www.ciwm.co.uk/web/FILES/Technical/21st_oct_FINAL_CIWM_2013_President's_report.pdf)

<sup>12</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/251567/pb13883-forecasting-2020-waste-arising-131017.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/251567/pb13883-forecasting-2020-waste-arising-131017.pdf)

Existing FALP forecasts forecast C&IW arising assuming that growth in this waste streams is proportional to employment. More specifically, London total C&IW arising projections are developed for each commercial and industrial sector, accounting for sector employment growth projections published by the GLA. The forecasted London total C&IW arising is then apportioned to individual boroughs on the basis of borough level tonnages estimated in the Defra 2009 C&IW survey. This existing approach is adopted here in producing updated estimates of future C&IW arisings.

### **3.3 Impact of Circular Economy / Waste Reduction**

As detailed above in section 2.3, in projecting household waste arisings, waste reduction activities are assumed to reduce the per capita household waste arising by 5% by 2031 – achieving the strategy target waste generation rate of 790 kg/household/year.

Similarly, waste prevention efforts in commerce and industry may reduce rates of waste generation per employee. The intention of the GLA is to drive the transition to a circular economy, and this can be expected to lead to some waste reduction in C&IW. In particular, with increasing servitisation goods, may be leased by customers, and subsequently returned to producers for re-manufacturing, rather than entering the waste stream.

In contrast to household waste, the current material composition of and management methods for C&IW are not well understood. The most recent source providing London-specific data – Defra's 2009 C&IW survey – characterises materials by high level type only. This lack of data on C&IW creates challenges in quantifying the future potential for waste reduction with certainty.

Environment Agency survey data for 2002/3 indicates a total London C&IW arising of 7.5 Mt, while the Defra 2009 C&IW survey suggests a C&IW arising of 4.6 Mt. These findings indicate a substantial 39% reduction in C&IW arisings has occurred to date.

As per the case of household waste, in estimating future C&IW projection a tension exists between the need to recognise circular economy objectives, and the need to provision for future C&IW management needs on a conservative basis.

Paralleling the case of household waste, in forecasting future C&IW arisings, waste generation rates per employee are assumed to reduce by 5% in 2031, relative to the forecasting baseline of 2009. Notably, projection findings presented below indicate that when coupled with the projected shift in employment from industry to commerce, this assumption is adequate to stabilise London's waste arisings at circa 5 Mt

### **3.4 Updated Waste Arisings Projections**

Adopting proposed refinements to the GLA forecasting methodology (section 3.1), and suggested waste reduction assumptions, SLR has developed revised C&IW forecasts.

Consistent with the GLA's approach, principal calculation steps in projecting the total London C&IW arising are as follows:

- Defra C&IW arising data and GLA employment forecasts are collated into a set of common, simplified business sectors. This step is necessary because in published Defra and GLA datasets use inconsistent sector categories.
- Arisings per employee are then calculated for calendar year 2009 (the year Defra's C&IW survey was carried out), for each sector.
- For each forecast year, for individual sectors, this arising per employee is multiplied by projected employment to give the sectoral waste arising.

- Annual sectoral waste arisings are then summed to give the forecasted total C&IW arising in London.

Following these steps, the London level C&IW arising is apportioned to individual boroughs:

- Borough proportional contributions to London's C&IW arising are calculated using Defra survey estimates for 2009.
- For each forecast year, these borough proportions are multiplied by the C&IW total to give the borough level C&IW arising.

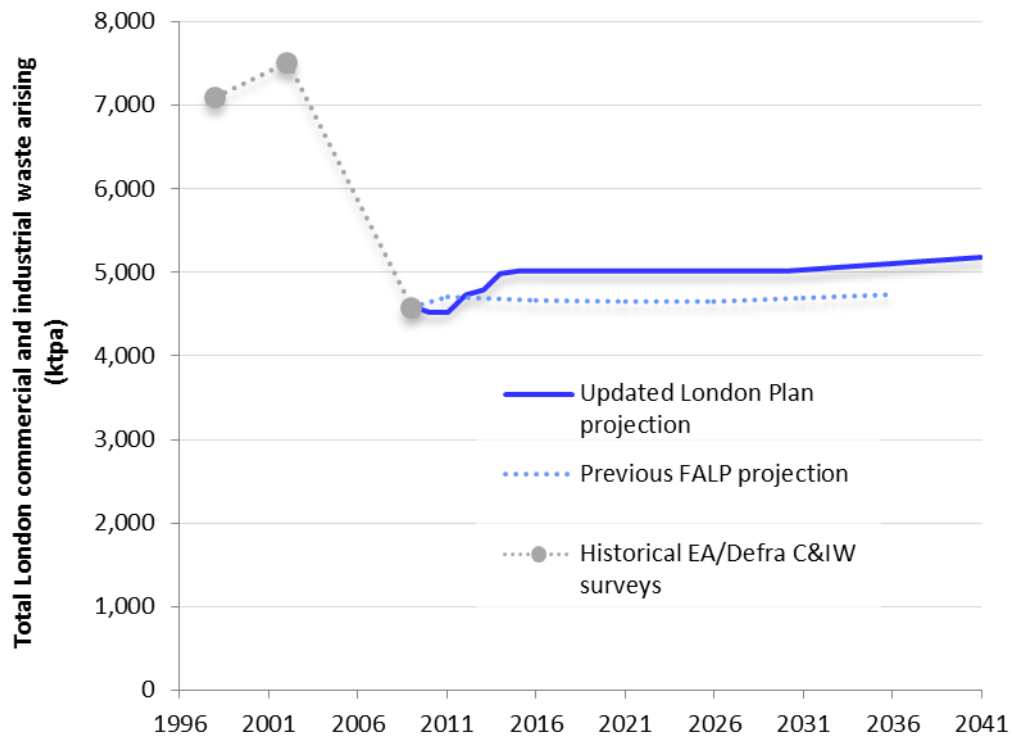
It is thus assumed that each borough's proportional share of London's total C&IW arising remains constant between 2009 and 2041.

For a summary of updated C&IW projections proposed for inclusion in the London Plan, please refer to Figure 3-1, and Table 3-3

- Figure 3-1 illustrates London's projected total C&IW arising (solid blue line), Also included for comparison is the previous C&IW forecasts published in the FALP (dotted blue line). For further context historical C&IW survey findings for total London waste arisings are also included (grey dots included for Environment Agency surveys in 1998/9 / 2002/3, and Defra's 2009 survey).
- For London Plan key target years, projected C&IW arisings by borough are shown in Table 2-2.

GLA employment projection, suggest a continuing shift from industry, to commerce. Since commercial activities are typically generate less waste per employee, the predicted shift acts to limit future C&IW arisings. When this shift is combined with an assumed 5% reduction in waste generation per employee across all sectors, the result is a plateau in the future C&IW arising in London – despite overall growth in employment.

**Figure 3-1 – Projected total London Commercial and Industrial Waste Arising**



**Table 3-3 – Projected Commercial and Industrial Waste Arisings by Borough**

<b>Borough</b>	<b>2021</b>	<b>2026</b>	<b>2031</b>	<b>2036</b>	<b>2041</b>
Barking & Dagenham	122	122	122	124	126
Barnet	154	154	155	157	160
Bexley	127	127	128	129	132
Brent	156	156	156	159	161
Bromley	123	123	123	125	127
Camden	276	276	276	281	285
City of London	226	226	226	230	233
Croydon	146	146	146	149	151
Ealing	191	191	191	194	197
Enfield	173	173	173	176	178
Greenwich	97	97	97	98	100
Hackney	89	89	89	90	92
Hammersmith & Fulham	126	126	126	128	130
Haringey	96	96	96	98	99
Harrow	80	80	81	82	83
Havering	125	125	125	127	129
Hillingdon	242	242	242	246	250
Hounslow	159	159	159	162	165
Islington	177	177	177	180	183
Kensington & Chelsea	143	143	143	145	148
Kingston upon Thames	88	88	88	89	91
Lambeth	114	114	114	116	118
Lewisham	82	82	82	84	85
Merton	97	97	97	99	101
Newham	120	120	120	122	124
Redbridge	82	82	83	84	85
Richmond upon Thames	98	98	98	99	101
Southwark	174	174	175	177	180
Sutton	83	83	83	85	86
Tower Hamlets	182	182	183	185	188
Waltham Forest	92	92	92	94	95
Wandsworth	144	144	145	147	149
Westminster	627	627	628	638	648
<b>Total</b>	<b>5,009</b>	<b>5,012</b>	<b>5,021</b>	<b>5,097</b>	<b>5,180</b>

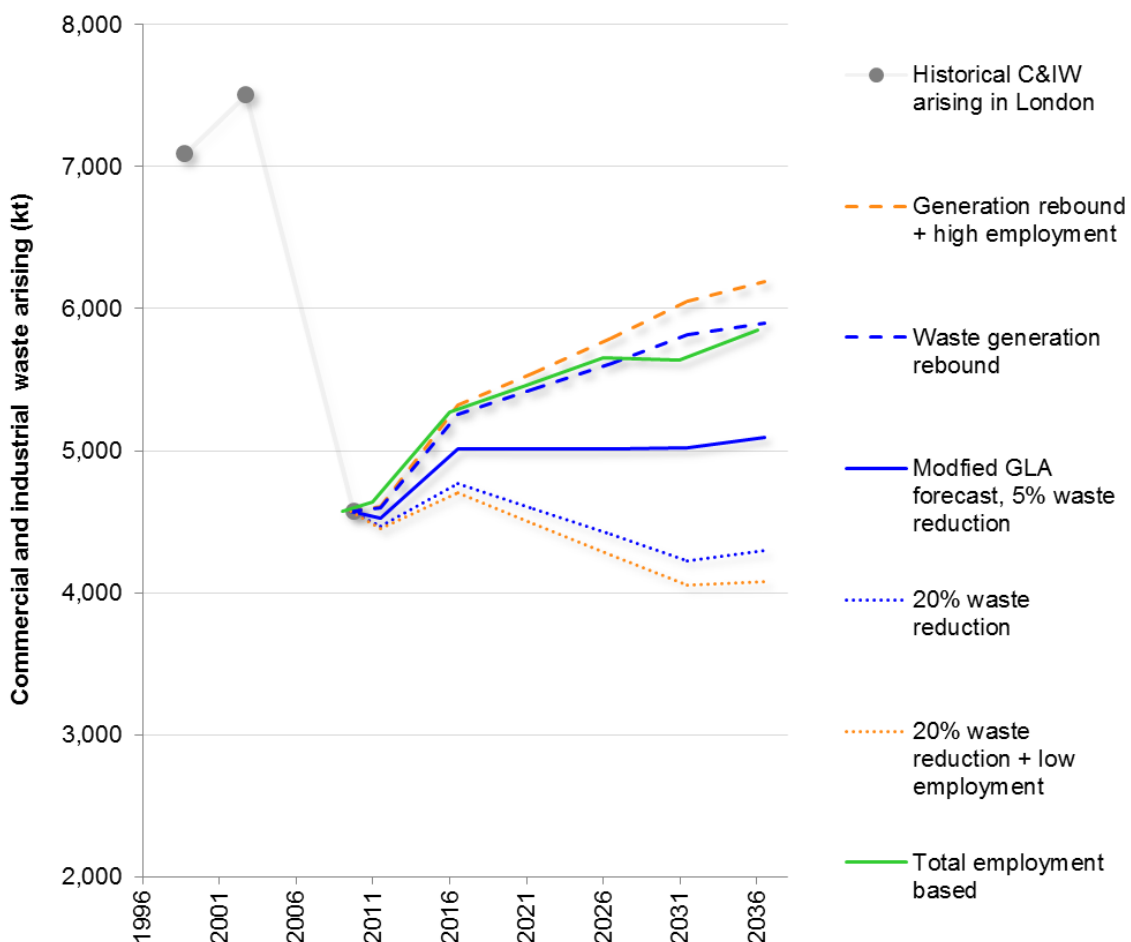
### 3.5 Sensitivity Testing

As for the case of household waste arisings, SLR has evaluated a number of alternative C&IW forecast scenarios to illustrate the sensitivity to parameter assumptions. Arisings projections considered are illustrated below in Figure 3-2. The solid blue line in this Figure corresponds to SLR’s updated forecast including proposed revisions to GLA forecasts – with the assumption of a 5% reduction in waste generation per employee, this scenario indicates limited overall growth in C&IW arisings up to 2036.

Other scenarios shown consider the impact of changes in waste generation per employee, deviations from GLA Economics employment forecasts<sup>13</sup>, and the use of a non-sectoral, total employment based forecasting scenario. For details of assumptions underpinning each of the scenarios shown, please refer to Table 3-4.

Further to the range of forecast scenarios, Figure 3-2 also illustrates arisings estimated by Defra’s 2009 C&IW survey, as well as surveys commissioned by the Environment Agency in 2002/3 and 1998/9.

**Figure 3-2  
Modelled Commercial and Industrial Waste Arising Scenarios**



<sup>13</sup> <https://files.datapress.com/london/dataset/gla-employment-projections/2016-06-30T15:16:52/London%20and%20sectors%20datastore.xlsx>

**Table 3-4  
Commercial and Industrial Waste Arising Scenario Assumptions**

Scenario	Summary
— Modified GLA forecast, 5% waste reduction	Updated scenario accounting for recommended modifications to GLA in-house forecasts. For individual commercial and industrial sectors, waste generation per employee is calculated for the baseline year of 2009. Arisings per employee are multiplied by GLA Economics employment projections to give the total C&IW arising.
- - - Waste generation rebound	A post-recession rebound in waste generation per employee is assumed to occur, with generation levels per employee rising to 10% above 2009 levels by 2031. The methodology used is otherwise as per the 'Sector employment based' scenario.
..... 20% waste reduction	Conversely this scenario assumes a strong circular economy, with continuing reduction in waste generation per employee, falling to 20% below 2009 levels in 2031. The methodology used is again otherwise identical to the 'Sector employment based' scenario.
- - - Generation rebound + high employment	An upper forecast scenario which takes the illustrative case where the GLA Economics employment projection is exceeded by 5% in 2036. This is compounded by rising waste production per employee as per the 'waste generation rebound' scenario.
..... 20% waste reduction + low employment	A lower case which illustratively shows employment 5% below GLA Economics forecasts by 2036. Waste production per employee is also assumed to reduce as per the '20% waste reduction' scenario.
— Total employment based	In this scenario, the total combined C&IW arising is divided by total employment to give overall waste per employee for commerce and industry as a whole. This rate of generation per employee is then multiplied by the GLA's forecasted total employment (excluding construction). Since this approach does not account for the GLA's predicted shift from industry (highly waste intensive per employee) to commerce (less waste intensive) the predicted arising is significantly higher than the sector employment based projection.



#### **4.0 CLOSURE**

This report has been prepared by SLR Consulting Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Greater London Authority; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

## **APPENDIX A – ESTIMATED HOUSEHOLD WASTE REDUCTION POTENTIAL**

Category	Indicative household waste composition <sup>14</sup>	Conservative estimate of waste reduction potential				Combined reduction potential	Combined reduction as a proportion of household waste	Comments
		Reduced consumption	Light-weighting	Servitisation				
Newspapers & magazines	7%	20%	0%	0%	<b>20%</b>	<b>1.5%</b>	Assumed continuing shift from paper publications to electronic media.	
Other paper	7%	20%	0%	0%	<b>10%</b>	<b>0.7%</b>	Assumed reduction in use of stationary paper, though recognising that this category also includes a significant proportion of non-recyclable paper.	
Cardboard	5%	0%	0%	0%	<b>0%</b>	<b>0.0%</b>	Possible that upward pressure on packaging cardboard exists, with increasing online purchases. Therefore no net change assumed.	
Plastic film	3%	9%	0%	0%	<b>9%</b>	<b>0.3%</b>	Estimated on the basis of reported reductions in plastic bag use in England, following the introduction of charging.	
Plastic bottles	2%	0%	5%	0%	<b>5%</b>	<b>0.1%</b>	Assumed that some further lightweighting potential exists.	
Other plastic packaging	2%	0%	5%	0%	<b>5%</b>	<b>0.1%</b>	Assumed that some further lightweighting potential exists.	
Other dense plastic	2%	0%	0%	0%	<b>0%</b>	<b>0.0%</b>	-	
Textiles & footwear	3%	5%	0%	0%	<b>5%</b>	<b>0.2%</b>	Nominal amount assuming expansion in trade of used clothing.	
Wood	4%	0%	0%	0%	<b>0%</b>	<b>0.0%</b>	-	
Furniture	1%	20%	0%	0%	<b>20%</b>	<b>0.2%</b>	Nominal reduction in consumption (please note that furniture reuse via HWRCs would still be recorded as a waste stream, and therefore not qualify as reduction).	

<sup>14</sup> Using WRAP survey data for Wales: <http://wales.gov.uk/docs/desh/publications/100526municipalwastecompositionen.pdf>

Disposable nappies	2%	0%	0%	0%	0%	0.0%	Assumed limited room for reduction improvement without large scale funding of reusable nappy schemes.
Other Combustibles	4%	0%	0%	0%	0%	0.0%	-
Packaging glass	7%	0%	5%	0%	5%	0.3%	Some lightweighting potential assumed to remain – though there will be a practical limit to this.
Other glass	0%	0%	0%	0%	0%	0.0%	-
Rubble (C&D waste)	5%	0%	0%	0%	0%	0.0%	-
Other non-combustibles	1%	0%	0%	0%	0%	0.0%	-
Metal cans	2%	0%	5%	0%	5%	0.1%	Assumed that some further lightweighting potential exists.
Other metal	2%	0%	0%	0%	0%	0.0%	-
Food waste	17%	14%	0%	0%	14%	2.3%	14% Estimated by WRAP for the case of West London. <sup>15</sup> 20% estimated by LWARB. <sup>16</sup>
Garden waste	14%	0%	0%	0%	0%	0.0%	Judged unlikely that behaviour managing garden waste will change without significant changes to services (e.g. withdrawal of garden waste services).
Other organics	3%	0%	0%	0%	0%	0.0%	-

<sup>15</sup> [http://www.wrap.org.uk/sites/files/wrap/West%20London%20LFHW%20Impact%20case%20study\\_0.pdf](http://www.wrap.org.uk/sites/files/wrap/West%20London%20LFHW%20Impact%20case%20study_0.pdf)

<sup>16</sup> [http://www.lwarb.gov.uk/wp-content/uploads/2015/12/LWARB-circular-economy-report\\_web\\_09.12.15.pdf](http://www.lwarb.gov.uk/wp-content/uploads/2015/12/LWARB-circular-economy-report_web_09.12.15.pdf)

HHW	1%	0%	0%	0%	0%	0.0%	-
WEEE	3%	0%	0%	10%	10%	0.3%	Assumed some potential for servitisation, particularly for small WEEE.
Fines	2%	0%	0%	0%	0%	0.0%	-
<b>Total</b>	<b>100%</b>	-	-	-	-	<b>6.0%</b>	

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