Ricardo
Energy & Environment

Options Appraisal for London Borough of Barnet

Final Report

Report for Resource London
LWARB tender: 2018-19 12

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Executive Summary

The research for this report, jointly commissioned by the London Borough of Barnet ('the Council') and Resource London, has been undertaken to help identify opportunities to increase kerbside recycling levels and reduce residual waste arisings in Barnet, in line with the framework for greater consistency in household collections.

The report explores alternative service options around the Council's existing refuse, dry recycling and garden waste collection systems, including capacity restrictions for residual waste and options for reintroducing a separate weekly food waste collection service (a service which was previously suspended in November 2018).

To select the service options to be modelled, discussions were held between Ricardo Energy & Environment, the Council and Resource London at the project inception meeting. The options are fully described in Table 1 below. The following terms are used within the report to describe how materials are presented at the kerbside and collected within the vehicle:

- Twin-stream – Collection of dry recyclate in two streams with either glass or paper collected in separate containers and in separate compartments on a collection vehicle.
- Comingled – Collection of all dry recyclate (paper, card, plastics, cans, glass) within one container and in one vehicle compartment.

Table 1: Options Modelled

Option	Residual Waste	Dry Recycling	Garden Waste	Food
1 "Current service + food waste"	Weekly in a 240l Wheeled Bin	Weekly comingled in 240l bin	Fortnightly in a 240l Wheeled Bin	Weekly separate collections in food caddy in a dedicated separate food waste vehicle
2 "Alternate weekly dry recycling"	Weekly in a 240l Wheeled Bin	Fortnightly twin-stream (paper/card out) on alternate weeks – e.g. week one paper/card, week two plastics, cans and glass	Fortnightly in a 240l Wheeled Bin	Collected weekly in food caddy, with recycling on recycling vehicle (in a separate compartment)
3 "Fortnightly refuse"	Fortnightly in a 240l Wheeled Bin	Weekly comingled in 240l bin	Fortnightly in a 240l Wheeled Bin	Weekly separate collections in food caddy in a dedicated separate food waste vehicle
4 "Restricted refuse capacity"	Weekly in a 180l Wheeled Bin	Weekly comingled in 240l bin	Fortnightly in a 240l Wheeled Bin	Weekly separate collections in food caddy in a dedicated separate food waste vehicle
5 "Restricted refuse capacity + fortnightly dry recycling"	Weekly in a 180l Wheeled Bin	Fortnightly twin-stream (paper/card out) collected every two weeks with paper/card in one compartment of recycling vehicle with remaining dry recycling (glass, cans and plastics) collected in the other compartment	Fortnightly in a 240l Wheeled Bin	Weekly separate collections in food caddy in a separate food waste vehicle
6 "Fortnightly refuse and dry recycling"	Fortnightly in a 240l Wheeled Bin	Fortnightly comingled in 240l bin	Fortnightly in a 240l Wheeled Bin	Weekly separate collections in food caddy in a separate food waste vehicle

The report provides the results of the modelling of various scenarios presented by Ricardo Energy & Environment based on their experience of other authorities and agreed with Resource London and the Council for further exploration.

The modelling was undertaken using KAT (WRAP's Microsoft Excel-based Kerbside Analysis Tool) with the outputs analysed using Ricardo Energy & Environment's in-house tools.

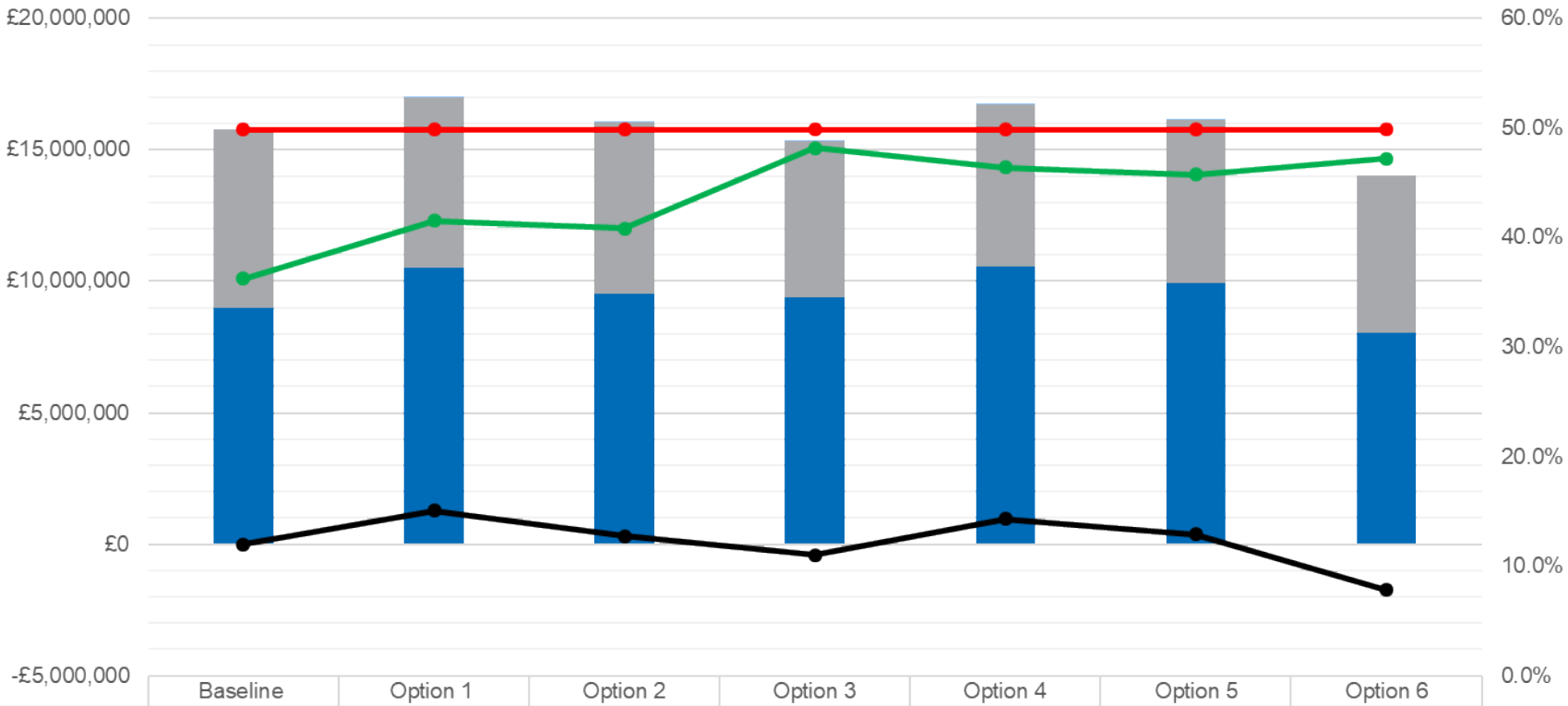
The report provides full details of Barnet's current service profile and benchmarks the Council's performance against other local authorities with similar demographics, and provides the performance outputs, resource implications and costs of each of the service scenarios.

The outcomes of each option have been presented in comparison with the Baseline figures, which are a modelled version of the Council's current service as agreed with Council officers. It should be noted that the modelled Baseline excludes communal properties (which are addressed in section 10). In addition, the Baseline contains assumptions based on an eight-hour working day.

As background, and to fully explain how the outputs have been achieved, information on the Baseline calculations and assumptions for the modelled service options has been provided, either in the main body of the report or as appendices.

Ricardo Energy & Environment provided this support to the Council on behalf of Resource London, and this report details the findings of the options reviews and modelling carried out. Figure 1 below summarises the net costs (split between collection and treatment costs) and the recycling rate for each option modelled.

Figure 1: Summary of Outputs



	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Depot Lease Costs	£0	£31,000	£8,454	£16,908	£31,000	£19,726	£0
Treatment Costs	£6,773,125	£6,508,658	£6,565,291	£5,942,811	£6,161,782	£6,223,239	£5,968,318
Collection Costs	£8,998,200	£10,496,100	£9,508,600	£9,407,500	£10,546,500	£9,913,800	£8,059,700
Total Net Costs	£15,771,325	£17,035,786	£16,082,347	£15,367,169	£16,739,244	£16,156,747	£14,028,041
Difference on Baseline	£0	£1,264,461	£311,022	-£404,156	£967,919	£385,422	-£1,743,284
Baseline Benchmark	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325
Recycling Rate	36.2%	41.5%	40.8%	48.2%	46.4%	45.7%	47.2%

N.B. It should be noted that the 'Additional Depot Space Lease Costs' are not visible in the graph due to the low figures compared to the other totals, however these have been accounted for in overall costs where applicable

The Council developed the evaluation criteria and weightings to assess the Options. These included elements such as public acceptability, frequency of collections and number of containers, alongside the financial elements and reduction of residual waste. **Error! Reference source not found.** below provides a summary of the evaluation which shows that Option 6 is the highest-ranking Option. The 'Raw Score' is score given to each Option for each criterion under the evaluation methodology. The 'Weighted Ranking' represents how the Options performed once the weightings applied to each criterion were calculated. For example, the 'cost' evaluation criteria accounted for 35% of the overall assessment, whereas 'public acceptability' accounted for 22% of the overall assessment. This means that the highest score of '6' given to one Option for 'public acceptability' would account for less of the overall weighting than a '6' given for 'cost'. This explains why although there is a broad correlation between raw and weighted scores shown below, there are certain instances where a raw score differs from the weighted score. The ranking of the Options has been undertaken based on the weighted scores.

Figure 2: Summary of Evaluation

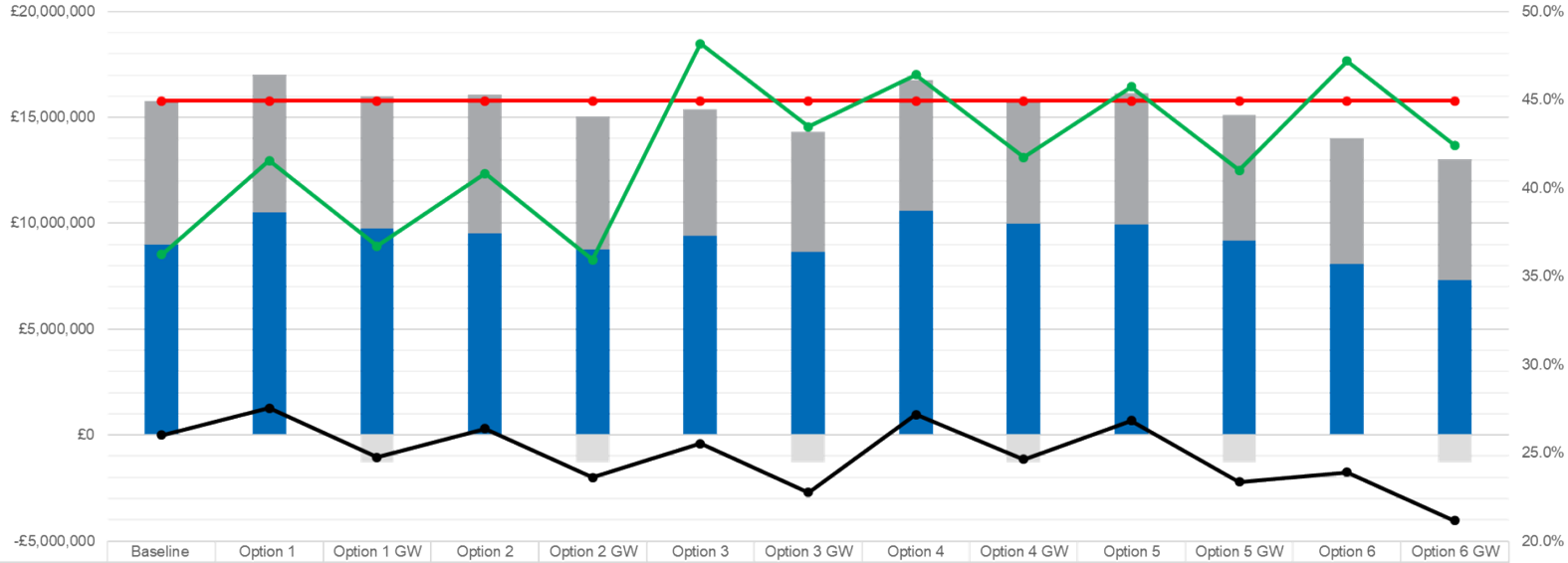
	Baseline	**Option 1: "Current service + food waste"**	**Option 2: "Alternate weekly dry recycling"**	**Option 3: "Fortnightly refuse"**	**Option 4: "Restricted refuse capacity"**	**Option 5: "Restricted refuse capacity + fortnightly dry recycling"**	**Option 6: "Fortnightly refuse and dry recycling"**
Raw Score	**3**	**5**	**7**	**2**	**4**	**6**	**1**
Weighted Ranking	**4**	**6**	**7**	**2**	**3**	**5**	**1**

An assessment of the impact of introducing a chargeable garden waste service was undertaken as a sensitivity following the main Options modelling. This comprised two scenarios:

- The first assumed a subscription rate of 35% and an annual charge of £35
- The second assumed a subscription rate of 14% and an annual charge of £50. It should be noted that this scenario assumes a very conservative householder uptake.

The assessment concluded that the garden waste service could be applied to each Option and, based solely on the savings made on vehicle/staff requirements, disposal fees and potential income the first service scenario, would save the Council in the region of £2.3m per annum (comprising £760,000 in reduced collection costs, £267,000 in reduced disposal costs and £1.3m of income from the service). The second scenario would save approximately £2.1m per annum (comprising £1.1m in reduced collection costs, £267,000 in reduced disposal costs and £726,000 of income from the service). However, this would result in a reduction in recycling rate of approximately 4.8%. **Error! Reference source not found.** and Figure 4 below summarise the impact of introducing a chargeable garden waste service on each Option and for both scenarios.

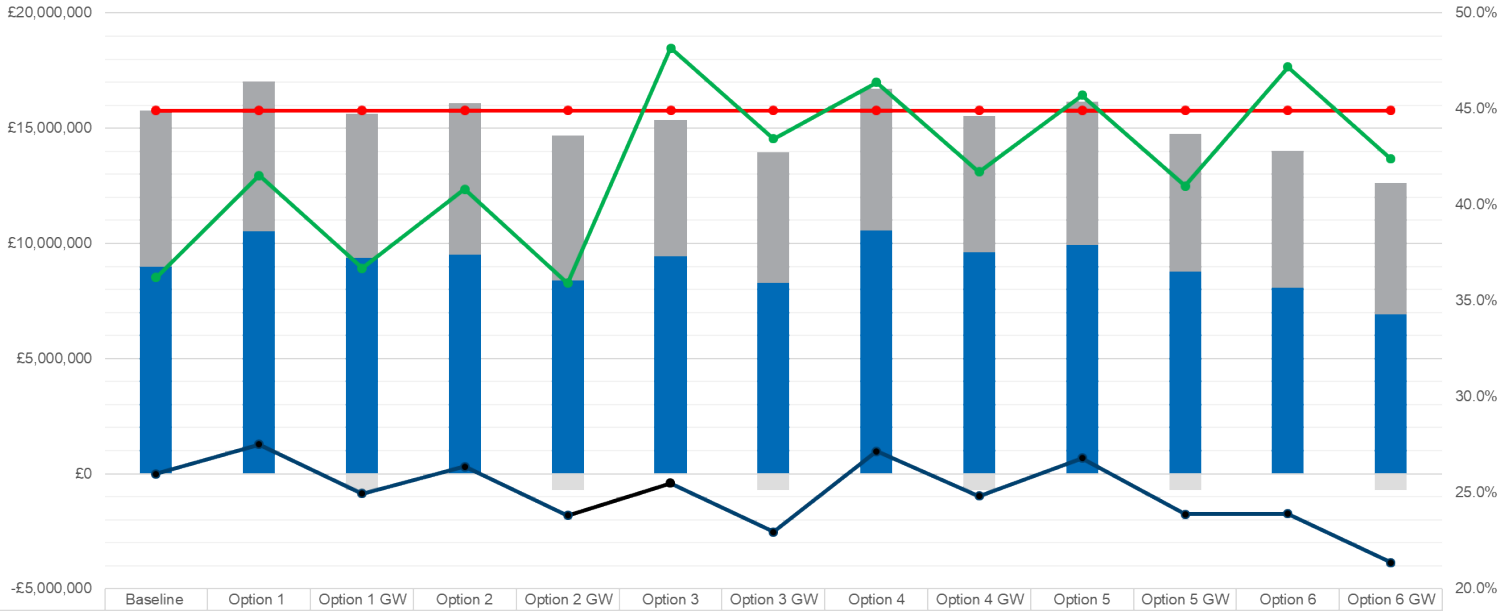
Figure 3: Garden Waste Service Summary - £35 Subscription Fee



	Baseline	Option 1	Option 1 GW	Option 2	Option 2 GW	Option 3	Option 3 GW	Option 4	Option 4 GW	Option 5	Option 5 GW	Option 6	Option 6 GW
Treatment Costs	£6,773,125	£6,508,658	£6,242,041	£6,565,291	£6,298,673	£5,942,811	£5,678,608	£6,161,782	£5,894,538	£6,223,239	£5,955,995	£5,968,318	£5,704,294
Collection Costs	£8,998,200	£10,496,100	£9,737,700	£9,508,600	£8,750,214	£9,407,500	£8,649,062	£10,546,500	£9,975,014	£9,913,800	£9,155,394	£8,059,700	£7,301,335
Income from Garden Waste	£0	£0	-£1,270,990	£0	-£1,270,990	£0	-£1,270,990	£0	-£1,270,990	£0	-£1,270,990	£0	-£1,270,990
Additional Depot Space Lease Costs	£0	£31,000	£19,726	£8,454	£0	£16,908	£5,636	£31,000	£22,544	£19,726	£8,454	£0	£0
Total Net costs	£15,771,325	£17,035,786	£14,728,516	£16,082,347	£13,777,897	£15,367,169	£13,062,316	£16,739,244	£14,621,106	£16,447,258	£13,558,342	£14,028,041	£11,734,639
Baseline Benchmark	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325
Difference on Baseline	£0	£1,264,461	-£1,042,809	£311,022	-£1,993,428	-£404,156	-£2,709,009	£967,919	-£1,150,219	£675,933	-£2,212,983	-£1,743,284	-£4,036,686
Recycling Rate (inc. Garden and Food Where Applicable)	36.2%	41.5%	36.7%	40.8%	35.9%	48.2%	43.5%	46.4%	41.7%	45.7%	41.0%	47.2%	42.4%

N.B. It should be noted that the 'Additional Depot Space Lease Costs' are not visible in the graph due to the low figures compared to the other totals, however these have been accounted for in overall costs where applicable

Figure 4: Garden Waste Service Summary - £50 Subscription Fee



	Baseline	Option 1	Option 1 GW	Option 2	Option 2 GW	Option 3	Option 3 GW	Option 4	Option 4 GW	Option 5	Option 5 GW	Option 6	Option 6 GW
Treatment Costs	£6,773,125	£6,508,658	£6,242,041	£6,565,291	£6,298,673	£5,942,811	£5,678,608	£6,161,782	£5,894,538	£6,223,239	£5,955,995	£5,968,318	£5,704,294
Collection Costs	£8,998,200	£10,496,100	£9,371,828	£9,508,600	£8,384,303	£9,407,500	£8,283,150	£10,546,500	£9,609,103	£9,913,800	£8,789,482	£8,059,700	£6,935,424
Income from Garden Waste	£0	£0	-£726,300	£0	-£726,300	£0	-£726,300	£0	-£726,300	£0	-£726,300	£0	-£726,300
Additional Depot Space Lease Costs	£0	£31,000	£14,090	£8,454	£0	£16,908	£0	£31,000	£16,908	£19,726	£2,818	£0	£0
Total Net costs	£15,771,325	£17,035,786	£14,901,659	£16,082,347	£13,956,675	£15,367,169	£13,235,459	£16,739,244	£14,794,249	£16,447,258	£14,021,996	£14,028,041	£11,913,418
Baseline Benchmark	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325
Difference on Baseline	£0	£1,264,461	-£869,666	£311,022	-£1,814,650	-£404,156	-£2,535,866	£967,919	-£977,076	£675,933	-£1,749,330	-£1,743,284	-£3,857,908
Recycling Rate (inc. Garden and Food Where Applicable)	36.2%	41.5%	36.7%	40.8%	35.9%	48.2%	43.5%	46.4%	41.7%	45.7%	41.0%	47.2%	42.4%

N.B. It should be noted that the 'Additional Depot Space Lease Costs' are not visible in the graph due to the low figures compared to the other totals, however these have been accounted for in overall costs where applicable

As a further sensitivity, the Council requested that the impact of increased disposal fees per tonne was investigated, to reflect the work being undertaken by North London Waste Authority (NLWA) to revise the long-term levy modelling carried out in 2017. **Error! Reference source not found.** below shows the modelled change in price per waste stream between 2018/19 and 2021/22.

Table 2: Disposal Fee Changes

	2018/19 (current pricing - revised at 4th NLWA budget review)	2021/22
Residual	£89.44	£101.35
Dry Recyclable	£67.06	£59.13
Food	£32.44	£34.12
Garden	£55.52	£58.60

According to the NLWA, there is a risk that by 2025/26 the Council's residual waste costs could double from the current position. However, as uncertainty increases the further into the future assessments are made, it was agreed that the figures provided from NLWA for 2021/22 would be used to gauge the future position. Although these figures may be subject to change, 2021/22 was the latest year for which estimated disposal costs were available. Given the volatility within waste markets for certain material streams, particularly dry recycling, attempting to model gate fees six years into the future would likely be inaccurate. It should be noted that food waste disposal costs have remained largely similar, and this is in line with the latest WRAP Gate Fees Report 2018, which states that the downward trend for anaerobic digestion (AD – the common route for separate food waste treatment) gate fees appears to be continuing[1]. It is likely that the disposal of residual waste will continue to become more expensive, and therefore the Options that include the reduction of residual waste will become increasingly financially attractive.

Table 3: Disposal Fee Comparison to Baseline

Option	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
18/19 Price	£6,773,125	£6,508,658	£6,565,291	£5,942,811	£6,161,782	£6,223,239	£5,968,318
Difference on Baseline	***n/a***	***-£264,467***	***-£207,834***	***-£830,314***	***-£611,343***	***-£549,886***	***-£804,807***
21/22 Price	£7,326,978	£7,015,046	£7,089,942	£6,328,782	£6,578,118	£6,657,470	£6,371,375
Difference on Baseline	***n/a***	***-£311,932***	***-£237,036***	***-£998,196***	***-£748,860***	***-£669,509***	***-£955,603***

Error! Reference source not found.Error! Reference source not found. shows the impact on cost compared to the Baseline for each Option as a result of the NLWA modelled change in disposal fees. Options that restrict residual waste the most realise the greatest savings on disposal costs.

[1] http://www.wrap.org.uk/sites/files/wrap/WRAP%20Gate%20Fees%202018_exec+extended%20summary%20report_FINAL.pdf

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Appendices

1 Introduction

This work has been undertaken by Ricardo Energy & Environment (Ricardo) on behalf of Resource London and the London Borough of Barnet (the 'Council'). The project is part of an overall programme of work Resource London is conducting with London Boroughs to examine the business case for greater consistency in household recycling collections within London.

The main objective of Resource London is that by 2020, London will have more harmonised, consistent and efficient waste and recycling services that will:

- Reduce the city's waste footprint and reinvigorate recycling to make a significant contribution towards the Mayor's ambition for London to achieve 65% recycling by 2030; and
- make a significant contribution towards England achieving its 50% household waste recycling target in 2020.

This report presents the findings from modelling work conducted for Resource London and the Council on the front-line service delivery and explores the relative merits of a number of different waste and recycling collection systems. Commentary has also been provided on the recently published Resources & Waste Strategy for England, along with commentary on the risks and factors likely to affect the waste and recycling market in the short and longer terms.

Modelling (using WRAP's Microsoft Excel based Kerbside Analysis Tool, 'KAT') was used to explore a number of potential future options for the collection of household waste.

1.1 Rurality

The Council is defined as Rurality 2: Predominantly Urban, Lower Deprivation. The KAT tool utilises extensive information from local authorities to apply assumptions regarding recycling performance dependant on the rurality of each authority area.

1.2 Year of Modelling

The Baseline model utilises 2017/2018 data as provided by the Council, amended to take into account the cessation of the food waste collection service in November 2018. All future waste and recycling service options assume this level of waste arisings and household numbers to enable like-for-like comparisons with the agreed Baseline.

1.3 Household Numbers

The Council has provided data on the number of households in the authority area, with communal properties identified alongside standard kerbside properties. However, as the KAT tool is not designed to deal with properties with communal collections (e.g. flats), an assessment of the communal properties has been carried out as a discrete exercise from the main modelling (see section 10).

It was agreed with the Council that, for the purposes of modelling, a 70/30 split should be used as a guide, with 70% of the 148,220 households assessed as 'standard' kerbside properties, and the remaining 30% as 'flats/communals'. This split is set out below, and further detail is available at Appendix 4:

Table 4: Property Numbers Modelled

Modelled Properties	Non-modelled Properties	Total
103,754	44,466	148,220
70%	30%	100%

1.4 Current Collection System

The kerbside collection schemes operated by the Council for refuse, dry recycling and garden waste at the properties to be modelled as the baseline are shown in **Error! Reference source not found.**

Table 5: Current Collection System (Baseline) - Standard Kerbside Collection

	Residual Waste	Dry Recycling	Garden Waste
Container	240l wheeled bin	240l wheeled bin	240l wheeled bin
Materials	Refuse	Co-mingled dry recycling	Garden waste
Collection frequency	Weekly	Weekly	Fortnightly
Households served (exc. flats)	103,754	103,754	103,754

1.5 Waste Arisings

The Council has provided their total waste arisings for 2017/18 for residual, dry recycling and garden waste streams.

To calculate the tonnage associated with communal properties, the total waste arisings were divided by the total number of properties, to provide an average kg per household per year (kg/hh/yr), which was then multiplied by the number of communal properties and deducted from the total arisings. These tonnages, shown in **Error! Reference source not found.**, were used in the KAT model.

Table 6: Kerbside Collected Waste (Standard Collections) 2017/18

Collection	Actual 2017/18 data	Modelled Tonnage
Residual waste	77,032	55,646
Co-mingled recycling	26,567	16,873
Garden waste	14,744	14,744

It is assumed that all garden waste arisings are from 'standard' kerbside properties rather than from flats/communals, and therefore all garden waste tonnage has been included in the modelling.

1.6 Waste Composition

Waste composition data was provided by the Council from a study undertaken in 2014/2015. However, as this study didn't separately identify all materials (particularly plastic bottles), the composition data has been amended to incorporate the default overall composition provided by WRAP's KAT tool. The composition of each waste stream is shown at **Error! Reference source not found.**. Residual composition is determined by the level of material diverted by dry recycling, garden and food collections.

It should be noted that the waste composition for recycling represents the recyclable materials and does not include contamination (i.e. material that is not accepted by the Council's current recycling scheme), which has been modelled at 9.3% of the collected tonnage as agreed with the Council.

Table 7: Waste Composition

Material Category	Overall Composition (weight %)	Recycling Composition (weight %)	Organics Composition (weight %)
Newspaper and magazines	9.64%	33.74%	0.0%
Other paper	7.60%	0%	0.0%
Corrugated card/Tetrapaks	1.90%	0.86%	0.0%
Non-corrugated card	3.00%	19.87%	0.0%
Plastic film	4.55%	0.00%	0.0%
Plastic bottles	2.20%	6.62%	0.0%
Plastic – other	3.12%	4.27%	0.0%
Mixed Glass	6.64%	30.24%	0.0%
Steel cans	1.44%	1.85%	0.0%
Aluminium cans	0.29%	2.53%	0.0%
Foil	0.43%	0.00%	0.0%
Textiles	2.69%	0.00%	0.0%
Soil and other organic	3.74%	0.00%	18.66%
Food	21.70%	0.00%	0.0%
Garden	15.45%	0.00%	80.67%
Other	15.61%	0.00%	0.67%
Total	**100.0%**	**100.0%**	**100.0%**

1.7 Set-out Rates

The Council provided information on set-outs based on studies undertaken and these are shown in **Error! Reference source not found.** below. Set-out is the average percentage of households setting out containers for collection on any collection day.

Table 8: Assumed Set-out Rates

	Residual waste	Dry recycling	Garden waste
Barnet	60%	60%	25%

1.8 Vehicles

1.8.1 Number of Vehicles

The modelling focuses on the standard kerbside service collection rounds. The number of vehicles used for the Councils' standard kerbside service are shown in **Error! Reference source not found.**. However, since properties with communal containers (i.e. flats) are not included in the modelling, we have pro-rated the number of vehicles down in the same proportion (see **Error! Reference source not found.**) for residual waste and recycling. Garden waste vehicles are unaffected as it is assumed all garden waste is generated from standard kerbside properties. The figures below reflect the vehicle numbers modelled.

It should be noted that the assumptions regarding working hours (see section 1.9) do not mirror the Council's actual current service. Following the results of the modelling of the Baseline and all six Options based on the Council's current working hours, it was agreed that the working hours should be remodelled in line with the planned changes to future working hours, and therefore reduced back to eight hours per day. The Baseline was therefore modelled with these assumptions included, to facilitate accurate and fair comparison with the Options, each of which includes the same assumptions. The reduction in hours results in an increase in the number of collection vehicles for all material streams.

Table 9: Numbers of Vehicles Used to Collect Kerbside Waste

	Residual Waste	Co-mingled Recycling	Garden Waste
Total Current Fleet (current working hours)	18	18	7
Modelled Vehicles (current working hours)	12.5[2]	12.3[3]	6.7[4]
Modelled Vehicles (eight-hour working day)	16.6[5]	15.6[6]	7.5[7]

1.8.2 Number of Days/Weeks Worked

The Council has reported that the standard kerbside collection service operates five (5) days per week (including public holidays), fifty-two weeks per year, with some adjustments in service over the Christmas period. The garden waste service operates fortnightly for 46 weeks of the year (23 collections).

1.8.3 Specification of Vehicles

The vehicles used in the Baseline are based on the information provided by the Council and are shown in **Error! Reference source not found.**. The vehicle payloads provided by the Council are the average tonnages collected on each load per vehicle, rather than the maximum vehicle payload. As such, payloads may be subject to minor changes during the development of the Baseline.

Table 10: Specification of Vehicles (Standard Kerbside Service)

Authority	Residual Waste	Dry Recycling	Garden Waste
Barnet	**RCV (Residual Collection Vehicle)**	**RCV with food pod**	**RCV**
	Avg. tip 11.6 tonne payload	Avg. tip 10.3 tonne payload	Avg. tip 10.4 tonne payload

1.9 Timings

Driving distances have been provided as averages by the Council. Default driving speeds from the KAT Tool were then used to convert the distances provided into average collection timings, as shown in **Error! Reference source not found.**. This calculation enables the actual time spent collecting waste

[2] Rounded up to 13 for costing purposes
[3] Rounded up to 13 for costing purposes
[4] Rounded up to 7 for costing purposes
[5] Rounded up to 17 for costing purposes
[6] Rounded up to 16 for costing purposes
[7] Rounded up to 8 for costing purposes

for the services to be calculated, which in turn affects the tonnages of materials which can be collected. The timings provided are estimates and have been subject to minor amendments whilst refining the Baseline, particularly the average collection speeds.

Table 11: Average Collection Timings

Collection Timings	Residual	Recycling	Garden
Average speed when collecting	5.20 mph	4.03 mph	5.20 mph
Average speed when not collecting	19.35 mph	20.50 mph	20.50 mph
Average time taken to drive from starting depot to beginning of round	20 minutes	20 minutes	20 minutes
Average time taken to drive from round to unloading point (one-way)	20 minutes	20 minutes	20 minutes
Average time taken to unload	30 minutes	30 minutes	30 minutes
Average time taken to drive from unloading point to the finish depot	30-45 minutes	30 minutes	30-45 minutes
Average hours worked by each crew per day	8 hours	8 hours	8 hours

1.10 Costs

1.10.1 Collection

The Council has provided us with data regarding their in-house service costs to facilitate the construction of the Baseline, shown in **Error! Reference source not found.** below.

Table 12: Barnet Service Costs

Item	Residual Waste Costs	Dry Recycling Costs	Garden Waste Costs
Container	1x 240l wheeled bin: £18.66	1x 240l wheeled bin: £19.51	1x 240l wheeled bin: £19.13
Vehicle purchase	RCV - £190,000	RCV with pod - £190,000	RCV - £190,000
Vehicle Running (annual)	£15,500	£15,500	£15,500
Vehicle Standing (annual)	£6,800	£6,800	£6,800
Driver (HGV)	£38,020 per annum per driver		
Driver (non-HGV)	£26,962 per annum per driver		
Loader	£33,624 per annum per loader		
Supervision/Management	£482,481 per annum		
Overheads	10% of total Street Scene budget: £760,369 per annum		

Staff costs are inclusive of on costs. The overhead proportion has been estimated by the Council as representing 10% of the total Council Street Scene management budget; this figure has been utilised consistently across all of the options.

Overheads include the non-operational costs incurred in the running of the service; this includes costs associated with the management of the service and associated apportioned costs for central council departmental inputs i.e. Human Resources, Information Technology, Health & Safety, Procurement, Finance and Legal, along with other costs such as utilities and insurances,

Where the Council has not obtained specific vehicle standing and running costs, Ricardo have used assumptions from our database comprising recent data, including purchase, running and standing costs.

1.10.2 Treatment

The other key element of the options modelling is the cost of disposing of or recycling the collected material. Each option changes the proportion and total tonnage of material collected and will therefore change the treatment costs.

Disposal costs have been provided by the North London Waste Authority (NWLA) and are shown in **Error! Reference source not found.** below. As treatment costs vary regularly, we have agreed with the Council to utilise the costs shown in the Table as '2018/19 (current pricing - revised at 4th NLWA budget review)'.

Table 13: NWLA Disposal Costs

Waste type	2018/19	2018/19 (current pricing - revised at 4th NLWA budget review)	2019/20
Residual	£89.47	£89.44	£95.95
Dry recyclable	£56.01	£67.06	£66.70
Food	£84.71	£32.44	£33.94
Green	£56.66	£55.52	£57.28

1.10.3 Operational

Staff and container costs will be as per those used in the Baseline for all options, to ensure a like-for-like comparison. Where data for vehicle purchase costs is not provided, we have used the framework price the authorities would obtain if they were to use the Dennis Eagle framework to procure vehicles, as shown in **Error! Reference source not found.**.

In all options, depot costs have not been included as standard, however, for certain options, there would be a requirement for capital investment in both land and physical infrastructure to enable additional activities to be conducted, such as additional vehicle parking. The Council has provided a cost of £2,818 per vehicle (above the Baseline total) for additional parking, which has been factored into the overall cost per Option, where applicable. It is essential to note that this is only an indicative cost – there is no actual additional depot space that has been identified as available at this time. Such additional space would need to be identified and procured at a cost that cannot be accurately defined at this time, within the context of a London borough which is expected to have significant housing growth in the coming years. If suitable depot space cannot be found, the possibility of introducing service changes that require more space will be significantly curtailed.

Table 14: Vehicle Cost Assumptions

Vehicle	Prices incl. bin lift (where applicable or stated otherwise)	MPG	Standing Costs	Running Costs
Food 7.5 non-compaction	£85,000	12.6	£1,395	£10,100
Twin pack	£200,000	2.7	£2,245	£14,100
Barnet RCV - Recycling	£190,000	3.5	£6,800	£15,500
Barnet RCV - Garden	£190,000	3.5	£6,800	£15,500
Barnet RCV - Refuse	£190,000	3.5	£6,800	£15,500

The vehicle costs, excluding the current prices provided by the Council, in **Error! Reference source not found.** are sourced from numerous procurement processes undertaken by Ricardo and provide a good estimate of the true costs of collection vehicles. The Council has agreed that we will apply these costs to all future Options.

2 Modelled Options

This section of the report explores the forward-looking analysis, and Options to be considered as part of the collections modelling appraisal.

2.1 Vehicles and Containers

The vehicles and containers used in each of the future options modelled were agreed with Resource London and the Council. The vehicles and containers that were modelled for are shown in **Error! Reference source not found.**5.

Table 15. Vehicles and Containers used in the Options Modelling

Option	Residual waste	Dry recycling	Garden waste	Food waste
		Method		
Current	Weekly via 240 litre wheeled bin - RCV	Weekly comingled in 240l bin – RCV	Fortnightly in 240l bin - RCV	None
1 “Current service + food waste”	Weekly via 240 litre wheeled bin - RCV	Weekly comingled in 240l bin – RCV	As current	Weekly food waste (collected separately) 7.5t RCV (non-compaction)
2 “Alternate weekly dry recycling”	Weekly via 240 litre wheeled bin - RCV	Fortnightly twin stream with glass, cans and plastics in 240l bin and paper/card in 55l box each collected on alternate weeks on a Twinpack vehicle e.g. Week One – plastics, cans and glass (with food in smaller compartment), Week Two – Paper/Card (with food in smaller compartment)	As current	Weekly food waste (collected on twinpack compartment)
3 “Fortnightly refuse”	Fortnightly via 240 litre wheeled bin - RCV	Weekly comingled in 240l bin - RCV	As current	Weekly food waste (collected separately) 7.5t RCV (non-compaction)
4 “Restricted refuse capacity”	Weekly via 180 litre wheeled bin - RCV	Weekly comingled in 240l bin - RCV	As current	Weekly food waste (collected separately) 7.5t RCV (non-compaction)
5 “Restricted refuse capacity + fortnightly dry recycling”	Weekly via 180 litre wheeled bin- RCV	Fortnightly twin stream (paper out) and with glass, cans and plastics in 240l bin and paper/card in 55l box – Twinpack vehicle	As current	Weekly food waste (collected separately) 7.5t RCV (non-compaction)
6 “Fortnightly refuse and dry recycling”	Fortnightly via 240 litre wheeled bin – RCV	Fortnightly comingled via 240l - RCV	As current	Weekly food waste (collected separately) 7.5t RCV(non-compaction)

2.2 Contamination

Within kerbside recycling collections, there will be a certain proportion of the material that is classed as contamination and will not contribute to the recycling rate. This contamination rate will vary according to:

- Scheme type;
- Residual waste capacity;
- Communications and awareness campaigns; and
- Enforcement.

WRAP evidence demonstrates that where residents are required to separate their recyclate into different containers, contamination is more easily identified and consequently the level of contamination falls. Conversely, fully co-mingled schemes tend to attract a higher level of contamination, as it is more difficult to identify in a bin containing fully mixed recyclate.

We have provided, in **Error! Reference source not found.**, a breakdown of the proposed contamination rates to be modelled for each methodology, as agreed with the Council. This includes typical values for contamination, sourced from the Council and Ricardo data.

Table 16. Rejects and Non-recycled Material

Option	Contamination level
Baseline	9.3%
Separate paper/card stream	5.26%
Co-mingled portion of two-stream	9.3%

2.3 Estimated Set-out Rates

The set-out rate is the percentage of service users who will present their containers for collection on their collection day. The following table shows the estimated set-out rates for each option along with the rationale behind the rate, utilising information on fill rates provided by the Council. In summary, as capacity in the residual waste containers falls, they will be fuller when collected. Residents will be encouraged to separate more of their recyclate (including food waste) to utilise the available capacity in their recycling containers, which will therefore be fuller when emptied.

Table 17: Proposed Set-out Rates

Option	Coverage	Recycling Set-out	Residual set out	Food	Reason
Baseline	100%	60%	60%	n/a	As per current estimate
Option 1	100%	60%	60%	30%	As Baseline and low use of food waste containers in Council participation study (the study)
Option 2	100%	85%	60%	30%	Residual as baseline, reduced frequency of recycling should result in full containers for most householders based on the study. Food as Option 1
Option 3	100%	70%	90%	40%	Reduced frequency of residual should result in full containers for most householders based on the study. The reduced residual frequency should see an increase in set out for both recycling and food waste.
Option 4	100%	65%	85%	35%	Recycling as Baseline, reduced capacity of residual should result in fuller containers for most householders based on

Option	Coverage	Recycling Set-out	Residual set out	Food	Reason
					the study. The reduced residual capacity should see an increase in set out for both food waste and recycling.
Option 5	100%	85%	85%	35%	Reduced capacity of residual and frequency of recycling should result in fuller containers for most householders based on the study. The restricted residual capacity should see a moderate increase in set out for food waste.
Option 6	100%	85%	90%	40%	Reduced frequency of residual and recycling should result in fuller containers for most householders based on the study. The reduced residual frequency should see an increase in set out for food waste.

It should be noted that there are numerous factors that can influence set out rates, and we have agreed with the Council that the rates used are realistic. For food waste in particular, there is little data available on the effect of set-out rates resulting from a change in residual service (collection frequency or capacity). We have therefore assumed that a change in residual waste collection frequency to fortnightly will increase the set-out rate for food waste by 10% This is largely due to residents not wanting to leave food waste in the residual bin for two weeks at a time. Similarly, the set-out rate for dry recyclate will increase by 10%.

With restricted residual capacity, these concerns are mitigated as the frequency remains at a weekly collection, however the reduced space in the residual bin is likely to deliver an increased food waste yield, and for these options, a 5% increase in set out rate has been estimated for both food waste and recyclate.

Where the frequency of dry recycling collections is reduced (Options 3 and 6), the set-out rate will increase, as the containers will be fuller and therefore require emptying more regularly.

2.4 Potential Material Yields

Having considered the level of contamination and the set-out rates for each of the options, the next step is to explore the potential changes to the yield of each material stream for each of the modelled collection options. The initial data utilised for this exercise was sourced from WRAP's Local Authority Portal and calculated through Ricardo's in-house benchmarking tool. This data provided the average yields for schemes operated by local authorities of the design represented by each of the modelled options.

This provided an evidence-based indication of the potential impact of the service changes on material yields, which were then adjusted to take account of the Council's rurality and current recycling levels. It should be noted that this data is only an indication of the potential effect on the resulting yields based on benchmarking, and the modelling of the Options may yield different results.

2.4.1 Food Waste Yields

All modelled options included a separate food waste collection service. The Council provided average yield data from the recently suspended food waste collection service, which equated to an average of 0.86kg/hh/wk (44.72kg/hh/yr). This has been used for the modelling of the Options where residual waste has remained as a weekly collection in a 240l bin (ie mirroring the previous service).

For Options where residual waste collections reduce in frequency to a fortnightly collection, we have used the WRAP Food Waste Ready Reckoner to establish what the increase in yield is likely to be. The uplift from the weekly residual collection minimum yield to the fortnightly residual collection minimum

yield is 19.70%. When applied to the average yield provided by the Council, this results in a yield of 1.03kg/hh/wk (53.53kg/hh/yr), which has been used for Options 3 and 6.

For restricted capacity Options (4 and 5), it has been assumed that this increase in yield would be halved, due to an overall residual capacity reduction of 60 litres per week, or half that of the reduced frequency collections. The average food waste yield provided by the Council has modelled using an increase of 9.85%, equating to 0.94kg/hh/wk (49.12kg/hh/yr) for Options 4 and 5.

2.4.2 Potential Combined Waste Yields

Combining all the dry recyclate and residual waste yield estimates and the Council's food waste collection yields, **Error! Reference source not found.** represents the estimated yields used for the options modelling.

Please note that a comprehensive description of the methodology utilised to develop the yield estimates can be found in the assumptions report at Appendix 2.

It should also be noted that, since properties with communal containers (i.e. flats) are not included in the modelling at this stage, the yields only represent the materials collected from standard kerbside properties. It should be noted that, as identified in **Error! Reference source not found.**, the dry recycling tonnage for each option includes an element of contaminated or non-acceptable material; this material has been subtracted from the recycling tonnage and transferred to the residual tonnage.

Table 18: Estimated Combined Yields (kg/hh/yr)

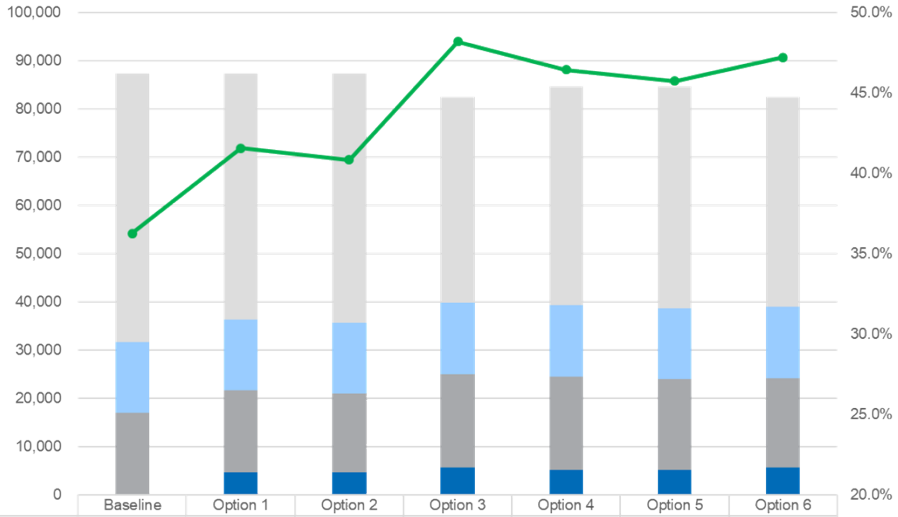
	Paper	Card	Cans	Glass	Plastic bottles	Mixed Plastics	Total Dry Recycling	Food Waste	Residual waste	Residual (Inc. Contamination)
Barnet yield baseline	***60.48***	***37.17***	***7.86***	***54.21***	***11.87***	***7.66***	***179.24***	***0***	***519.71***	
Option 1	60.48	37.17	7.86	54.21	11.87	7.66	179.24	44.72	474.99	
Difference on Baseline	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***n/a***	***-8.60%***	
Recycling Contamination Rate					***9.30%***					
Residual waste plus recycling contamination										***491.66***
Option 2	56.85	34.93	7.38	50.95	11.16	7.20	168.48	44.72	485.75	
Difference on Baseline	***-6%***	***-6%***	***-6%***	***-6%***	***-6%***	***-6%***	***-6%***	***n/a***	***-6.54%***	
Recycling Contamination Rate	***5.26%***					***9.30%***				
Residual waste plus recycling contamination										***497.71***
Option 3	69.55	42.74	9.04	62.34	13.66	8.81	206.13	53.19	392.86	
Difference on Baseline	***15%***	***15%***	***15%***	***15%***	***15%***	***15%***	***15%***	***n/a***	***-24.41%***	
Recycling Contamination Rate					***9.30%***					
Residual waste plus recycling contamination										***412.03***
Option 4	69.55	42.74	9.04	62.34	13.66	8.81	206.13	48.95	417.88	
Difference on Baseline	***15%***	***15%***	***15%***	***15%***	***15%***	***15%***	***15%***	***n/a***	***-19.59%***	
Recycling Contamination Rate					***9.30%***					
Residual waste plus recycling										***437.05***

	Paper	Card	Cans	Glass	Plastic bottles	Mixed Plastics	Total Dry Recycling	Food Waste	Residual waste	Residual (Inc. Contamination)
contamination										
Option 5	65.92	40.51	8.56	59.09	12.94	8.34	195.36	48.95	428.64	
Difference on Baseline	***9%***	***9%***	***9%***	***9%***	***9%***	***9%***	***9%***	***n/a***	***-17.52%***	
Recycling Contamination Rate	***5.26%***					***9.30%***				
Residual waste plus recycling contamination										***442.51***
Option 6	66.53	40.89	8.64	59.63	13.06	8.42	197.16	53.19	401.83	
Difference on Baseline	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***n/a***	***-22.68%***	
Recycling Contamination Rate					***9.30%***					
Residual waste plus recycling contamination										***420.16***

3 Recycling Rates

Based on the changes to the yield of each material stream for each of the options modelled, the tonnages of each material stream and the estimated recycling rates for each Option can be seen in **Error! Reference source not found.** below:

Figure 5: Waste Stream Tonnages and Recycling Rate



	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Residual (inc. Contamination)	55,646	51,006	51,642	42,709	45,323	45,899	43,520
Garden Waste	14,744	14,744	14,744	14,744	14,744	14,744	14,744
Dry Recycling	16,873	16,873	16,237	19,403	19,403	18,827	18,591
Food	0	4,640	4,640	5,554	5,097	5,097	5,554
Recycling Rate (inc. Food and Garden Where Applicable)	36.2%	41.5%	40.8%	48.2%	46.4%	45.7%	47.2%

Key Observations:

- Option 3 delivers the highest recycling rate at 48.2%, 12% higher than the baseline with reduced frequency residual resulting in significant diversion of recycling and food waste from the residual stream.
- Option 2 delivers the lowest recycling rate of all options, with the weekly residual in a 240l container and increased complexity of recycling system reducing the amount of dry recycling yielded. The collection of food waste has partially mitigated the effect of this to some degree.
- Reduced residual capacity and frequency has had a positive effect on recycling rate in all options where this is present, as evidenced by Options 3, 4, 5 and 6.
- Option 1 has improved on the baseline solely due to the collection of food waste.

It should be noted that these results show the outcomes of the modelling for the standard kerbside properties only. The results of the tonnage from communal properties can be seen in section 10.

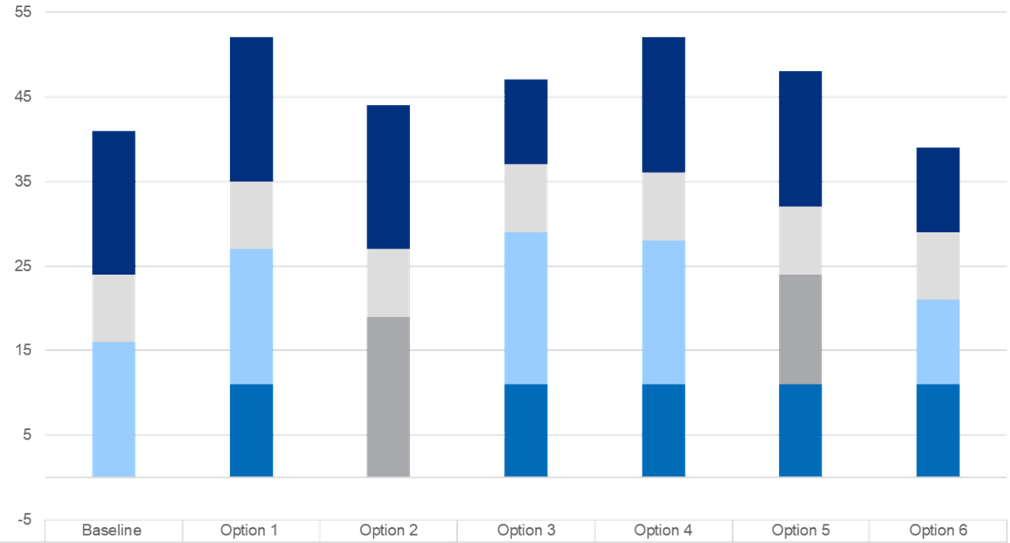
4 Frontline Service Provision – Vehicles and Staffing

4.1 Resources Required – Frontline Vehicles

The KAT modelling shows that differing numbers of frontline vehicles are required across the Options. Although some of the existing vehicles may be suitable for use initially, we have modelled on the assumption that all Options, including the Baseline, require a new vehicle fleet. This is to enable consistent comparisons to be made between the costs of each option.

All capital costs are depreciated over a 5-year period and this annual equivalent amount is included in the annual cost for each option. We have taken this approach as the existing collection vehicles will ultimately need replacing and it allows for Options to be compared on a like for like basis. The results of this modelling are presented below in Figure 6:

Figure 6: Vehicles Required for Each Option



	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Total	41	52	44	47	52	48	39
Barnet RCV - Refuse	17	17	17	10	16	16	10
Barnet RCV - Garden	8	8	8	8	8	8	8
Barnet RCV - Recycling	16	16	0	18	17	0	10
Twin pack	0	0	19	0	0	13	0
Food	0	11	0	11	11	11	11

Key observations:

- Options 1 and Option 4 require the highest number of vehicles with the addition of food waste vehicles onto the Baseline, and with no reduction in the number of residual vehicles resulting in a fleet of 52 vehicles. Option 4 requires a high number of vehicles as both residual and recycling collections are weekly.
- Option 6 requires two fewer vehicles than the Baseline, even though food is collected separately, due to the reduced collection frequency for both recycling and residual waste.
- Reduced collection frequency and restricted capacity has a generally positive effect on vehicle numbers, as evidenced by Options 3, 5 and 6.
- The vehicle numbers only represent the requirements for collections from standard kerbside properties.

4.2 Annual Vehicle Costs

The capital purchase, standing and running costs for each vehicle type are detailed in **Error! Reference source not found.** to **Error! Reference source not found.** below. These include the cost of purchasing the vehicles, their subsequent operation, fuel, maintenance, repair, insurance, tax, licences and the replacement of consumables such as tyres. It is assumed that all vehicles will need to be purchased, with the cost depreciated over 5 years.

Accompanying assumptions on total vehicle capital costs for each option are provided within **Error! Reference source not found.**, with the annual depreciated cost shown in **Error! Reference source not found.**. Standing and running costs have been taken from Ricardo's vehicle database, except for the 'Barnet RCV' vehicles, where data was supplied by the Council. Where figures provided by the

Council are used, these represent the highest likely costs at current prices; in some options lower cost vehicles may be used.

Table 19: Assumed Vehicle Costs

Vehicle – Euro 6 Engines	Prices incl. bin lift	MPG	Standing Costs	Running Costs
Food 7.5 non-compaction	£85,000	12.6	£1,395	£10,100
Twin pack	£200,000	2.7	£2,245	£14,100
Barnet RCV - Recycling	£190,000	3.5	£6,800	£15,500
Barnet RCV - Garden	£190,000	3.5	£6,800	£15,500
Barnet RCV - Refuse	£190,000	3.5	£6,800	£15,500

Table 20: Capex - Vehicle Capital Costs

Vehicle Type	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Food 7.5 non - compaction		£935,000		£935,000	£935,000	£935,000	£935,000
Twin pack			£3,800,000			£2,600,000	
Barnet RCV - Recycling	£3,040,000	£3,040,000		£3,420,000	£3,230,000		£1,900,000
Barnet RCV - Garden	£1,520,000	£1,520,000	£1,520,000	£1,520,000	£1,520,000	£1,520,000	£1,520,000
Barnet RCV - Refuse	£3,230,000	£3,230,000	£3,230,000	£1,900,000	£3,040,000	£3,040,000	£1,900,000
Total	**£7,790,000**	**£8,725,000**	**£8,550,000**	**£7,775,000**	**£8,725,000**	**£8,095,000**	**£6,255,000**

Table 21: Annual Vehicle Costs - Depreciated over 5 years

Vehicle Type	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Food 7.5 non-compaction		£187,000		£187,000	£187,000	£187,000	£187,000
Twin pack			£760,000			£520,000	
Barnet RCV - Recycling	£608,000	£608,000		£684,000	£646,000		£380,000
Barnet RCV - Garden	£304,000	£304,000	£304,000	£304,000	£304,000	£304,000	£304,000
Barnet RCV - Refuse	£646,000	£646,000	£646,000	£380,000	£608,000	£608,000	£380,000
Total	**£1,558,000**	**£1,745,000**	**£1,710,000**	**£1,555,000**	**£1,745,000**	**£1,619,000**	**£1,251,000**

Key observations:

- The relative similarity in capital costs for the two main types of vehicles (RCV and Twin pack) means that more vehicles required equates to higher capital costs.
- Option 6 incurs the lowest capital requirement as the reduced frequency for both residual and recycling has resulted in the fewest vehicles of all the options.
- Option 4, retaining weekly frequency for both residual and recycling, requires the most vehicles and incurs the highest cost

Table 22: Annual Vehicle Costs - Standing Costs

Vehicle Type	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Food 7.5 non-compaction		£15,345		£15,345	£15,345	£15,345	£15,345
Twin pack			£42,655			£29,185	
Barnet RCV - Recycling	£108,800	£108,800		£122,400	£115,600		£68,000
Barnet RCV - Garden	£54,400	£54,400	£54,400	£54,400	£54,400	£54,400	£54,400
Barnet RCV - Refuse	£115,600	£115,600	£115,600	£68,000	£108,800	£108,800	£68,000
Total	**£278,800**	**£294,145**	**£212,655**	**£260,145**	**£294,145**	**£207,730**	**£205,745**

Standing costs are those costs required for a vehicle irrespective of its use i.e. tax, licensing and insurance.

Key observations:

- Of the Options, 1 and 4 incur the highest annual cost (relative to the Baseline) due to both requiring the largest fleet
- Option 3 incurs the next greatest cost, requiring a large fleet that incur greater costs per unit
- Options 2 and 5 are cheaper due to the lower number of vehicles required
- Option 6, utilising the fewest RCVs incurs the lowest cost of all the options.
- The vehicle numbers only represent the requirements for collections from standard kerbside properties.

Table 23: Annual Vehicle Costs – Running Costs

Vehicle Type	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Food 7.5 non-compaction		£111,100		£111,100	£111,100	£111,100	£111,100
Twin pack			£267,900			£183,300	
Barnet RCV - Recycling	£248,000	£248,000		£263,500	£263,500		£155,000
Barnet RCV - Garden	£124,000	£124,000	£124,000	£124,000	£124,000	£124,000	£124,000
Barnet RCV - Refuse	£263,500	£263,500	£263,500	£155,000	£248,000	£248,000	£155,000
Total	**£635,500**	**£746,600**	**£655,400**	**£669,100**	**£746,600**	**£666,400**	**£545,100**

Running costs are those costs (excluding fuel) required for an operational vehicle above the standing costs i.e. maintenance, tyres, driver damage and AdBlue (a solution added to a vehicle's exhaust system to reduce emissions).

Key observations:

- Options 1 and 4 currently incur the highest running costs due to having the largest fleets
- Options 2 and 5 are the next most expensive
- Option 6 incurs the lowest running costs due to requiring the lowest number of RCVs to deliver the services.

- The vehicle numbers only represent the requirements for collections from standard kerbside properties.

Table 24: Annual Fuel Costs

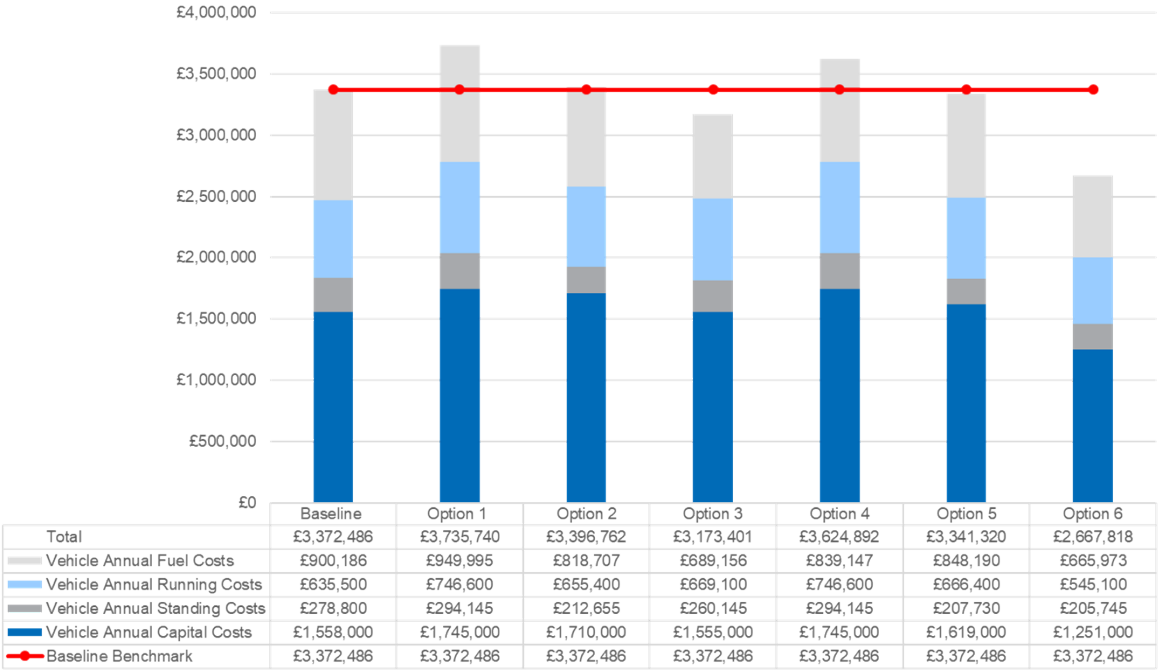
Vehicle Type	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Recycling	£341,962	£341,962	£383,647*	£247,778	£363,335	£372,377	£210,104
Garden	£182,573	£182,573	£182,573	£182,573	£182,573	£182,573	£182,573
Residual	£375,651	£375,651	£252,487	£210,104	£243,431	£243,431	£224,594
Food	£0	£49,809	£0	£48,702	£49,809	£49,809	£48,702
Total	£900,186	£949,995	£818,707	£689,156	£839,147	£848,190	£665,973

*Includes food costs collected on same twin-pack vehicle

Fuel prices were calculated using February 2019 costs[8] minus VAT, which equates to £1.07 per litre of diesel.

Figure 7 below summarises the total annual vehicle costs for each option, including depreciated annual capital purchase costs, standing and running costs, and annual fuel costs,

Figure 7: Summary of Annual Vehicle Operating Costs per Option



4.3 Resources Required – Front Line Operatives

Error! Reference source not found. shows the level of crew assigned to each vehicle type. It should be noted that the food waste vehicles were originally modelled with driver plus one loader; however, this resulted in a significant increase in the number of vehicles required, and therefore a driver plus two loaders approach is more economically viable. This approach has been agreed with the Council.

[8] https://www.theaa.com/driving-advice/driving-costs/fuel-prices

Table 25: Vehicle Crew Levels

Vehicle Type	Driver	Loader	Total
Food 7.5 non-compaction	1	2	3
Twin pack	1	2	3
Barnet RCV - Recycling	1	2	3
Barnet RCV - Garden	1	2	3
Barnet RCV - Refuse	1	2	3

Error! Reference source not found. lists the number of front-line operatives estimated as being required for each scenario. It should be noted that these are solely the operatives required to deliver the Options and spare or pool operatives to cover sick or holiday are not included.

Table 26: Front Line Operatives Estimated for Each Option

Vehicle Type	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Loaders	82	104	88	94	104	96	78
Drivers	41	52	44	47	52	48	39
Total	**123**	**156**	**132**	**141**	**156**	**144**	**117**

As all options use vehicles requiring a driver plus two loaders, the lower the number of vehicles requires fewer staff, with Option 6 incurring the lowest number and Option 4 the highest.

4.4 Annual Crew Costs

The annual crew costs, provided by the Council, include drivers, loaders and supervisor costs which are presented in **Error! Reference source not found.**. These directly relate to the modelled driver and loader cost requirements shown in **Error! Reference source not found.**.

Table 27: Cost Assumptions for Operatives (Annual Cost – provided by Council)

Operative	Cost
Loader	£33,624
HGV Driver	£38,020
Non-HGV Driver	£26,962

Table 28: Annual Crew and Supervision Costs

	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Crew	£4,315,981	£5,352,296	£4,631,785	£4,825,957	£5,352,296	£4,931,225	£3,983,814
Supervision	£482,481	£482,481	£482,481	£482,481	£482,481	£482,481	£482,481
Total	**£4,798,463**	**£5,834,778**	**£5,114,266**	**£5,308,439**	**£5,834,778**	**£5,413,706**	**£4,466,296**

As previously indicated, the use of equal crew levels in all vehicles means that the vehicle numbers directly correlate to staff costs, with Options 1 and 4 incurring the highest and Option 6 the lowest costs.

It should be noted that the crew numbers only represent the requirements for collections from standard kerbside properties.

5 Resources Required – Containerisation

Error! Reference source not found. to **Error! Reference source not found.** outline the assumed containerisation required for each Option modelled, as well as both the capital cost (to purchase them outright) and the capital cost annualised with the addition of annual container replacement fees.

Table 29: Containerisation Utilised in Each Option

Vehicle Type	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Recycling	240l Wheeled Bin		240l Wheeled Bin + 40l box	240l Wheeled Bin		240l Wheeled Bin + 40l box	240l Wheeled Bin
Garden	240l Wheeled Bin						
Food	n/a	23 litre caddy plus 7 litre caddy					
Residual	240l Wheeled Bin				180l wheeled bin		240l Wheeled Bin

Options 2 and 5 are the only options that are not fully comingled with regards to recycling. It was decided that these two Options should be included in the appraisal to establish the practicalities of introducing a scheme that improves material quality by separating out paper and card. This was deemed pertinent given the focus the Resources & Waste Strategy for England has on material quality (see section 12).

Options 4 and 5 have been assessed on the basis of restricting residual waste capacity by reducing the 240l wheeled bin to a 180l wheeled bin. This is likely to have a positive impact on residual waste reduction and recycling yields (see section 2.4.)

Table 30: Containerisation - Capital Costs

	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Recycling	£0	£0	£299,849	£0	£0	£299,849	£0
Garden	£0	£0	£0	£0	£0	£0	£0
Food	£0	£0	£409,828	£409,828	£409,828	£409,828	£409,828
Residual	£0	£0	£0	£0	£1,660,064	£1,660,064	£0

It should be noted that it has been assumed that food waste containers will need to be supplied to all standard households. It is accepted that there are likely to be a significant number of food containers still present and usable in residents' homes, from the recently suspended Council food waste service. However, it is difficult to establish how many are still present and the specific locations of these, therefore a worst-case scenario of providing new containers to all properties has been modelled.

It should also be noted that these costs are solely for the containers and do not include any delivery or shipping of the containers.

Table 31: Containerisation - Annual Replacement Costs

	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Recycling	£29,726	£29,726	£101,689	£29,726	£29,726	£101,689	£29,726
Garden	£7,431	£7,431	£7,431	£7,431	£7,431	£7,431	£7,431
Food	£0	£98,359	£98,359	£98,359	£98,359	£98,359	£98,359
Residual	£29,726	£29,726	£29,726	£29,726	£190,907	£190,907	£29,726
Total	£66,882	£165,241	£237,205	£165,241	£326,423	£398,387	£165,241

It should also be noted that for Options 4 and 5, the Council may receive an income from the sale of the old 240l residual bins when they are replaced by new 180l bins. However, following a number of conversations the Council had with its supplier, there are uncertainties as to the extent this service would be supplied e.g. would bins need to be collected and cleaned by the Council prior to collection etc. A certain level of income may be achieved from the sale of the old bins, however due to the variables and uncertainties surrounding this, a figure has not been included in the overall costs. It should be noted that any income achieved would be a one-off figure and would not be included in annual revenue costs across the life of a service.

6 Annual Gross Collection Costs

The cost of waste and recycling collections is a significant consideration for local authorities when determining their future collection system configuration.

KAT and Ricardo's in-house cost models can help in these considerations by detailing the relative and comparative costs and performance of the different service scenarios[9].

The annual collection cost of each Option, as modelled through KAT and refined through Ricardo's in-house cost modelling tool, is shown in Table 32. This includes the cost of:

- Front-line operatives
- Supervision
- Overheads (at an assumed 10% of the current overall Street Scene budget for all Options)
- Annualised container costs (including the depreciated purchase of new containers, where necessary, and replacement containers at a 4% annual replacement rate for boxes and food waste containers, 1.5% for wheelie bins)
- Vehicle costs (depreciated over 5 years)
- Vehicle standing costs, running costs and fuel.

It should be noted that the collection costs do not include costs or income related to disposal.

Error! Reference source not found. shows a comparison of the collection cost of each Option, as well as indicating the difference from the cost of the Baseline (costs above the Baseline are shown in red, those below are shown as a negative figure).

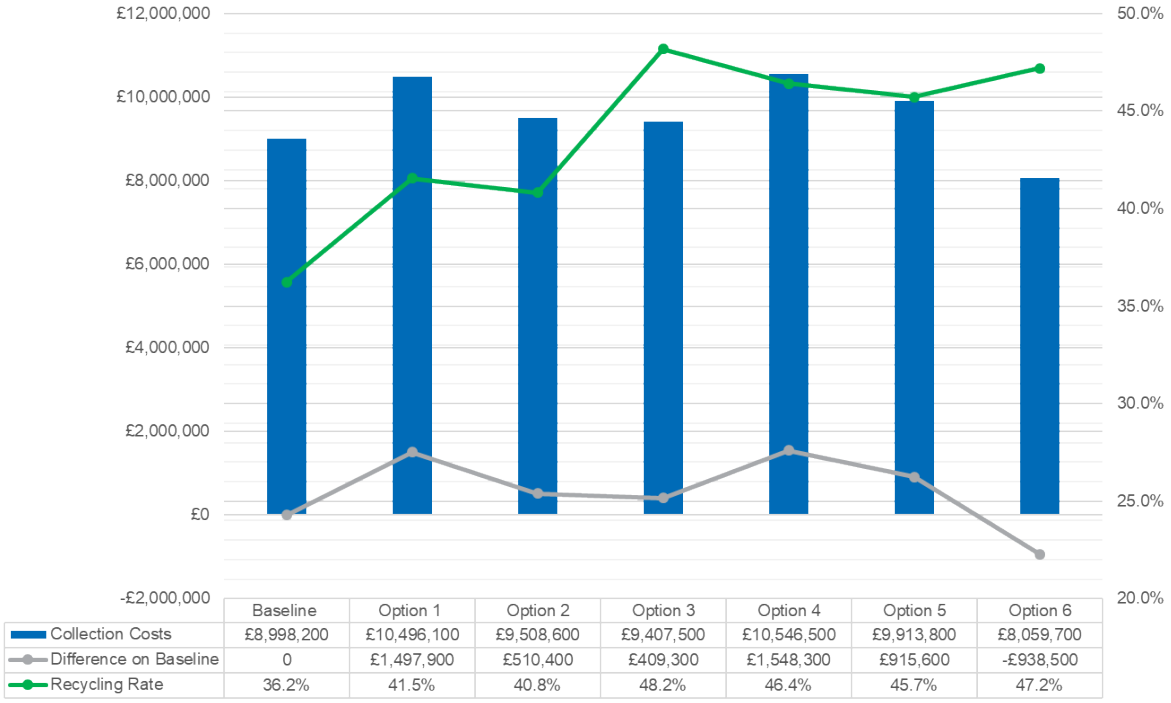
[9] However, the modelling only covers certain cost elements and should not be used for budgetary purposes without considering additional in depth financial appraisal

Table 32: Annual Collection Cost

	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Annual Gross cost (£M)	£8,998,200	£10,496,100	£9,508,600	£9,407,500	£10,546,500	£9,913,800	£8,059,700
Difference on Baseline	***n/a***	***£1,497,900***	***£510,400***	***£409,300***	***£1,548,300***	***£915,600***	***-£938,500***
Ranking of Gross Service Cost	n/a	5	3	2	6	4	**1**

The annual collection costs as detailed in **Error! Reference source not found.** are also shown in Figure 8.

Figure 8: Annual Collection Costs and Recycling Rate



7 Treatment and Disposal

For the purposes of modelling, the NWLA '2018/19 (current pricing - revised at 4th NLWA budget review)' have been used. These are shown in **Error! Reference source not found.**.

Table 33: NLWA Disposal Prices

	2018/19	2018/19 (current pricing - revised at 4th NLWA budget review)	2019/20
Residual	£89.47	£89.44	£95.95
Dry recyclable	£56.01	£67.06	£66.70
Food	£84.71	£32.44	£33.94

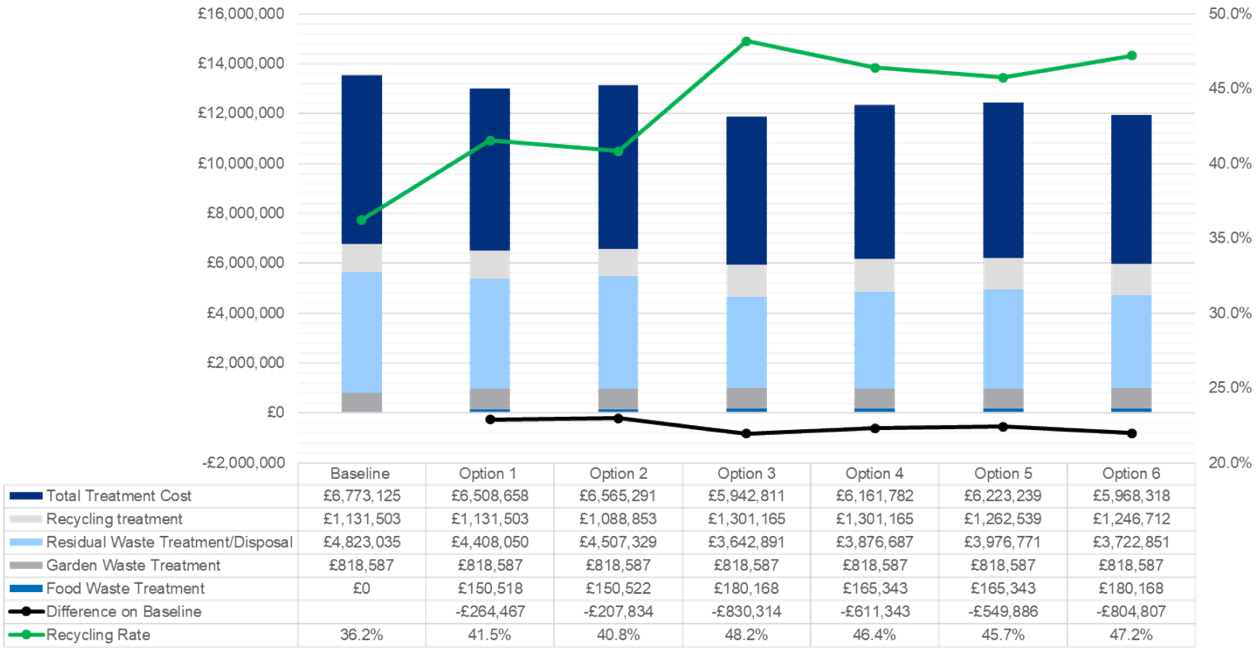
Green	£56.66	£55.52	£57.28

It should be noted that these are interim prices for the purposes of modelling. There is currently some uncertainty regarding what costs the Council will be required to pay, particularly with regard to the updating of the levy payments the Council currently pays to finance the North London Heat and Power Project's Energy from Waste (EfW) facility. Further detail on the potential future costs is included at section 12.3.

Table 34: Disposal Costs per Option

	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Food Waste	£0	£150,518	£150,522	£180,168	£165,343	£165,343	£180,168
Garden Waste	£818,587	£818,587	£818,587	£818,587	£818,587	£818,587	£818,587
Residual Waste	£4,823,035	£4,408,050	£4,507,329	£3,642,891	£3,876,687	£3,976,771	£3,722,851
Recycling Treatment	£1,131,503	£1,131,503	£1,088,853	£1,301,165	£1,301,165	£1,262,539	£1,246,712
Total Treatment	**£6,773,125**	**£6,508,658**	**£6,565,291**	**£5,942,811**	**£6,161,782**	**£6,223,239**	**£5,968,318**

Figure 9: Treatment Costs



Key observations:

- Garden waste remains consistent across all options.
- Option 3 is the least expensive as it generates the lowest residual waste
- Option 2 is the most expensive due to retaining weekly 240l residual collections and the more complicated alternate weekly recycling service reducing the amount of recycling yielded, some of which remains in the residual stream.
- Option 3's lowest cost also correlates with having the highest recycling rate.

- The tonnages of each material stream only represent the requirements for collections from standard kerbside properties.

8 Options Appraisal – Approach

A two-phased approach has been designed to evaluate the performance based on a scored then weighted approach. Four overarching criteria with twelve sub-criteria were assessed utilising a scoring system ranking the Options from 0 – 6, indicated in Figure 10:

Figure 10: Scoring System

Rating	Score	Descriptor
	5 - 6	Options that perform well will be highlighted green and given a score between 5 and 6
	3 - 4	Options that perform moderately will be highlighted amber and given a score between 3 and 4
	0 - 2	Options that perform poorly will be highlighted red and given a score between 0 and 2

The preliminary scores have generated a weighted score for each Option with regards to its performance against the Council's priorities and targets for future service provision. The scoring has been undertaken in line with the rationale set out in **Error! Reference source not found.**.

Table 35: Scoring Criteria

Criteria	Sub criteria	Scoring mechanism	% Weight
Environmental Impact	Household recycling rate (%)	Based on deviation from highest recycling rate	10%
	Household reduction in residual waste	Based on deviation from lowest kg per head/household	13%
	Contamination Potential	Comingled schemes have a higher contamination potential than twin-stream or multi-stream. 1 for high risk (comingled); 3 for moderate risk (twin-stream)	3%
Operational deliverability / flexibility / future proofing	Degree to which service can be replicated into flats	Simpler schemes such as comingled are easier to replicate for flats, twin-stream schemes are more complex. Please note this is about existing properties and not any housing growth the Borough expects to see 3 can replicate with modifications; 6 easy to replicate with small modification; 9 - no modification needed	4%
	Type of vehicle / Ease of maintenance	RCVs are easier to maintain and run compared to twin-packs 3 for twin pack; 6 for RCVs	8%
	Manual Handling	Wheeled bins are safer to	5%

Criteria	Sub criteria	Scoring mechanism	% Weight
		manoeuvre than containers picked up from the ground 3 for twin stream, 6 for comingled	
Public acceptability	Collection frequency of residual	3 for fortnightly; 6 for weekly	15%
	Number of containers for setting out for any stream	3 for two containers, 6 for one	5%
	Degree of service change to communicate	A service change similar to the current service would be a simple change, however adding containers or reducing frequency would be considered a moderate change 3 for moderate service changes; 6 for service similar to current	2%
Cost	Capital / implementation costs	This covers the capital cost for vehicles and containers but does not include any changes to infrastructure. All options have been assessed on the basis of new vehicles provided for the scheme Based on deviation from lowest cost (vehicles, containers)	10%
	Ongoing revenue costs for operation of service	Operational costs, including staffing Based on deviation from lowest cost	15%
	Disposal costs	Based on deviation from lowest cost	10%
			100%

Error! Reference source not found. details the evaluation by criteria and Option. Under each Option column ‘R’ and ‘W’ refers to ‘Raw Score’ and ‘Weighted Score’ respectively.

Table 36: Options Appraisal Summary Analysis

Criteria	Sub criteria	Scoring mechanism	% Weight	Baseline		Option 1		Option 2		Option 3		Option 4		Option 5		Option 6	
				R	W	R	W	R	W	R	W	R	W	R	W	R	W
Environmental impact	Household recycling rate (%)	Based on deviation from highest recycling rate	10%	0.00	0.00	2.67	0.27	2.31	0.23	6.00	0.60	5.11	0.51	4.77	0.48	5.51	0.55
	Household reduction in residual waste	Based on deviation from lowest kg per head/household	13%	0.00	0.00	2.15	0.28	1.86	0.24	6.00	0.78	4.79	0.62	4.52	0.59	5.62	0.73
	Contamination Potential	1 for high risk (comingled); 3 for moderate risk (twin-stream)	3%	1.00	0.03	1.00	0.03	3.00	0.09	1.00	0.03	1.00	0.03	3.00	0.09	1.00	0.03
Operational deliverability / flexibility / future proofing	Degree to which service can be replicated into flats	3 can replicate with modifications; 6 easy to replicate with small modification; 9 - no modification needed	4%	9.00	0.36	6.00	0.24	3.00	0.12	6.00	0.24	6.00	0.24	3.00	0.12	6.00	0.24
	Type of vehicle / Ease of maintenance	3 for twin pack; 6 for RCVs	8%	6.00	0.48	6.00	0.48	3.00	0.24	6.00	0.48	6.00	0.48	3.00	0.24	6.00	0.48
	Manual Handling	3 for twin stream, 6 for comingled	5%	6.00	0.30	6.00	0.30	3.00	0.15	6.00	0.30	6.00	0.30	3.00	0.15	6.00	0.30
Public acceptability	Collection frequency of residual	3 for fortnightly; 6 for weekly	15%	6.00	0.90	6.00	0.90	6.00	0.90	3.00	0.45	6.00	0.90	6.00	0.90	3.00	0.45
	Number of containers for setting out for any stream	3 for two containers, 6 for one	5%	6.00	0.30	6.00	0.30	2.00	0.10	6.00	0.30	6.00	0.30	3.00	0.15	6.00	0.30
	Degree of service change to communicate	3 for moderate service changes; 6 for service similar to current	2%	6.00	0.12	6.00	0.12	3.00	0.06	6.00	0.12	6.00	0.12	3.00	0.06	6.00	0.12
Cost	Capital / implementation costs	Based on deviation from lowest cost (vehicles, containers)	10%	8.47	0.85	1.62	0.16	1.75	0.18	5.72	0.57	0.00	0.00	0.75	0.07	9.00	0.90
	Ongoing revenue costs for operation of service	Operational costs, including staffing	15%	3.74	0.56	0.12	0.02	2.50	0.38	2.75	0.41	0.00	0.00	1.53	0.23	6.00	0.90
	Disposal costs	Based on deviation from lowest cost	10%	0.00	0.00	1.91	0.19	1.50	0.15	6.00	0.60	4.42	0.44	3.97	0.40	5.82	0.58
		Total	100%	52.2	3.9	45.5	3.3	32.9	2.8	60.5	4.9	51.3	3.9	39.5	3.5	65.9	5.6
		Total Raw Score		52.2		45.5		32.9		60.5		51.3		39.5		65.9	
		Total Weighted Score			3.9		3.3		2.8		4.9		3.9		3.5		5.6
		RANKING raw score		3		5		7		2		4		6		1	
		RANKING weighted			4		6		7		2		3		5		1

Table 37: Summary of Results

	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Raw Score	3	5	7	2	4	6	1
Weighted Score	4	6	7	2	3	5	1

9 Chargeable Garden Waste

Following the initial modelling of the Options, the Council requested the impact of introducing chargeable garden waste to be modelled against the Options. To provide an indication of how the garden waste tonnage is likely to change following the introduction of a chargeable service, an assessment of similar Rurality 2 authorities who had introduced a chargeable service was undertaken using our in-house benchmarking tool and tonnage data from WasteDataFlow. **Error! Reference source not found.** below shows which authorities were assessed on the basis of available information and the date they introduced a chargeable garden service.

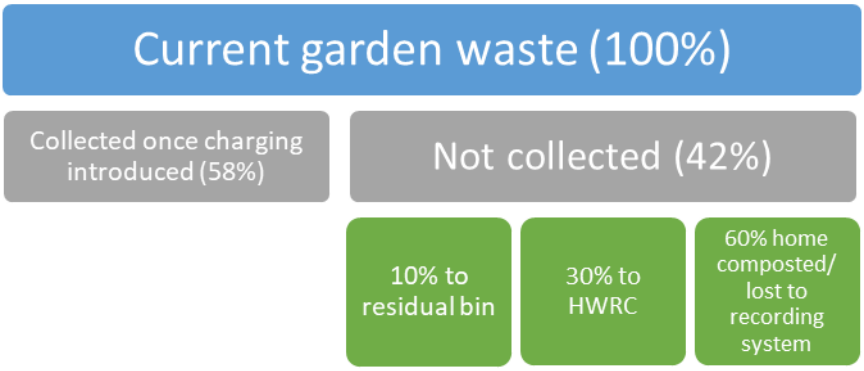
Table 38: Comparator Authorities

Authority	Date of Introduction
London Borough of Croydon	2016
London Borough of Ealing	2012
Oxford City Council	2011

Tonnage data for each authority was then examined to establish the impact on the arisings of garden waste pre and post introduction of service. Where the month of the introduction of the scheme was unknown, it was assumed to be from the start of the financial year (April). The three Rurality 2 authorities for which data was available indicated that on average the garden waste tonnage had reduced by 41.95% (42%) following the introduction of a chargeable service. This reduction of 42% has been applied to the Council's tonnage for the purposes of modelling, resulting in the original garden tonnage of 14,744t for all options reducing to 8,558t for all options.

Based on evidence provided by numerous service options appraisals conducted by Ricardo, Figure 11 shows how garden waste is predicted to be transferred to other collection and treatment methods once charging is introduced.

Figure 11: Garden Waste Transfer Diagram



Although 10% of the garden waste tonnage no longer collected being diverted to the residual waste bin may seem high, it should be noted that 42% of the existing 14,744t of garden waste is 6,186t. 10% of this equates to ~620t per annum, which is ~0.01% of the total residual tonnage for standard households.

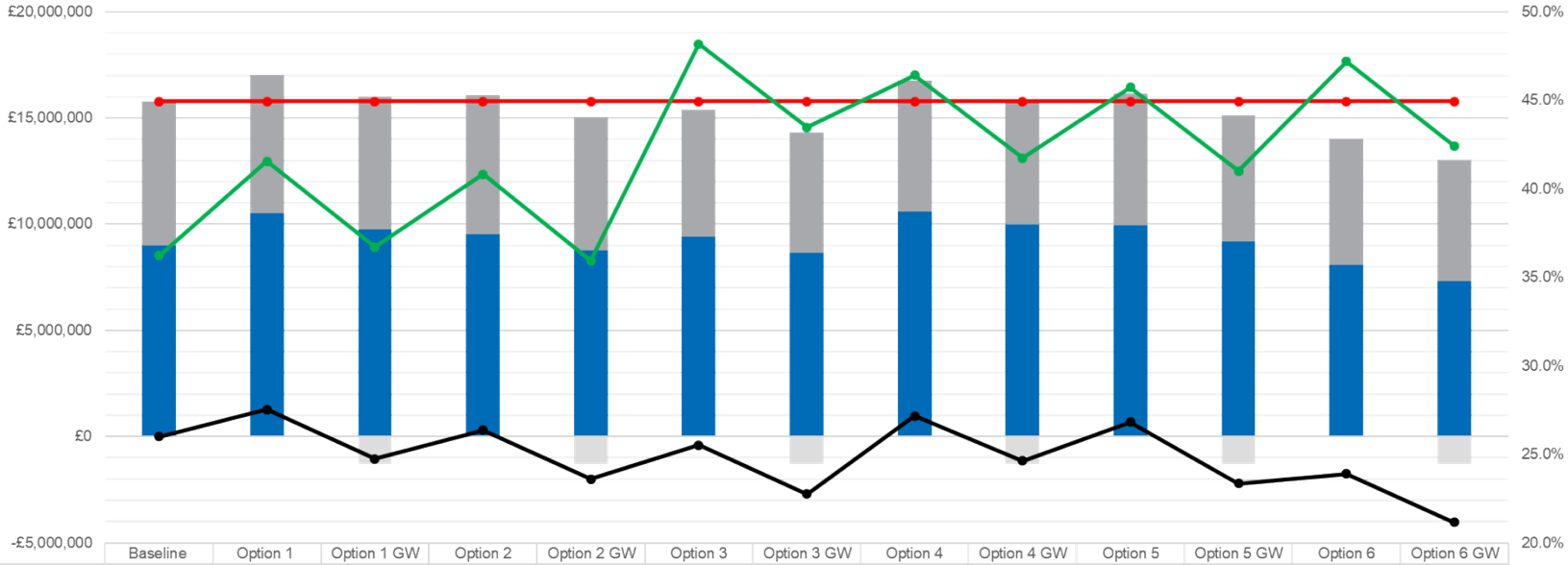
The modelling has shown that this can be easily absorbed into the residual service with no detrimental effects to the operation and associated costs.

Based on information provided within the Council's own assessment of chargeable garden waste conducted in 2016 ('Chargeable Garden Waste Collection Service Outline Business Case (OBC)'), and the more recent information contained within the Environment Committee November 2018 (Business Planning 2019 – 2024) report, we have modelled two scenarios:

- The first assumes a subscription rate of 35% of the 103,754 standard households in the Borough. This equates to 36,314 households paying for a garden waste service, which we have assumed will be £35 per year. As all service users will be paying for the service, we have assumed a high set-out rate of 85%.
- The second assumes a subscription rate of 14% of the 103,754 standard households in the Borough. This equates to 14,526 households paying for a garden waste service, which we have assumed will be £50 per year. As all service users will be paying a greater sum than the first scenario for the service, we have assumed a higher set-out rate of 90%.

All other assumptions within the models have stayed the same. Figure 12 and Figure 13 shows the comparison of all six Options with and without chargeable garden waste compared to the Baseline for both scenarios.

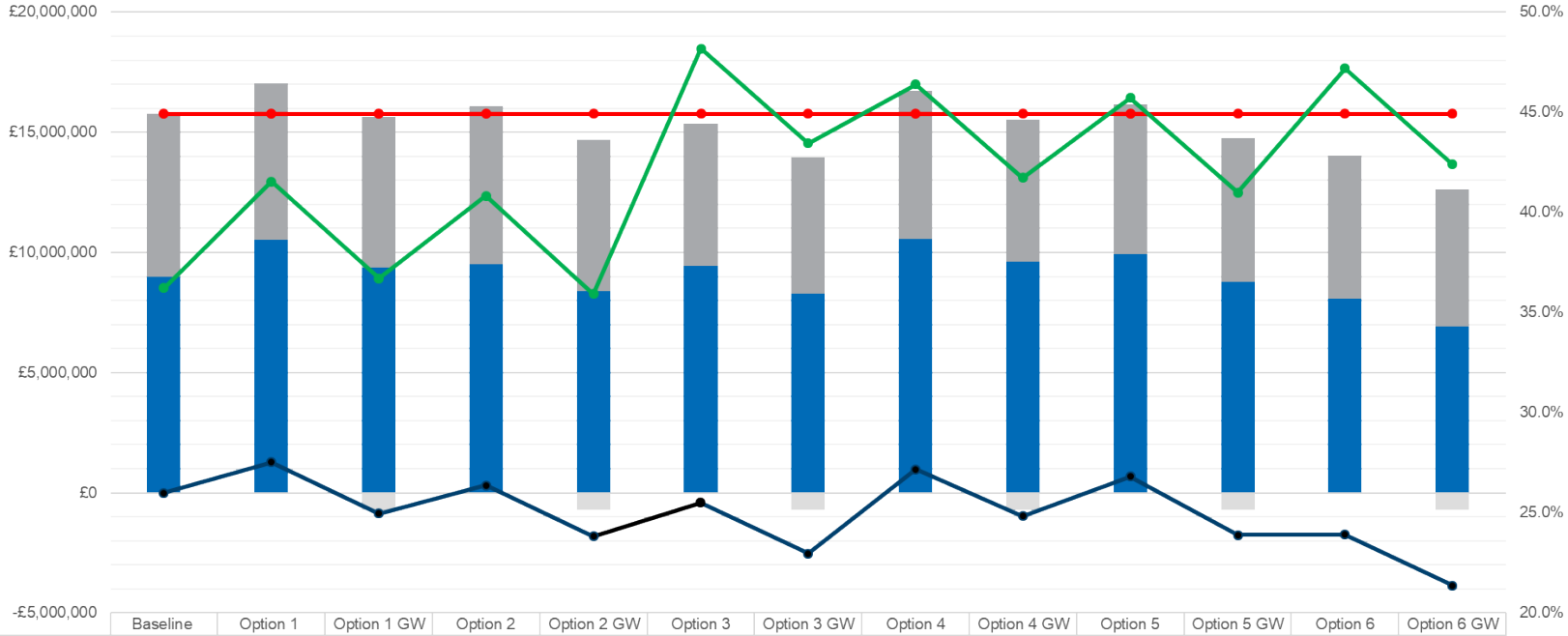
Figure 12: Chargeable Garden Waste Option Comparison - £35 Subscription Fee



	Baseline	Option 1	Option 1 GW	Option 2	Option 2 GW	Option 3	Option 3 GW	Option 4	Option 4 GW	Option 5	Option 5 GW	Option 6	Option 6 GW
Treatment Costs	£6,773,125	£6,508,658	£6,242,041	£6,565,291	£6,298,673	£5,942,811	£5,678,608	£6,161,782	£5,894,538	£6,223,239	£5,955,995	£5,968,318	£5,704,294
Collection Costs	£8,998,200	£10,496,100	£9,737,700	£9,508,600	£8,750,214	£9,407,500	£8,649,062	£10,546,500	£9,975,014	£9,913,800	£9,155,394	£8,059,700	£7,301,335
Income from Garden Waste	£0	£0	-£1,270,990	£0	-£1,270,990	£0	-£1,270,990	£0	-£1,270,990	£0	-£1,270,990	£0	-£1,270,990
Additional Depot Space Lease Costs	£0	£31,000	£19,726	£8,454	£0	£16,908	£5,636	£31,000	£22,544	£19,726	£8,454	£0	£0
Total Net costs	£15,771,325	£17,035,786	£14,728,516	£16,082,347	£13,777,897	£15,367,169	£13,062,316	£16,739,244	£14,621,106	£16,447,258	£13,558,342	£14,028,041	£11,734,639
Baseline Benchmark	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325
Difference on Baseline	£0	£1,264,461	-£1,042,809	£311,022	-£1,993,428	-£404,156	-£2,709,009	£967,919	-£1,150,219	£675,933	-£2,212,983	-£1,743,284	-£4,036,686
Recycling Rate (inc. Garden and Food Where Applicable)	36.2%	41.5%	36.7%	40.8%	35.9%	48.2%	43.5%	46.4%	41.7%	45.7%	41.0%	47.2%	42.4%

N.B. It should be noted that the 'Additional Depot Space Lease Costs' are not visible in the graph due to the low figures compared to the other totals, however these have been accounted for in overall costs where applicable

Figure 13: Chargeable Garden Waste Option Comparison - £50 Subscription Fee



	Baseline	Option 1	Option 1 GW	Option 2	Option 2 GW	Option 3	Option 3 GW	Option 4	Option 4 GW	Option 5	Option 5 GW	Option 6	Option 6 GW
Treatment Costs	£6,773,125	£6,508,658	£6,242,041	£6,565,291	£6,298,673	£5,942,811	£5,678,608	£6,161,782	£5,894,538	£6,223,239	£5,955,995	£5,968,318	£5,704,294
Collection Costs	£8,998,200	£10,496,100	£9,371,828	£9,508,600	£8,384,303	£9,407,500	£8,283,150	£10,546,500	£9,609,103	£9,913,800	£8,789,482	£8,059,700	£6,935,424
Income from Garden Waste	£0	£0	-£726,300	£0	-£726,300	£0	-£726,300	£0	-£726,300	£0	-£726,300	£0	-£726,300
Additional Depot Space Lease Costs	£0	£31,000	£14,090	£8,454	£0	£16,908	£0	£31,000	£16,908	£19,726	£2,818	£0	£0
Total Net costs	£15,771,325	£17,035,786	£14,901,659	£16,082,347	£13,956,675	£15,367,169	£13,235,459	£16,739,244	£14,794,249	£16,447,258	£14,021,996	£14,028,041	£11,913,418
Baseline Benchmark	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325
Difference on Baseline	£0	£1,264,461	-£869,666	£311,022	-£1,814,650	-£404,156	-£2,535,866	£967,919	-£977,076	£675,933	-£1,749,330	-£1,743,284	-£3,857,908
Recycling Rate (inc. Garden and Food Where Applicable)	36.2%	41.5%	36.7%	40.8%	35.9%	48.2%	43.5%	46.4%	41.7%	45.7%	41.0%	47.2%	42.4%

N.B. It should be noted that the 'Additional Depot Space Lease Costs' are not visible in the graph due to the low figures compared to the other totals, however these have been accounted for in overall costs where applicable

When the £35 chargeable garden waste service is applied to the Options, the number of garden waste vehicles and associated crew reduces by four, resulting in annual collection cost savings of £758,000. For the £50 scenario, this is reduced by six (predominantly due to the conservative subscription rate of 14%), resulting in annual collection cost savings of ~£1.1m. For both scenarios, all other aspects of the collection service in all options remains the same, as the proportion of garden waste diverted to the residual stream (**Error! Reference source not found.**) is low enough for each residual service to absorb without needing additional vehicles or each vehicle requiring an additional tip, which would have increased fuel costs.

The garden waste treatment costs have reduced by £260,000 per annum in all Options due to the reduced amount of garden waste tonnage collected, although there are slightly increased residual treatment costs due to the partial diversion of garden waste to the residual stream. In options where depot space leasing costs are present, these costs reduce due to the lower number of garden waste vehicles required.

The assumed annual income from the service equates to £1,270,990, with 36,314 households paying a yearly subscription of £35. For the £50 scenario, this decreases to £726,300 as although the annual subscription cost is higher, this is outweighed by the significantly lower number of householders subscribing. It should be noted that these sums are solely the income and do not account for any administration costs or similar.

The modelling indicates that the introduction of a chargeable garden waste service would save the Council in the region of £2.3m per annum for the £35 scenario, and approximately £2.1m per annum in the £50 scenario. The savings in both scenarios are as a result of the reduced vehicles and treatment costs, bolstered by income from the service. However, implementing a chargeable garden waste service would result in a reduction in recycling rate of approximately 4.8%, regardless of which Option the service was applied to.

10 Communal Properties

An assessment of the communal properties within the Borough has been undertaken as a discrete exercise from the main modelling. This is due to the KAT tool being designed to model standard property collections only. There are numerous difficulties in modelling communal properties due to the variations in number of properties within a block of flats, the density of communal properties within the borough etc, and therefore this exercise is intended to provide an estimate of the requirements to provide a service to the Borough's communal population based on several assumptions. It was agreed with the Council that communal properties would only be assessed against Option 1, in order to minimise disruption and ensure simplicity of service, whilst still meeting the aspiration of the London Environment Strategy to provide a food waste service to all property types.

Table 39: Standard and Communal Properties

Standard Properties	Communal Properties	Total
103,754	44,466	148,220
70%	30%	100%

For this assessment, 44,466 properties were examined, using the information on material arisings from communal properties, as indicated below. Due to the property type, for the purposes of this assessment it is assumed that no garden waste arises from communal properties. It should be noted that the information on residual and dry recycling yields has been provided by Resource London as part of an ongoing communal project involving a very small number of flatted properties and is only being used as a rough approximation of expected yields. It should also be noted that the food yield estimate has been

provided by WRAP separately to the Resource London data. The food waste tonnage has therefore been removed from the residual tonnage to reflect the diversion from the residual stream.

Table 40: Communal Material Yields

Material	Yield hh/kg/wk	Tonnes/pa
Dry recycling	1.69	3,907
Food	0.5	1,156
Residual	9.29	21,481
Residual adjusted for food waste		*20,325*

For dry recycling, it is reasonable to expect a higher level of contamination from communal properties than standard households due to various factors including lack of 'ownership' of bins. For the purposes of this exercise, we have assumed a contamination rate of 15.1% in line with the analysis of flats undertaken by MEL on behalf of the Council in 2014/15. Set-out rates and participation analysis are not required as it is assumed that none of the communal properties are required to put any bins out for collection and they will be emptied regardless.

The numbers of vehicles required is difficult to establish due to the variables in terms of distribution of communal properties and associated travel time, number of bins at each site etc. For the purposes of this assessment, it is assumed that the number of vehicles remaining between the total current fleet and the modelled fleet is sufficient to provide the dry recycling and residual service, with **Error! Reference source not found.** indicating the assumptions for the Baseline as part of the main modelling exercise.

Table 41: Vehicles (Main Modelling)

	Residual Waste	Co-mingled Recycling	Garden Waste
Total Current Fleet (current working hours)	18	18	7
Modelled Vehicles (current working hours)	12.5[10]	12.3[11]	6.7[12]
Modelled Vehicles (eight-hour working day)	***16.6[13]***	***15.6[14]***	***7.5[15]***

There are currently five vehicles 'spare' under the current working hours for both residual and dry recycling. However, the 13 vehicles used in the main modelling increased by 25% and 21% for residual waste and recycling respectively to accommodate the reduced working hours. It is a reasonable assumption that this increase will need to be applied to the five remaining vehicles responsible for servicing communal properties.

[10] Rounded up to 13 for costing purposes
[11] Rounded up to 13 for costing purposes
[12] Rounded up to 7 for costing purposes
[13] Rounded up to 17 for costing purposes
[14] Rounded up to 16 for costing purposes
[15] Rounded up to 8 for costing purposes

Table 42: Communal Vehicle Assumptions

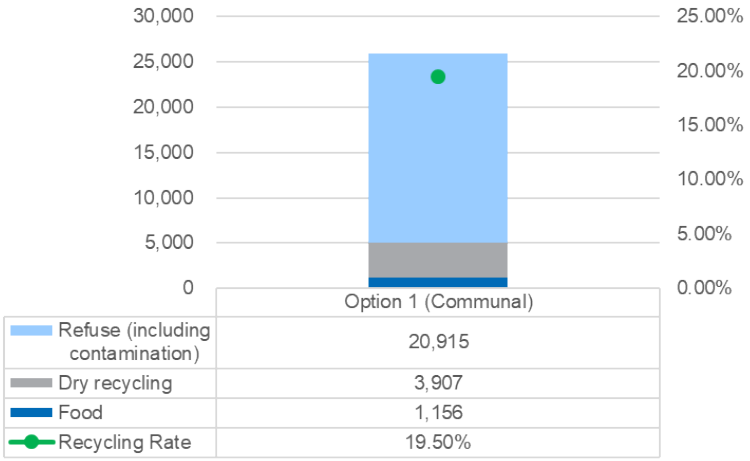
	Residual Waste	Co-mingled Recycling
Communal Vehicles (current working hours)	5	5
Modelled Vehicles (eight-hour working day)	6.25 (7)	6.05 (6)

Although increasing the five dry recycling vehicles by 21% results in a figure of 6.05 vehicles, this has been reduced to six whole vehicles as it is reasonable to assume the additional 5% vehicle requirement could be absorbed by the remaining recycling fleet, reducing the potential cost by one vehicle and crew.

As there are no current food waste vehicles in the fleet, an assessment has been made of their requirement for communal food waste based on the food waste requirements for Option 1. The average load per day per food waste vehicle in Option 1 is ~1.6t. However, as these are kerbside rounds, they will be required to collect all food caddies presented on their routes, with a relatively significant amount of time taken to collect small amounts of food per collection.

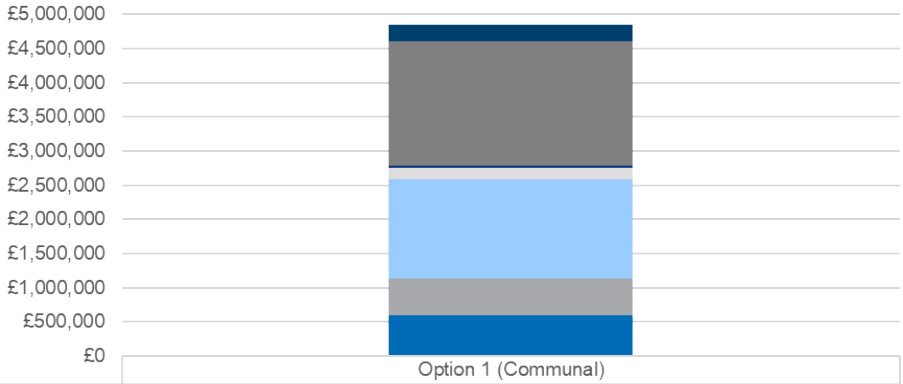
With communal collections, the food waste will be concentrated in larger containers resulting in greater quantities collected per pick up, with significantly less time spent stopping between pick-ups. Using the estimated food waste yield of 1,156t per annum, this equates to 4.45t per day requiring collection. It is a reasonable assumption that, due to the greater ease in which communal food waste can be collected, an individual vehicle can collect a greater tonnage per day than a kerbside round. It is therefore a reasonable to assume that two food waste vehicles will be capable of providing a collection service to the 44,466 communal properties in the Borough. **Error! Reference source not found.** below shows the estimated split of communal tonnage and associated recycling rate:

Figure 14: Estimated Communal Tonnage



Based on these assumptions, Figure 15 below shows the estimated costs to provide an Option 1 service to the Council's communal properties. All other assumptions regarding costs, staffing requirements etc. have remained the same, however the overhead figure of £760,369 and the supervision figure of £482,481 have been removed as including these would be a duplication with the main modelling (as both overheads and supervision are fixed regardless) and provide an imbalanced estimate.

Figure 15: Estimated Communal Service Cost



	Option 1 (Communal)
Recycling treatment	£237,616
Residual Waste	£1,817,868
Food Waste	£37,501
Container costs	£165,241
Crew costs	£1,457,386
Vehicle capital costs	£528,000
Vehicle operating costs	£604,862
Total	£4,848,474

11 Environmental Assessment

To assess the environmental impact of the service, the Waste and Resources Assessment Tool for the Environment (WRATE) used to assess the highest-ranking scenario, Option 6 and the Baseline. WRATE is a simplified life cycle assessment (LCA) model, originally developed by the Environment Agency with support from Defra, which allows users to quantify and compare the relative environmental burdens of equivalent integrated waste management systems.

WRATE calculates the potential impacts arising from all processes in the waste management system including the collection, transportation, transfer, recycling, treatment and disposal of materials. The model takes account of the construction and operation of infrastructure and vehicles, and offsets this burden against the avoided burdens associated with materials and energy recovery. It accounts for all inputs of waste, energy and materials, and all outputs of energy, process residues, materials and emissions.

11.1 Scenarios and Assumptions

The following tables and figure show the tonnage, composition and scenario modelled within the WRATE tool. The residual waste composition varies depending on the level of material diverted by dry recycling, garden and food waste collections.

Table 43: Waste Composition

Material Category	Overall Composition (weight %)	Recycling Composition (weight %)	Garden Composition (weight %)	Food Composition (weight %)
Newspaper and magazines	9.64%	33.76%	0.00%	0.00%
Other paper	7.60%	0%	0.00%	0.00%
Corrugated card/Tetrapaks	1.90%	0.86%	0.00%	0.00%
Non-corrugated card	3.00%	19.87%	0.00%	0.00%
Plastic film	4.55%	0.00%	0.00%	0.00%
Plastic bottles	2.20%	6.62%	0.00%	0.00%
Plastic – other	3.12%	4.27%	0.00%	0.00%
Mixed Glass	6.64%	30.24%	0.00%	0.00%
Steel cans	1.44%	1.85%	0.00%	0.00%
Aluminium cans	0.29%	2.53%	0.00%	0.00%
Foil	0.43%	0.00%	0.00%	0.00%
Textiles	2.69%	0.00%	0.00%	0.00%
Soil and other organic	3.74%	0.00%	0.00%	0.00%
Food	21.70%	0.00%	0.00%	100.00%
Garden	15.45%	0.00%	100.00%	0.00%
Other	15.61%	0.00%	0.00%	0.00%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Table 44: Tonnage

Waste stream	Baseline	Option 6
Dry recycling	16,873	18,591
Garden waste	14,744	14,744
Food waste		5,554
Residual	55,646	43,520
Total	**87,263**	**82,409**

Figure 16: WRATE Scenario – Baseline

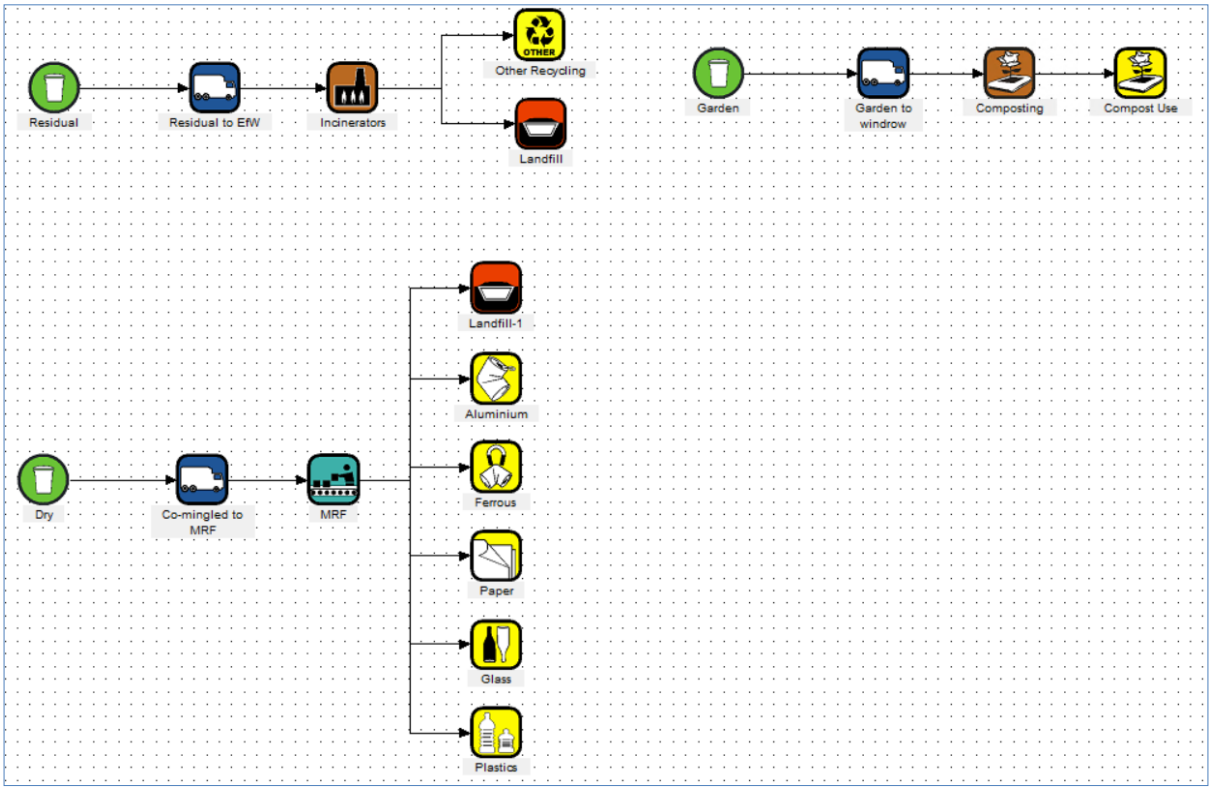
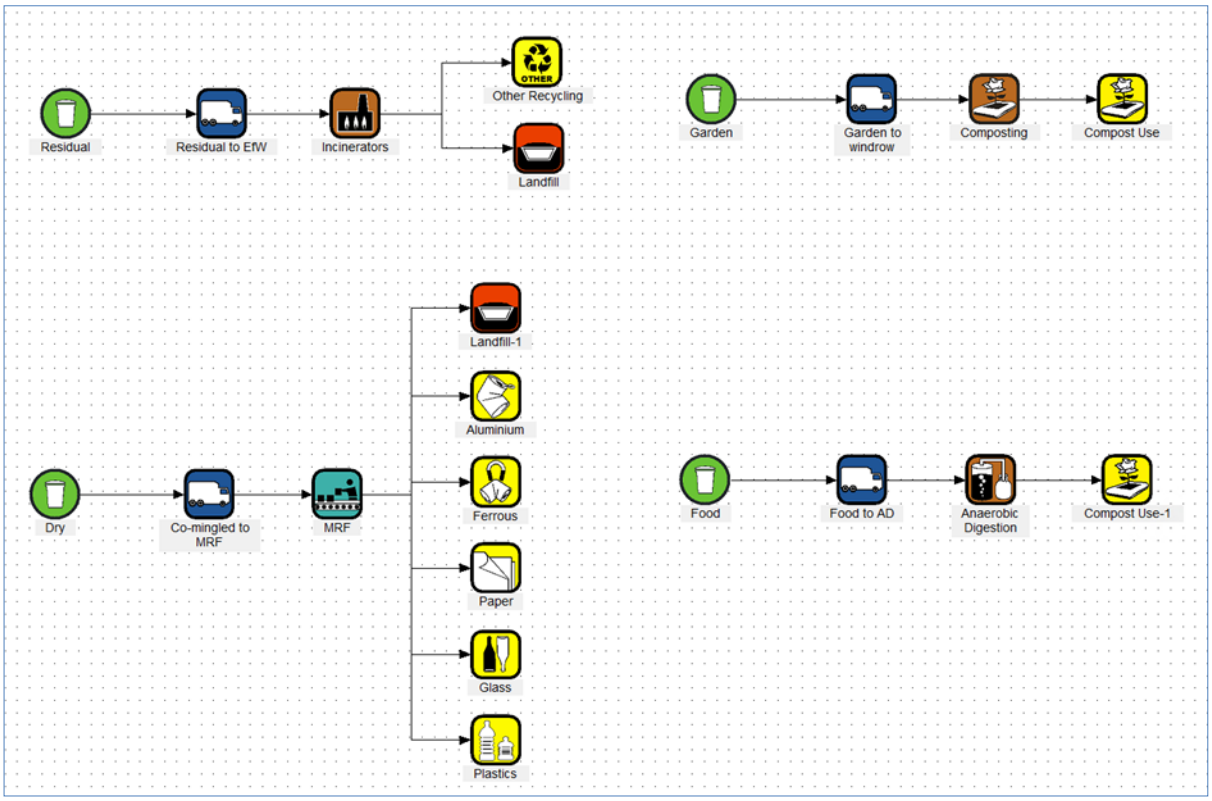


Figure 17: WRATE Scenario – Option 6[16]



[16] It should be noted that 'Compost Use – 1' is for agricultural use.

The following default processes have been used as proxies for Council disposal facilities:

- Residual – Billingham large EfW
- Dry recycling – MRF with IR plastic sorting
- Food waste – Dranco large AD
- Garden waste - Windrow composting

The electricity mix used is UK 2019 and the transport assumptions are provided in the following table. Table 45 shows the travelling distances per annum for the Baseline and Option 6, this includes collection and onward transport to the disposal/treatment sites. Option 6 has lower travel distance for the three main collections due to reduced frequency of collections but does have the addition of a food waste collection.

Table 45: Transport Assumptions

Waste stream	Total km per year Baseline	Total km per year Option 6	Vehicle type
Residual	433,910	259,426	26t RCV
Recycling	394,996	242,688	26t RCV
Garden	210,888	210,888	26t RCV
Food	0	202,519	7.5t LGV*

** Used as proxy for 7.5t RCV*

11.2 Results

WRATE can generate results for several impact categories, specifically climate change (Global Warming Potential - GWP), human toxicity, acidification, eutrophication potential, freshwater aquatic ecotoxicity and depletion of abiotic resources. For the purposes of this assessment, we have focused on reporting against the climate change (GWP 100) impact, but also provided the results for the other impacts.

The following table presents the headline results: negative values indicate a net offset i.e. the greater the negative value the more preferable the solution from a sustainability perspective.

Overall the results indicate that Option 6 performs better in three of the categories and the Baseline in three categories. However, overall the results are relatively similar.

A key point is that Option 6 is managing less waste as a degree of waste minimisation has occurred due to reducing the collection frequency. **This reduced tonnage is not considered in the WRATE analysis but if it was, it would potentially deliver some further improvement for option 6.** Reducing waste and thus the energy and effort of extracting materials and making products has a very significant environmental benefit.

Table 46: WRATE Impact Assessment Results for the Baseline and Option 6[17]

Impact Assessment	Unit	Baseline	Option 6	Best performing option
climate change: GWP 100a	kg CO2-Eq	-10,933,947	-11,359,063	Option 6
acidification potential: average European	kg SO2-Eq	-10,127	-20,123	Option 6
eutrophication potential: generic	kg PO4-Eq	12,851	11,599	Option 6
freshwater aquatic ecotoxicity: FAETP infinite	kg 1,4-DCB-Eq	-3,927,831	-3,719,407	Baseline
human toxicity: HTP infinite	kg 1,4-DCB-Eq	-43,494,351	-42,048,874	Baseline
resources: depletion of abiotic resources	kg antimony-Eq	-281,794	-265,274	Baseline

It should be noted that these figures are the result of all waste streams being assessed in both the Baseline and Option 6.

11.2.1 Climate Change Results

GWP as a measure of greenhouse gas emissions from alternative equivalent waste management systems is widely accepted as being the most important sustainability indicator, for example GWP with a time horizon of 100 years is used in the Kyoto Protocol. In line with 2006 IPCC (Intergovernmental Panel on Climate Change) "Guidelines for National Greenhouse Gas Inventories Volume 5 Waste", biogenic CO2 emissions are excluded from WRATE GWP calculations.

Figure 18: Climate Change Results

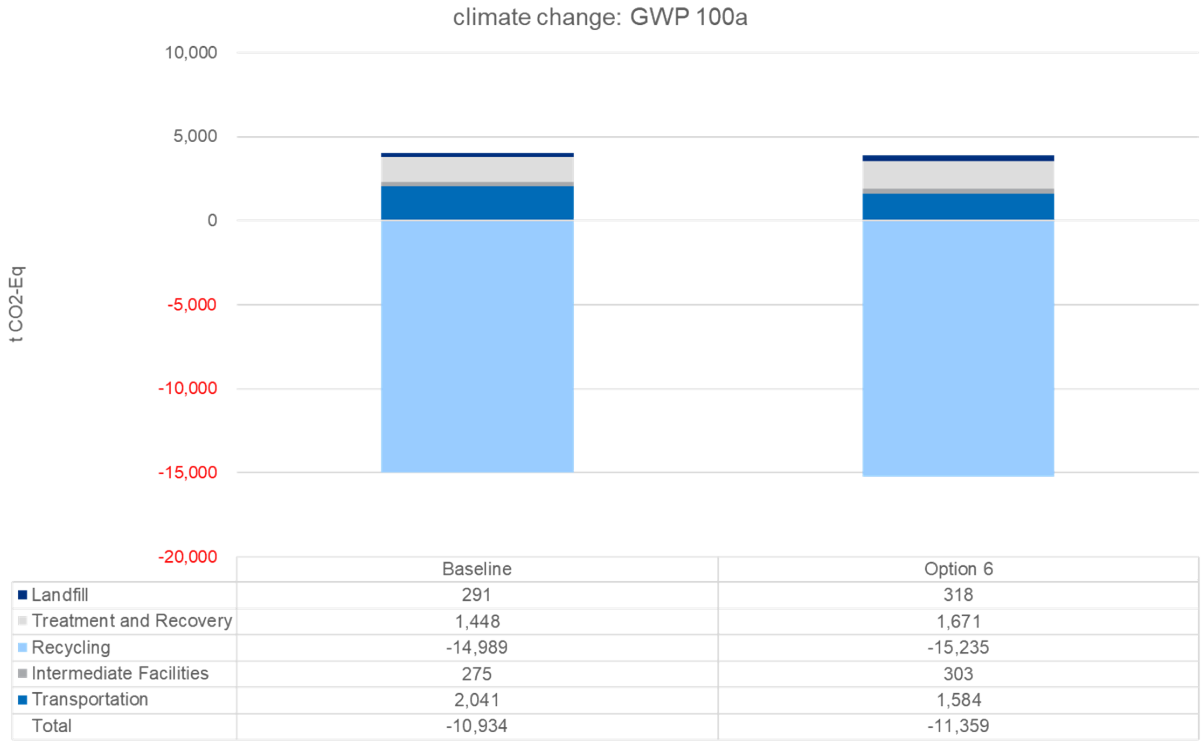


Figure 18 presents a breakdown in kg CO2-E for the scenario's transportation, recycling, treatment/recovery and landfill. The total is negative, which indicates the overall system has a beneficial impact. On a per tonne basis, recycling has the greatest positive impact primarily due to the dry recycling

[17] It should be noted that these impact assessment figures should not be added together to create an overall or cumulative total as they are assessed on different bases. They should therefore be used in isolation.

and the use of compost and digestate materials. Treatment and recovery have a relatively small disbenefit due to the energy produced from the EfW and AD facilities nearly offsetting the emissions released. The energy recovered offsets the need for energy from other sources (marginal mix and more carbon intensive) and therefore reduces emissions. Intermediate facilities are emissions from the MRF and mainly from energy usage. There is a small amount of emissions from landfill due to management of rejects from the MRF and EfW residues. It should be noted that Figure 18 above indicates there are slightly higher emissions from landfill in Option 6 compared to the Baseline. This is due to the higher proportion of recycling captured in Option 6, which results in a higher proportion of MRF rejects to landfill compared to the Baseline. The results do indicate that emissions from the collection vehicles (transportation) do have an influence, but they are significantly outweighed by the recycling.

It should be noted that the WRATE assessment indicates a -0.125 (Baseline) and -0.137 (Option 6) t CO2-Eq saving per tonne of material.

11.2.2 Other Impact Assessments

The following section provides more detail on the other impact assessments assessed. It should be noted they are all negative (except for eutrophication), and therefore have an overall beneficial impact.

Acidification Potential (AP) relates to the release of acidic gases, such as sulphur dioxide, which have the potential to react with water in the atmosphere to form 'acid rain' and cause ecosystem impairment. The benefits from recycling offset the emission from the EfW plant. Reduced material going to the EfW helps Option 6, as well as reduced transport emissions.

Eutrophication Potential (EP) reflects released nitrate and phosphate levels. Nitrates and phosphates are essential for life but increased concentrations in water can encourage excessive growth of algae, reducing the oxygen within the water and damaging ecosystems. The emission mainly come from the EfW with some contribution from the composting and AD facilities. Reduced material going to the EfW helps Option 6, as well as reduced transport emissions.

Freshwater Aquatic EcoToxicity Potential (FAETP) is a measure of the adverse effects on aquatic organisms that result from being exposed to toxic substances. It is well known that fish can 'bioaccumulate' concentrations of mercury and other toxins. Mobile heavy metals are extremely toxic to aquatic life, so activities that reduce releases of heavy metals will be favourable in this assessment. The benefits of recycling significantly outweigh any impacts from other stages of the scenario. There is a slight disbenefit from using the digestate from the AD facility that has processed the food waste as this poses a small risk.

Human Toxicity Potential (HTP) is a measure of the impacts on human health. Characterisation factors describe the fate, exposure and effects of toxic substances over an infinite time horizon. Similar to the Freshwater EcoToxicity, the benefits of recycling significantly outweigh any impacts from other stages. There is a slight disbenefit from using the digestate from the AD facility that has processed the food waste as this poses a small risk.

Abiotic Resource Depletion (ARD) is related to extraction of scarce minerals and fossil fuels. The abiotic depletion factor is determined for each extraction of minerals and fossil fuels based on the remaining reserves and rate of extraction. Recycling reduces the need for mineral extraction and energy recovery from the EfW and AD, reduces the need to use fossil fuels. Option 6 benefits from higher recycling but less material going to the EfW and thus reduced energy production (due in part to the waste minimisations factor).

11.3 EfW vs AD Sensitivity

In order to compare different management routes of food waste, two simple scenarios were set up in WRATE:

- EfW – 4,631t of food waste processed in the Billingham EfW (chosen for scale – originally opened in 1998 but additional lines added in 2009)
- AD - 4,631t of food waste processed in the Dranco large AD

The below analysis gives a high-level assessment of the two treatment methods proposed for food. The actual performance of a scenario depends on a number of additional factors, such as:

- Collection and transport requirements;
- Energy recovery efficiency and method (heat, electricity or biogas production);
- Use of outputs such as bottom ash from the EfW and digestate from the AD; and
- Electricity mix offset by generation.

The overall results can be seen in the table below. The best performing scenario for each impact assessment is highlighted green. On a climate change perspective, the use of AD appears to be twice as beneficial as EfW. The use of digestate on land does pose a risk to freshwater aquatic ecotoxicity and to a lesser degree human toxicity. AD appears to be more beneficial for acidification but not for resource depletion and eutrophication.

Table 47: EfW vs AD for Treating Food Waste[18]

Impact Assessment	Unit	EfW	AD
climate change: Global Warming Potential (GWP) 100a	kg CO2-Eq	**-235,396**	-460,696
acidification potential: average European	kg SO2-Eq	**4,463**	2,606
eutrophication potential: generic	kg PO4-Eq	1,272	**1,798**
freshwater aquatic ecotoxicity: FAETP infinite	kg 1,4-DCB-Eq	-35	**38,699**
human toxicity: HTP infinite	kg 1,4-DCB-Eq	171,381	**261,523**
resources: depletion of abiotic resources	kg antimony-Eq	-5,496	**-3,720**

The results indicate that there is not a clearly preferred treatment option and it depends on what is most important to the Council. The results should be considered alongside other factors such as cost, recycling rate, road movements, etc, to determine an overall preferred option. To illustrate the impact of haulage and road movements has on the GWP of the material, we have used our in-house carbon tool to assess the difference in impact of 4,631t of separate food waste being hauled in bulk to the Biogen AD facility at Baldock in Hertfordshire compared to that 4,631t of food waste being delivered direct to the EfW at Edmonton EcoPark mixed in with the residual waste stream (as per the current service). For the purposes of assessment, a number of assumptions have been made in agreement with the Council:

[18] It should be noted that these impact assessment figures should not be added together to create an overall or cumulative total as they are assessed on different bases. They should therefore be used in isolation.

- Residual waste vehicles direct deliver to the EfW at Edmonton EcoPark
    - The outputs from the modelling indicate that the 17 residual waste vehicles for the Baseline service travel 61 miles per day.
    - Assuming 261 working days per year, this equates to 15,921 miles per annum per vehicle, or 270,657 miles per annum for the residual fleet.
    - The residual waste vehicle fuel efficiency is 3.5mpg
- Food waste is delivered by the food waste vehicles to the Council's main operational depot on Oakleigh Road where it is bulked for onward transport
    - The outputs from the modelling indicate that the 11 food waste vehicles required to collect the 4,631t travel 45 miles per day.
    - Assuming 261 working days per year, this equates to 11,745 miles per annum per vehicle, or 129,195 miles per annum for the food waste fleet.
    - The food waste vehicle fuel efficiency is 12.5mpg
- The Biogen AD facility is located 33 miles away, equating to 66 miles per vehicle movement.
    - To transport the food in bulk to the AD facility, it has been assumed that this will occur via 20m^3 Ro-Ro skips containing 20t of food waste, transported by an articulated vehicle that is greater than 33t. This would mean for 4,631t of food waste, 232 vehicle movements would be needed, equating to 15,312 road miles.
    - According to the Department for Transport, in 2016 such an articulated vehicle over achieved an efficiency of 7.9mpg[19]
- All vehicle types have been assumed to use the same fuel type of diesel (with an average biofuel blend).

Figure 19 below summarises the difference in impact of the two routes, using one vehicle per route to represent the total mileage required for the service:

Figure 19: EfW vs AD Haulage Comparison

Waste Stream	Residual waste (including food) to EfW	Food waste delivered to bulking point	Food bulked and transferred to AD facility
Average annual vehicle mileage (miles)	270,657	129,195	15,312
Number of Veh	1	1	1
Mile per gallon factor	3.5	12.5	7.9
Fuel consumption (Gallon)	77,331	10,336	1,938
Fuel consumption (litre)	351,552	46,987	8,811
Fuel type	Diesel (average biofuel blend)	Diesel (average biofuel blend)	Diesel (average biofuel blend)
Global warming potential (kg CO2 eq)	1,112,999	148,758	27,896
Global warming potential (t CO2 eq)	1,113	149	28

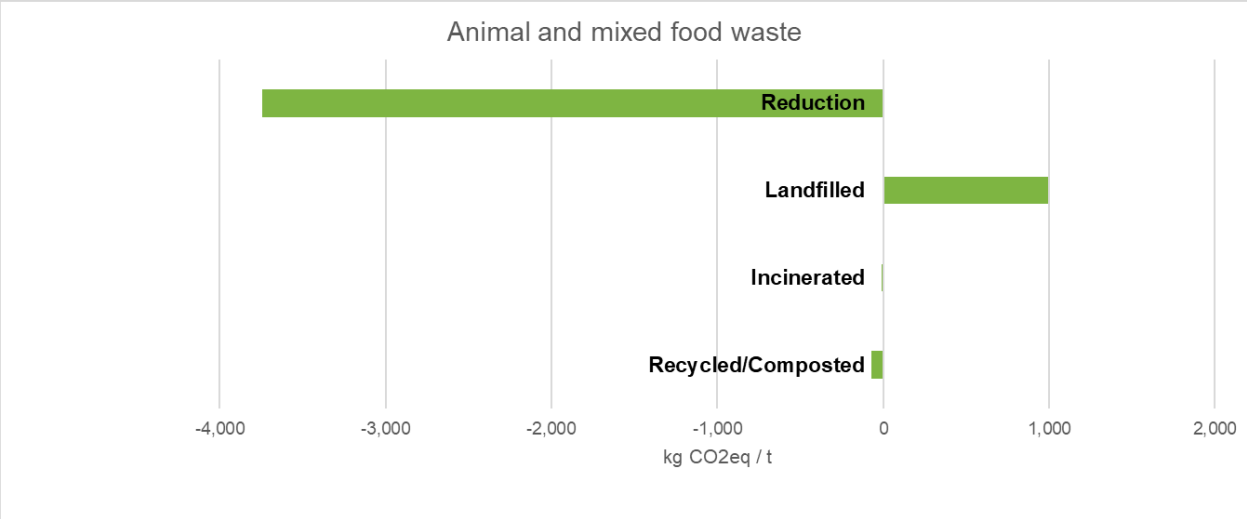
[19] Source: https://www.gov.uk/government/statistical-data-sets/energy-and-environment-data-tables-env#fuel-consumption-env01

The assessment indicates that the impact of the vehicle movements for a separate food waste collection system and haulage creates an additional 177t CO2-Eq, or an increase of 16% compared to the current service vehicle movements. However, when this is subtracted from the difference of 225.3t CO2-Eq between the Baseline (EfW) and Option 6 (AD) in Table 47, a separate food waste service still produces a reduction of -48.3t CO2-Eq compared to the Baseline service, despite the additional vehicle movements.

In general, climate change is often used a proxy for environmental performance and the use of AD or EfW significantly out performs other alternatives, such as landfill. For example, the Scottish Carbon Metric identifies that landfilling of food waste results in a significant detrimental impact, as shown in Figure 20. The data suggests recycling/composting (which includes AD) has a beneficial impact on climate change and incineration has a less beneficial impact.

However, food production is often very carbon intensive and therefore reducing food waste production can have the greatest overall environmental impact.

Figure 20: Carbon Emissions (Source: Scottish Carbon Metric)



12 Factors Affecting Future Waste Scenarios

12.1 London Environment Strategy (LES)

The Mayor's LES, published in May 2018, contains the ambition that 'London will be a zero-waste city. To this end, it sets targets to achieve the vision that by 2026 no biodegradable or recyclable waste will be sent to landfill and by 2030 65% of London's municipal waste will be recycled.'

The Strategy's waste objectives, targets and minimum service levels for London are:

- To cut food waste and associated packaging waste by 50% per person by 2030
- To achieve a 65% municipal waste recycling rate by 2030, including a 50% recycling rate for local authority collected waste (LACW) by 2025
- To send zero biodegradable or recyclable waste to landfill by 2026
- London to manage net 100% of all the waste it produces by 2026

The Strategy sets a minimum level of service for household waste recycling that waste authorities should deliver by 2020:

- All properties with kerbside recycling collections to receive a separate weekly food waste collection service
- All properties to receive a collection of, at a minimum, the six main dry materials, glass, cans, paper, card, plastic bottles and mixed rigid plastics (pots, tubs and trays).

To enable this, the LES sets minimum recycling standards for London's waste authorities to meet by 2020, including a requirement for separate food waste collection.

The Mayor has not set local targets but instead expects each local authority to develop a Reduction and Recycling Plan (RRP) and set its own reduction and recycling targets that can make an effective contribution to the Mayor's London-wide targets. Those local targets should be stretching and recognise local circumstances. Each borough's RRP should focus on activities aiming to reduce waste and deliver the Mayor's minimum recycling service levels by 2020.

It is expected that each Borough's RRP will set out key specific and measurable actions, or a package of actions, with planned milestones (timeframes) for delivery. The actions should show how and by when a borough will work towards achieving their locally set targets and objectives, which should include:

- Local waste reduction targets including separate targets for household waste produced per head, household residual waste collected per household, and total annual avoidable food waste produced per head for 2022 and 2025.
- Household and LACW recycling targets (% by weight for 2022 and 2025), going beyond the Mayor's LACW recycling target where possible
- Year for implementing the Mayor's minimum level of service for household waste recycling (by 2020 at the latest)

The RRP should also address wider environmental issues where new Contracts and/or new service arrangements are introduced (applying to both contracted-out and in-house services), with targets of:

- All waste fleet heavy vehicles being ULEZ compliant (Euro VI diesel) by April 2019 (inner London) and London-wide by October 2020
- All new cars and vans (less than 3.5 tonnes) used for waste activities being zero emission capable from 2025
- Performance against the Mayor's CO2e emissions performance standard (EPS) targets (-0.069 tonnes of CO2e per tonne of waste managed by 2021, and -0.084 tonnes per tonne of waste managed by 2025).

It should be noted that it is a statutory requirement that each boroughs' waste contracts are in general conformity with the London Environment Strategy, and the Mayor may use his powers to direct a borough where he considers their waste activities to be detrimental to the LES.

Potential Impacts for Barnet

- Introduction of a separate weekly food waste
- Changes to vehicle fleet
- Changing cost model
- Requirement for additional depot space
- Commitment to an agreed future recycling rate target

12.2 Resource & Waste Strategy for England

On 17th December 2018 the Government released 'Our waste, our resources, a strategy for England' which sets out how England will minimise waste, promote resource efficiency and move towards a circular economy. The Strategy is wide ranging and sets out actions to be taken now, with longer term policy commitments in line with the Government's '25 Year Environment Plan'. This was followed up by four consultation documents, released on 18th February 2019, which add more depth to the Strategy. The headline proposals within the Strategy and consultations, will influence the Council's ongoing development of future waste collection and disposal arrangements.

12.2.1 Consultation on Consistency in Household Recycling Collections in England

Subject to consultation, the following are three of the main proposals included:

1. ***Specify a 'core set' of materials to be collected***

- Food Waste - every household and appropriate business to have a weekly, separate collection of food waste subject to consultation, by 2023.
    - For collection authorities not currently collecting food waste, this represents a fundamental service change. It is encouraging that the government recognises the possibility of additional costs, and appears to accept that this represents a 'new burden' and may require funding. However, the strategy contains no detail on the level of funding or how it will be allocated. There is also no mention of how the government will assess the additional cost and whether the impact on disposal contracts and costs will be incorporated.

    - Dry recycling – every household to be provided with a collection of six key recyclable materials; paper, cardboard, glass bottles and jars, plastic bottles, tins and cans and plastic tubs and trays

2. ***Determine which collection systems drive quality;***
    - The emphasis on quality is significant, given the relatively high and increasing levels of contamination collected by local authority schemes, particularly in fully comingled schemes.
    - WRAP's Materials Facility Reporting Portal recently published the data for January to March 2018, charting the volume of 'target' and 'non-target' material received by 101 MRFs in England and Wales. In this period, 84.9% of the material received was target material (lower than the 85.6% rate for the previous quarter), and represents the lowest percentage of target material per quarter since reporting began in 2014. The percentage of non-recyclable waste was 9.6%, again the highest level since reporting to the standards required by the Regulations began. The percentage of non-target material made up the remaining 5.5% of input.

3. ***Garden Waste***
    - Free garden waste collections for households with gardens subject to consultation. The Strategy states that 'New duties will be assessed to account for new burdens, and funded appropriately'.
    - Given that the Council currently is looking at potentially charging for a garden waste collection service, this proposal has the potential to inflict a significant future financial

burden on the Council. Again, the Strategy contains no detail of the methodology for calculating or allocating funding.

Potential impacts for Barnet

- Requirement to introduce a separate weekly food waste collection to all property types
- Requirement to provide a free garden waste collection
- Changing cost model
- Requirement for additional depot space

12.2.2 Consultation on Introducing a Deposit Return Scheme (DRS) in England, Wales and Northern Ireland

A DRS would see a deposit added to the price of drinks in in-scope drinks containers at the point of purchase, which would be redeemed when consumers return their empty drinks containers to designated return points.

The consultation seeks views on proposals to introduce a DRS for drinks containers in England, Wales and Northern Ireland. Defra confirm that they are considering two options for a DRS, which would differ in terms of the size of the drinks containers in-scope. These are:

- The 'all-in' model, which would not place any restrictions on the size of drinks containers in-scope of a DRS. This would target a large amount of drinks beverages placed on the market.
- The 'on-the-go' model would restrict the drinks containers in-scope to those less than 750ml in size and sold in single format containers. This model would target drinks beverages most often sold for consumption outside of the home (while 'on-the–go').

The concerns expressed by local authorities have focussed on the negative impact DRS could have on the operational and financial aspects of kerbside collection schemes. All DRS options will target materials currently collected at the kerbside; it is therefore likely that tonnages collected will fall. With collection vehicles still required to provide a service to all households, this may impact on round efficiency, particularly if lower tonnages fail to translate to reduced vehicle requirements.

The consultation states that "the UK government will ensure that local authorities in England are resourced to meet new net costs arising from the policies that flow from the Strategy, including upfront transition costs and ongoing operational costs." It should be noted that the methodology for this is not specified.

Potential impacts for Barnet

- Reduction in volume and quality of recycling collected from the kerbside
- Impacts on round efficiency
- Changing Cost Model
- Changes to the overall costs paid for disposal

12.2.3 Consultation on Reforming the UK Packaging Producer Responsibility System

The consultation identifies that

- "The management of packaging waste costs local authorities in the region of £820 million per year. The proposals in this consultation mean that the funding to meet these costs will transfer from central government and local taxpayers to businesses: local authorities will be paid by producers for collecting and managing packaging that arises in household waste.
- Local authorities will have to collect all recyclable packaging that is identified for collection through household collection services. Collection services will have to meet with any minimum collection standards required in each nation. This will lead to more consistent service provision across the country."
- The proposed overarching principles for packaging Extended Producer Responsibility (EPR) are that "Businesses will bear the full net cost of managing the packaging they handle or place on the market at end of life. Subject to this consultation, this should include the cost of collection, recycling, disposal, the clear-up of littered and fly tipped packaging, and communications relating to recycling and tackling littering."

However, the proposals for payments to local authorities for household packaging waste look to take into account "the legitimate variations between local authorities in the cost of collection (per household or per tonne of packaging material) and the amount of material available to collect from households"

The proposals for the calculation of payments do not directly relate to the direct costs incurred by each authority – the consultation proposes a methodology which categorises authorities into groupings, defined by their rurality and socio-demographics; this is based on an assumption that these are the primary factors impacting on the cost and performance of collection services. Defra has utilised the six local authority rurality groups developed by WRAP as the basis for their cost modelling.

This proposed methodology of average payments based on regional groupings or other variables has the potential to divorce the level of payments from actual costs incurred, as this approach doesn't appear to take account of contractual arrangements, specific collection methodologies or other authority-specific costs.

Similarly, the proposal that payments for the disposal of packaging waste in the residual waste stream (ie not separated for recycling by residents) would be based on the average disposal gate fee for household waste for landfill or incineration fails to make allowance for contractual arrangements with disposal facilities, which may vary substantially across authorities.

Also, the consultation proposes that the tonnage of packaging waste in the residual stream is based on an estimate informed by waste composition analysis; it is not specified whether this is based on authority-specific information or regional averages, again raising the concern that the payments may not relate directly to each authority's actual performance and costs.

Potential impacts for Barnet

- Payments for the collection of recyclable material
- Please see Appendix 3 for more detail on the Strategy.

12.3 North London Heat and Power Project

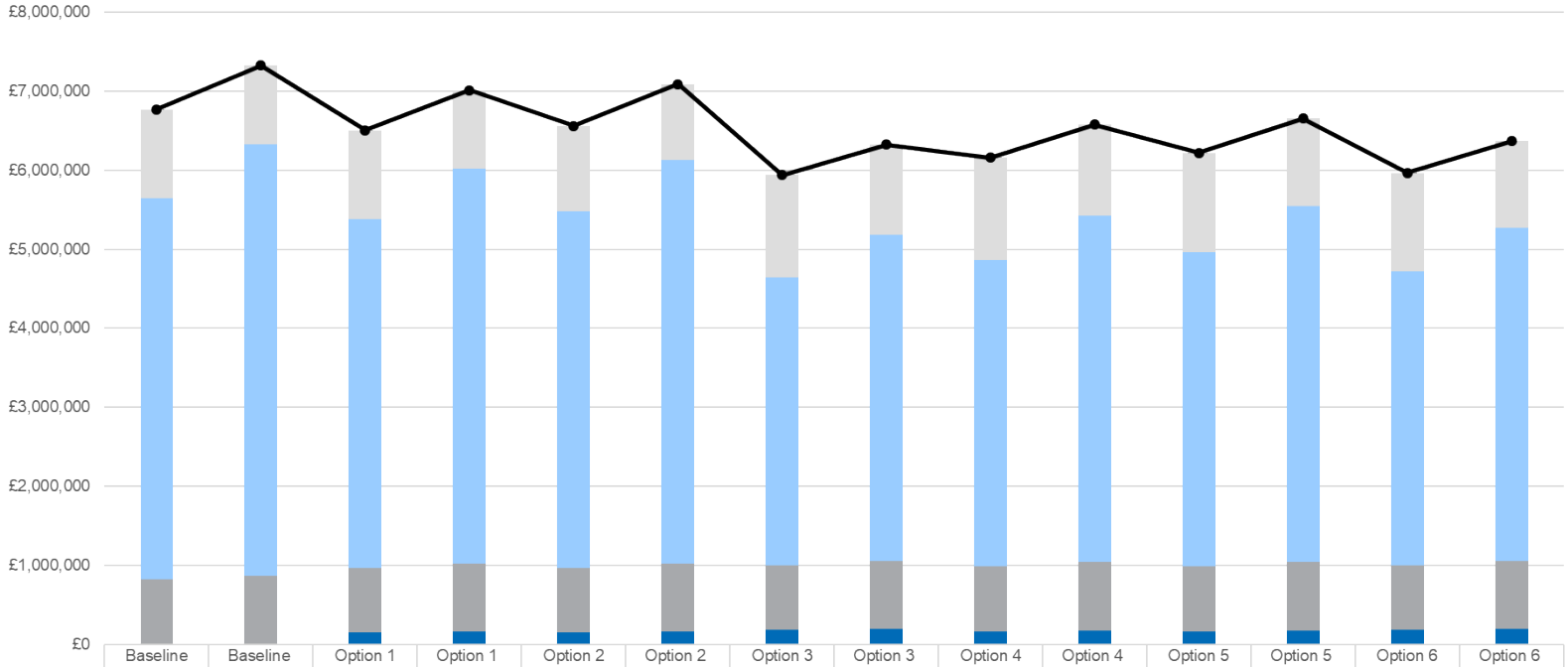
The Council is facing rising costs to fund the construction of a new Energy from Waste facility that will replace the Edmonton EcoPark by 2025. Currently the Council pays an additional £7 per tonne of residual waste to contribute to the funding of the EfW. Work is being undertaken to revise the long-term levy modelling carried out in 2017, however the Council's levy is expected to increase from 2021/22 and double by 2024/25. As part of this modelling project, the 2021/22 pricing has been applied to all Options, including the Baseline to assess the impact of this levy increase. Table 47 below shows the comparison between the current prices used for the modelling, and the prices provided by the Council for 2021/22. These prices are what have currently been budgeted for, however may be subject to change in future.

Table 48: Disposal Price Comparison

	2018/19 (current pricing - revised at 4th NLWA budget review)	2021/22
Residual	£89.44	£101.35
Dry Recyclable	£67.06	£59.13
Food	£32.44	£34.12
Garden	£55.52	£58.60

Figure 21 below shows the impact of the revised 2021/22 pricing on each Option compared to the current situation:

Figure 21: Disposal Cost Comparison



	Baseline (18/19)	Baseline (21/22)	Option 1 (18/19)	Option 1 (21/22)	Option 2 (18/19)	Option 2 (21/22)	Option 3 (18/19)	Option 3 (21/22)	Option 4 (18/19)	Option 4 (21/22)	Option 5 (18/19)	Option 5 (21/22)	Option 6 (18/19)	Option 6 (21/22)
Recycling	£1,131,503	£997,700	£1,131,503	£997,700	£1,088,853	£960,094	£1,301,165	£1,147,299	£1,301,165	£1,147,299	£1,262,539	£1,113,241	£1,246,712	£1,099,286
Residual	£4,823,035	£5,465,279	£4,408,050	£4,995,035	£4,507,329	£5,107,533	£3,642,891	£4,127,986	£3,876,687	£4,392,914	£3,976,771	£4,506,325	£3,722,851	£4,218,592
Garden	£818,587	£863,998	£818,587	£863,998	£818,587	£863,998	£818,587	£863,998	£818,587	£863,998	£818,587	£863,998	£818,587	£863,998
Food	£0	£0	£150,518	£158,313	£150,522	£158,317	£180,168	£189,498	£165,343	£173,906	£165,343	£173,906	£180,168	£189,498
Total	£6,773,125	£7,326,978	£6,508,658	£7,015,046	£6,565,291	£7,089,942	£5,942,811	£6,328,782	£6,161,782	£6,578,118	£6,223,239	£6,657,470	£5,968,318	£6,371,375
Difference on Baseline (per year)	£0	£0	-£264,467	-£311,932	-£207,834	-£237,036	-£830,314	-£998,196	-£611,343	-£748,860	-£549,886	-£669,509	-£804,807	-£955,603
Difference Between 18/19 and 21/22 per Option		£553,853		£506,388		£524,652		£385,971		£416,336		£434,230		£403,057

Table 49: Disposal Fee Comparison per Option

Option	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
18/19 Price	£6,773,125	£6,508,658	£6,565,291	£5,942,811	£6,161,782	£6,223,239	£5,968,318
21/22 Price	£7,326,978	£7,015,046	£7,089,942	£6,328,782	£6,578,118	£6,657,470	£6,371,375
Difference	***£553,853***	***£506,388***	***£524,652***	***£385,971***	***£416,336***	***£434,230***	***£403,057***

Table 50: Disposal Fee Comparison to Baseline

Option	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
18/19 Price	£6,773,125	£6,508,658	£6,565,291	£5,942,811	£6,161,782	£6,223,239	£5,968,318
Difference on Baseline	***n/a***	***-£264,467***	***-£207,834***	***-£830,314***	***-£611,343***	***-£549,886***	***-£804,807***
21/22 Price	£7,326,978	£7,015,046	£7,089,942	£6,328,782	£6,578,118	£6,657,470	£6,371,375
Difference on Baseline	***n/a***	***-£311,932***	***-£237,036***	***-£998,196***	***-£748,860***	***-£669,509***	***-£955,603***

Key observations:

- Although there is a reduction in price for dry recycling between 18/19 and 21/22, this is offset by the increase in the disposal of residual waste
- Each Option sees an increase in disposal costs under the 21/22 scenario
- Due to the marked increase in residual costs, higher savings correlate to how much material is diverted from the residual stream, with Option 3 achieving the highest saving of ~£1m per annum in 21/22, closely followed by Option 6 at ~£950,000 per annum in the same year.
- The Options that see the least savings compared to the Baseline are Options 2 and 1, saving ~£240,000 and ~£300,000 per annum respectively in 21/22.
- It should be noted that all Options make savings on the Baseline due to the diversion of food waste from the residual stream, however diverting recycling from the residual stream and minimising waste in general through restricted capacity of reduced frequency for residual collections realises greater savings on disposal costs.

12.4 Other legislation

Appendix 4 explores the wider drivers for change which have the potential to impact on the costs, methodologies and wider aspects of waste management at a national level. These should be considered when assessing the outputs of the options for future delivery in terms of the 'future proofing' of the service methodologies chosen. These drivers include:

- **Potential impacts from Brexit:**
  - The Department for Exiting the European Union (DEXEU) has confirmed that all EU legislation which has not already been transposed into UK law will be transferred to UK statute, including current regulations governing waste, packaging, waste electrical and electronic equipment (WEEE) and landfill. However, DEXEU has also stated that 'Following integration into UK law upon departure, all EU environmental laws will be open to being "amended, repealed or improved"'. The UK is therefore free to decide the future of its waste policy and laws. This uncertainty may impact on Local Authorities' municipal waste activities

- **Possible impacts from Chinese import restrictions:**
  - More recently there are concerns that the announcement from China to ban plastic waste and unsorted paper imports (as part of a ban on important 24 types of material) could see the UK stockpiling waste, or having to send waste to residual disposal routes

instead. Until recently, China had lower standards for receiving recyclable waste material, making it an easy choice for the UK to help reach higher recycling rates and reduce landfill. However, with a ban enforced at the end of 2017, on plastics such as polyethylene terephthalate (PET) drinks bottles and all mixed paper, including increased quality control on cardboard, pressure will be put on the British recycling industry.

- **National – Austerity considerations:**
  - Budget cuts continue to apply pressure on local authority spend, resulting in services and infrastructure being shaped by austerity, such as three or four weekly residual collections and chargeable garden waste collections.

- **The Environmental Protection Act 1990 & the Deregulation Act 2015:**
  - In England and Wales, Waste Collection Authorities are obliged by law to provide a domestic waste collection service to households as laid out in the Environmental Protection Act (EPA) 1990 (EPA).
  - Councils can require occupiers of premises to present their household waste for collection in a specified way under the EPA. However, their powers to enforce this have been substantially curtailed by Section 58 of the Deregulation Act 2015, making enforcement extremely difficult, undermining the ability of local authorities to enforce their collection policies, and making any form of enforcement activity regarding contamination of recyclate effectively impotent. The lack of enforcement options limits actions taken by Local Authorities to communications activity with no power to take further action and may therefore lead to a continuing increase in contamination rates.

- **The Waste (England and Wales) Regulations 2011:**
  - The Waste Framework Directive (2008/98/EC) is the overarching EU policy on waste and the Waste (England and Wales) Regulations (2011) (amended by the Waste (England and Wales) (Amendment) Regulations 2012) and the Environmental Permitting (England and Wales) Regulations 2010, implemented much of the directive, including the current 50% recycling target (to be achieved by 2020).

- **Potential impacts from the UK's adoption of the EU Circular Economy Package:**
  - The Circular Economy Package (CEP) was adopted by the European Commission in December 2015. It includes a range of policy options around waste management but also addresses product lifecycles in terms of intelligent product design, smarter use of raw materials, improved reuse and repair, increased recycling and more resilient markets for secondary raw materials. It also limits the use of landfill to 10% of municipal waste (based on the EU definition of municipal waste) by 2030.

- **Possible impacts from alternative recycling metrics and Carbon Impacts:**
  - One aspect of the CE approach is the exploration of whether recycling activities should be more focussed on those materials whose recycling represents the maximum environmental benefit, rather than simply collecting the heaviest elements of the waste stream. Under this approach, instead of an absolute target for recycling, individual material streams would have their own target, which could include packaging waste. The streams would be linked to the best environmental option for that particular material. Metrics such as carbon or residual waste production would provide a fairer

reflection of environmental performance, and also help to level the playing field between urban and rural authorities.

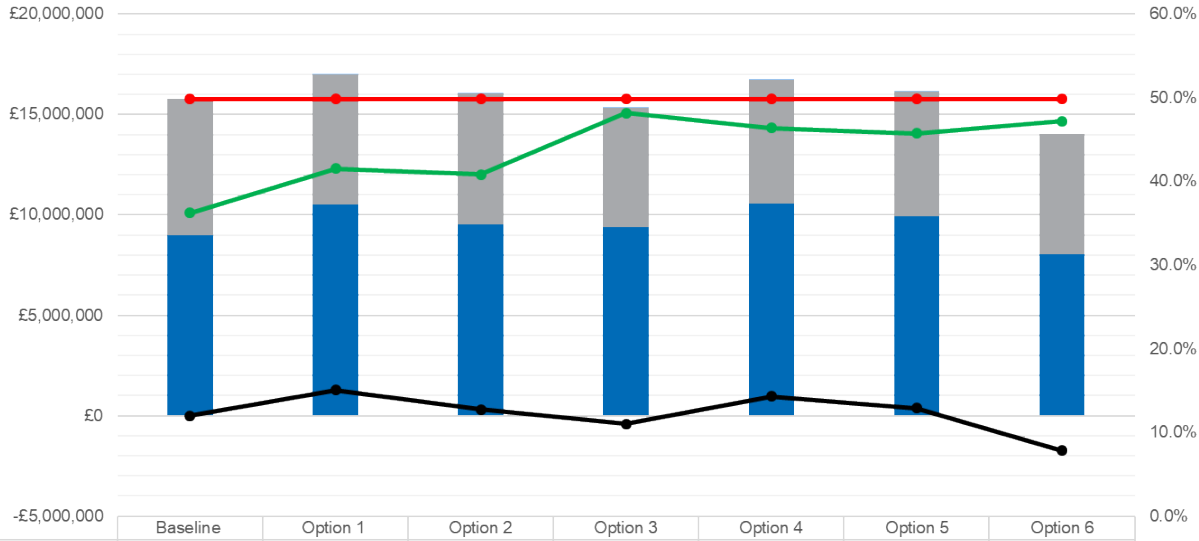
Potential impacts for Barnet

- Implications from BREXIT are as yet unknown
- Reduction in the availability of end markets for plastic overseas
- Less funding available from Government
- Less enforcement powers
- Attainment of a 50% recycling rate by 2020
- Development of more Circular Economy activities
- More emphasis on the collection of high carbon impact materials

13 Conclusion

Figure 22 summarises the costs and performance of the Options modelling:

Figure 22: Total Costs and Performance



	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Depot Lease Costs	£0	£31,000	£8,454	£16,908	£31,000	£19,726	£0
Treatment Costs	£6,773,125	£6,508,658	£6,565,291	£5,942,811	£6,161,782	£6,223,239	£5,968,318
Collection Costs	£8,998,200	£10,496,100	£9,508,600	£9,407,500	£10,546,500	£9,913,800	£8,059,700
Total Net Costs	£15,771,325	£17,035,786	£16,082,347	£15,367,169	£16,739,244	£16,156,747	£14,028,041
Difference on Baseline	£0	£1,264,461	£311,022	-£404,156	£967,919	£385,422	-£1,743,284
Baseline Benchmark	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325	£15,771,325
Recycling Rate	36.2%	41.5%	40.8%	48.2%	46.4%	45.7%	47.2%

N.B. It should be noted that the 'Additional Depot Space Lease Costs' are not visible in the graph due to the low figures compared to the other totals, however these have been accounted for in overall costs where applicable

All options improve on the Baseline recycling rate of 36.2% by an increase of between 4.2% (Option 2) to12% (Option 3). Options 1 – 6 all reduce residual waste compared to the Baseline due to a combination of removing the food waste from the residual waste stream, with Options 3 – 6 further reducing residual waste by extracting more recycling from the residual stream or minimising waste through restricting capacity or reducing frequency. The reduction in residual waste results in fewer disposal costs, due to the higher cost per tonne to dispose of residual waste compared to recycling. However, these reduced disposal costs are outweighed by the additional collection costs as a result of the dedicated food waste vehicles required for Options 1 – 6, resulting in Options 1, 2, 4 and 5 being

more expensive overall than the Baseline. However, Options 3 and 6 have reduced frequency of collections, resulting in savings of ~£400,000 for Option 3 and ~£1.7m for Option 6. Option 6 yields significantly greater savings than Option 3 because both residual waste and recycling are collected fortnightly on the same type of vehicle (Option 3 recycling remains at a weekly collection frequency), reducing the Baseline fleet by 13 vehicles.

Figure 23 below provides a summary of the evaluation, the methodology of which was designed and weighted by the Council. Based on the Council's evaluation methodology, Option 6 is the highest-ranking Option.

Figure 23: Summary of Evaluation

	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Raw Score	3	5	7	2	4	6	1
Weighted Score	4	6	7	2	3	5	1

In addition to the main modelling, an assessment of introducing chargeable garden waste was undertaken. This examined two scenarios:

1. Charging £35 per annum for the service; and
2. Charging £50 per annum for the service.

The modelling indicated that the introduction of a chargeable garden waste service would save the Council in the region of £2.3m per annum for the £35 scenario, and approximately £2.1m per annum in the £50 scenario. The savings in both scenarios are as a result of the reduced vehicles and treatment costs, bolstered by income from the service. However, implementing a chargeable garden waste service would result in a reduction in recycling rate of approximately 4.8%, regardless of which Option the service was applied to.

An additional assessment separate to the main modelling of the communal properties indicates that the cost of providing the Option 1 service to communal properties would cost approximately £4.85m and achieve a recycling rate of 19.5% for solely the communal properties. However, as this exercise was undertaken outside of the KAT modelling for the main project and was based on limited data, the communal findings should be interpreted in isolation and not be combined or used in conjunction with the main findings of the report.

Appendices

Appendix 1 – Modelling Limitations

WRAP's Kerbside Analysis Tool (KAT) is an industry recognised tool that is widely used in the planning and review of kerbside waste and recycling collection systems throughout UK local authorities, and has been used to model the collection system options, with the outputs fed through Ricardo's in-house tool to cost the options.

The modelling has been limited to the direct costs of the Baseline and Options as agreed with the Council and Resource London. Therefore, the following is a list of factors that need to be considered as part of the overall picture of service change:

- Infrastructure;
- Interface with other waste collection services;
- Bring site services;
- Land take requirements at the operational depot;
- Spare vehicles;
- Labour resource issues;
- Disposal activities; and
- Change to collection rounds.

Assumptions

All data and assumptions used are based on the best available information at the time of the modelling.

A number of input assumptions are based on the performance of similar collection systems in other authorities of a similar nature. Whilst every attempt has been made to use robust comparative inputs, future trends in waste management are varied, and cannot be predicted by the KAT model.

No planning is made in regards to future legislation changes and changes in household perception of waste and recycling management; that is to say that, we cannot model the unknown.

Local authority specific modelling is best using an accurate local waste composition. However, although the waste composition in the modelling was based on local data and carried out by a reputable company, this is just a snapshot of the waste composition at the time of the study, and no guarantees can be made as to its accuracy. Any waste composition needs to be regularly updated to take account of future changes in materials available for recycling, such as those brought about by factors such as technology, e.g. light-weighting of certain materials or through different buying habits.

Set-out and participation rates have a big influence on the results of KAT modelling. The set-out and participation rates used are based on information provided by the Council as amended with the agreement of the Council and WRAP.

There are also likely to be differences between what KAT and the in-house modelling has reported as the Baseline costs, and the actual cost. This can be due to varying amounts of overhead costs, contract costs and budgetary assignments. It is, therefore, again suggested that comparisons between the costs of different Options, be taken on their relative value, rather than absolute totals.

Where households are subject to a change in service, e.g. alternative collection days, a reduction in residual waste containment volume, or introduction of new containers, communications materials will

need to be produced and sent to relevant households. The costs for these are not included in the modelling.

Finally, although indications are given to the potential kerbside recycling rates associated with each Option, again these should be regarded on their relative values, as modelled, rather than an absolute value.

Appendix 2 – Assumption Report

*Separate Document '*Barnet Assumptions Report DRAFT v0.6 ISSUED'*

Appendix 3: Resource & Waste Strategy

On 17th December 2018 the Government released 'Our waste, our resources, a strategy for England' which sets out how England will minimise waste, promote resource efficiency and move towards a circular economy. The Strategy is wide ranging and sets out actions to be taken now, with longer term policy commitments in line with the Government's '25 Year Environment Plan'. The headline proposals within the Strategy that it suggested will influence the Council's ongoing review of future waste collection and disposal arrangements are:

- **Para 1.1.1** Extended Producer Responsibility (EPR) - ensuring that producers pay the full net costs of managing packaging waste at end of life (N.B. including the collection of packaging waste). Local authorities and waste operators will be able to use this support to collect all recyclable packaging waste and drive high quality recycling. Timescales - consultation has begun, legislate in 2021, operational reform in 2023.

- **Para 2.3.1** Deposit Return Schemes - consumers are charged a deposit up-front when buying a single-use container, which is redeemed when the empty container is returned. The government will carry out a consultation exercise will look at how the scheme might sit alongside other measures to boost recycling and how it will operate. The impact on the current kerbside collection arrangements provided by the Council, which include the collection of glass, steel and aluminium cans and plastic bottles, is unknown at this stage. However, these materials have significant value and any reduction in the amount collected by the Council will adversely affect income streams (either directly or indirectly). Timescales - consultation has begun, roll out deposit return scheme subject to consultation in 2023.

- **Para 3.1.1** Collect a consistent set of dry recyclable materials. Subject to consultation, the Government proposes legislation to (a) specify a 'core set' of materials to be collected; (b) determine which collection systems drive quality; (c) introduce non-binding performance indicators for local authorities and (d) introduce minimum service standards to improve the quantity and quality of what is recycled. Consultation will seek views on what the 'core set' will be, the collection system that preserves material quality and determining when separate collection is necessary, and whether non-binding performance indicators for the materials collected will improve both quality and quantity.
-

The emphasis on quality is significant given the relatively high and increasing levels of contamination collected by local authority schemes, particularly in fully comingled schemes. Timescales - consultation is in line with the extended producer responsibility in 2019, with legislation and operational reform subject to discussions at spending review.

- **Para 3.1.2** Food Waste - every household and appropriate business has a weekly, separate collection of food waste subject to consultation. Timescales - consultation in 2019, operational reform from 2023. The Strategy states that 'New duties will be assessed to account for new burdens, and funded appropriately'.
-

For collection authorities not currently collecting food waste, this represents a fundamental service change. It is encouraging that the government recognises the possibility of additional costs, and appears to accept that this represents a 'new burden' and may require funding. However, the strategy contains no detail on the level of funding or how it will be allocated. There is also no mention of how the government will assess the additional cost and whether the impact on disposal contracts and costs will be incorporated.

- **Para 3.1.2** Garden Waste - free garden waste collections for households with gardens subject to consultation. The Strategy states that 'New duties will be assessed to account for new burdens, and funded appropriately'.
-

Given that the Council currently is looking at potentially charging for a garden waste collection service, this proposal has the potential to inflict a significant future financial burden on the Council. Again, the Strategy contains no detail of the methodology for calculating or allocating funding.

- **Paras 3.1.4 & 3.1.5** Improving working arrangements and performance between local authorities, especially in 'two-tier' areas. Investigating amending the recycling credit system used by two-tier authorities.

This element may suggest that the government will explore the net costs of the changes developed above, in terms of the overall impact on the 'whole system cost' for each authority.

The Strategy states that 'Separate food waste collection also leads to higher yields of food waste collected than if it is captured mixed with garden waste'. This element appears to be an attempt to avoid the possibility of councils minimising costs by providing a service co-collecting food and garden waste.

- The Strategy states that 'New statutory responsibilities for local government would be subject to an assessment of new burdens'.

As highlighted above, this is encouraging, but without further detail on how additional costs will be assessed and/or allocated, the implications of the strategy remain unclear.

Appendix 4 – Drivers for Change

National – Austerity considerations

Efficiency is without doubt the main driver for local authorities as budget cuts continue to apply pressure on local authority spend. As such, services and infrastructure are being shaped by austerity (three-four weekly residual collection, chargeable garden waste collections), and in some instances, this is leading to innovative service delivery models.

The Environmental Protection Act 1990 & the Deregulation Act 2015

In England and Wales, Waste Collection Authorities are obliged by law to provide a domestic waste collection service to households. The Waste Disposal Authority (WDA) is required to provide or facilitate a facility(s) for the deposit of this waste. These duties are laid out in the Environmental Protection Act (EPA) 1990 (EPA).

Councils can require occupiers of premises to present their household waste for collection in a specified way under the EPA. However, their powers to enforce this, along with being able to require residents to recycle through the specification of what can be placed in each container and where containers should be placed were substantially curtailed by Section 58 of the Deregulation Act 2015 which downgrades failure to comply with any notice from a criminal to a civil offence whilst tightening the definition of an offence to "causing a nuisance or likely to be, detrimental to any amenities of the locality" This makes enforcement extremely difficult, undermining the ability of local authorities to enforce their collection policies.

The Deregulation Act also makes any form of enforcement activity regarding contamination of recyclate effectively impotent. The practical requirements of bringing a civil case against individual residents has yet to be fully tested, but the disproportionate effort and expenditure required acts as a significant disincentive to authorities. As a result, the growing issue of contamination in the kerbside recycling stream will be difficult to address. From an authority perspective, the lack of enforcement options limits any addressing of this issue to communications aimed at transgressing residents with no power to take further action. This may lead to a continuing increase in the proportion of contamination and non-target material delivered to MRFs from kerbside collection schemes, which means that MRF infrastructure may have to be flexible to deal with contamination challenges

The Waste (England and Wales) Regulations 2011

The Waste Framework Directive (2008/98/EC) is the overarching EU policy on waste covering recycling targets, a definition of waste and national waste management plans which also defines the "Waste Hierarchy". The Waste (England and Wales) Regulations (2011) (amended by the Waste (England and Wales) (Amendment) Regulations 2012) and the Environmental Permitting (England and Wales) Regulations 2010, implemented much of the directive, including the current 50% recycling target (to be achieved by 2020). These Regulations also require Waste Collection Authorities (WCAs) to separately collect paper, plastics, glass and metals. The collection of these materials either co-mingled or two-stream may be compliant, but only if it can be demonstrated that separate collection is not necessary to achieve good quality recyclables, or is not technically, environmentally or economically practical (known as TEEP). WCAs are required to carry out a 'TEEP' assessment to demonstrate that their collection system is compliant with the regulations. However, ambiguity in the detailed wording in the Waste Framework Directive, combined with a Judicial Review and a subsequent lack of clarity from Defra, means there is still much uncertainty in the market as to what this means in operational terms for both commercial and domestic kerbside collections.

25 Year Environment Plan

In terms of the need for a clear policy framework from central government, Therese Coffey, Parliamentary Secretary of State at DEFRA, has confirmed that they note the limitations of weight based targets, and the reliance of recycling rates on garden waste collections. Despite the recent publication by Michael Gove, Secretary of State for the Environment, of the Government's 25 year Environment Plan, there is no additional clarity on the issue of recycling targets or wider waste policy. there remains a lack of clear direction on the future of waste policy in England. It appears that in the short term, local decision makers will be required to continue to concentrate on improving recycling performance and saving costs in a manner most appropriate to their imperatives.

The 25 Year Plan does state that the Government will crackdown on plastics by eliminating all avoidable plastic waste achieving zero avoidable plastic waste by the end of 2042. They identify extending the 5p plastic bag charge to small retailers, removing consumer single-use plastics from the government estate, supporting the water industry with the roll out of more public drinking fountains, and working with retailers to implement plastic free aisles in supermarkets as measures they will pursue.

Potential impacts from EU Circular Economy Package

The Circular Economy Package (CEP) was adopted by the European Commission in December 2015. It includes a range of policy options around waste management but also addresses product lifecycles in terms of intelligent product design, smarter use of raw materials, improved reuse and repair, increased recycling and more resilient markets for secondary raw materials. It also limits the use of landfill to 10% of municipal waste (based on the EU definition of municipal waste) by 2030.

The current proposals suggest that the recycling rate calculation will be based on material sent to final recycling or MRF outputs minus losses. MBT (Mechanical Biological treatment) output will be excluded from calculations from 2027 onwards. Strengthened TEEP provisions will extend to bio-waste from 2023 and textiles from 2025. Separate collection of hazardous waste will apply from 2025 but without the TEEP provision. The Package has now passed through the EU legislative process. Before the Circular Economy Package was passed into law, all three European institutions (the European Council, European Parliament and the European Commission) were required to have an agreed stance.

Following consideration by EU member states in February, on 18th April MEPs in the European Parliament agreed the recycling targets set out in the EU's Circular Economy Package, and these were adopted by the European Council of Ministers on 22nd May. These targets include:

- By 2025, at least 55% of municipal waste (from households and businesses) should be recycled by member states.
- The target will rise to 60% by 2030 and 65% by 2035.
- 65% of packaging materials will have to be recycled by 2025, and 70% by 2030.
- Separate targets are set for specific packaging materials, such as paper and cardboard, plastics, glass, metal and wood.
- The proportion of municipal waste sent to landfill will be limited to a maximum of 10% by 2035.
- Separate collection of textiles and hazardous waste from households will be required by 2025.
- Separate collection of biodegradable waste will be required by 2024, although this is not required where the waste is composted at home (and will be subject to a revised version of TEEP assessment).

The agreed text, having been agreed by the EU Council of Ministers for final formal approval, has been published in the Official Journal of the EU, the official record of all EU legal acts. Following this formal approval and adoption, EU members will have two years to bring the legislation into law.

It is anticipated that as the CEP has been adopted into formal EU law before the end of the two-year Brexit process it will be among the environmental legislation brought into UK law via the 'European Union (Withdrawal) Bill'.

Whilst local authorities will be expected to reflect the principles of the Circular Economy, the primary impacts will be the increased recycling rate target and the further minimisation of allowable waste to landfill. It is also possible that the Extended Producer Regulations (EPR) will impact on Local Authorities. The latter, by making producers responsible for the full cost of recycling or disposing of products they bring to the market (including those costs currently incurred by local Authorities) should incentivise them to reduce the overall environmental impact of their products and packaging, reducing overall costs whilst minimising environmental impact. Proposals on how the EPR would be introduced in contrast to the current PRN methodology are currently the subject of consultation, with the ESA, LARAC and the compliance sector holding differing views. One possibility is that the packaging industry becomes 'responsible' for the cost of collecting household packaging waste. The packaging industry is, currently, lobbying against this approach, whilst Local Authorities are concerned that it may impact adversely on their statutory duties.

A further concern regards the potential impact on collection methodologies; The Waste (England and Wales) Regulations 2011, as amended in 2012 requires WCAs to separately collect paper, plastics, glass and metals. The revised Directive states: "Member States shall take measures to promote high quality recycling and, to this end, shall set up separate collection of waste where technically, environmentally and economically practicable and appropriate to meet the necessary quality standards for the relevant recycling sectors and to attain the targets…." . This revision of the wording of the 'TEEP' provision, along with the addition of biodegradable waste to the collection requirement may have implications on Councils' statutory collection responsibilities. However, the NOM is compliant with the current regulations, and the TEEP test remains in place in the CEP. Our modelling demonstrates that 'paper out' remains the most cost effective collection option across East Kent; however, our analysis has also incorporated consideration of fully co-mingled, 'glass out' and full source-segregated multi-stream collections. This assessment would stand as a TEEP assessment, and unless and until further guidance or regulations are introduced, we would consider the NOM to be compliant with the CEP requirements.

In January 2018, the European Commission published a Strategy for Plastics which aims to protect the environment for plastic pollution whilst fostering growth and innovation. The current proposals, which are focussed on littering (marine and land) caused by plastic items such as plastic straws, cotton buds and cutlery, as well as plates, beverage stirrers and sticks used to support balloons, as the most obvious products where "suitable and more sustainable alternatives are readily available". As such, it is proposed that market restrictions will be placed on these and similar items. At this stage, no immediate impact on Local Authorities seems likely.

The Europe-wide Strategy for Plastics in the Circular Economy

In January 2018, the European Commission published a Strategy for Plastics which aims to protect the environment for plastic pollution whilst fostering growth and innovation.

Potential impacts from revisions to packaging obligations

The Producer Responsibility Obligations (Packaging Waste) (Amendment) Regulations (2016), work on the principle of Collective Producer Responsibility, requiring obligated producers to pay a proportion of the cost of the recovery and recycling of their packaging. In the UK this obligation is achieved through Packaging Recovery Notes (PRNs) which are issued by accredited reprocessors when they have recovered and recycled a tonne of packaging material.

The EPR nominally require producers to fund the full cost of recycling their products. This would include post-consumer waste, currently funded by LAs. The producers have suggested that should they be required to fund this activity, they may prefer to implement material specific collection schemes to minimise cost and maximise quality. Alternatively, agreeing funding mechanisms with local authorities would enable the continuation of the cost-efficiencies of the current local authority led approach. Following consultation by Government, it appears that they consider the current Packaging Recovery Note (PRN) scheme to be working well, and at an acceptable cost to industry, and have no current plans for major revision. This would leave the current situation unchanged. However, this may be contingent on the wording of the CEP.

Recent government statements regarding producer responsibility, incorporation of the consideration of taxes and charges on single-use items such as takeaway containers, the 25p 'coffee cup tax' and the proposed 'clampdown on plastic waste' suggest that Government policy may be moving towards a more explicit 'Producer Pays' methodology. The impact of 'return and reward' schemes would have a substantive impact on both the volume and composition of municipal waste. Proposals currently revolve around plastic bottles, but may be extended. This would divert tonnage from the municipal waste stream to the commercial sector, and would effectively be a pre-sorted material stream. The Government has undertaken a recent consultation on a 'Deposit or Reward and Return Scheme' (DRRS) for drinks containers.

The impact of a 'single-use plastic container' tax, as recently suggested by Government, is less clear. Should such a scheme be introduced, the packaging industry would be incentivised to identify alternative packaging options, particularly for food packaging. If the net effect is a change in the type of containment, this may result in stable municipal waste tonnages but a change to waste composition, assuming the revised containment is recyclable.
These issues have been addressed in the Government's resource and Waste Strategy; however, since they will be subject to consultation, it is difficult to derive conclusions as to their potential impact at this stage.

Potential impacts from Brexit
The Department for Exiting the European Union (DEXEU) has confirmed that all EU legislation which has not already been transposed into UK law will be transferred to UK statute, including current regulations governing waste, packaging, waste electrical and electronic equipment (WEEE) and landfill. However, DEXEU has also stated that 'Following integration into UK law upon departure, all EU environmental laws will be open to being "amended, repealed or improved"'. The UK is therefore free to decide the future of its waste policy and laws.

This freedom has given rise to uncertainty over the future of environmental legislation and policy post-Brexit. This is due to the methodology which will be utilised to "amend, repeal or improve" the current Regulations, with Ministers, utilising secondary legislation to amend or repeal primary legislation without parliamentary scrutiny. This may limit the ability of the wider waste sector to influence policy decisions, and may also lead to politically motivated policies being introduced which impact on local authorities' municipal waste activities.

A further concern is that at present, the UK is reliant on enforcement from both the European Commission and the European Court of Justice (through the threat of heavy fines) to ensure that environmental standards and targets are met. The Government will therefore need to consider the means by which environmental commitments are given effect in domestic law, and the scope and scale of the regulatory and accountability systems by which the UK is held to adhere to the standards set. Will this involve an enhanced role for the EA, or will a new regulatory department be created? Environment Secretary Michael Gove has recently announced plans to consult on a proposal for a new,

independent body for environmental standards. The proposed consultation regarding this suggest this will be a new, independent body that will hold Government to account for upholding environmental standards post-Brexit. Further details have not yet been announced.

A further key impact of Brexit is the issue of exporting waste and recyclate to foreign markets. Currently, the adverse impact on the value of the pound has increased the cost of exporting RDF, whilst reducing the income received for recyclate. The potential impact of tariffs, dependant on the trade arrangements agreed between the UK and both the EU and the wider world have the potential to compromise the economics and/or practicalities of exporting waste.

Possible impacts from alternative recycling metrics and Carbon Impacts

One aspect of the CE approach is the exploration of whether recycling activities should be more focussed on those materials whose recycling represents the maximum environmental benefit, rather than simply collecting the heaviest elements of the waste stream. Under this approach, instead of an absolute target for recycling, individual material streams would have their own target, which could include packaging waste. The streams would be linked to the best environmental option for that particular material. Metrics such as carbon or residual waste production would provide a fairer reflection of environmental performance, and also help to level the playing field between urban and rural authorities.

The use of carbon metrics would allow authorities to make more holistic decisions regarding recycling and reuse, and to prioritise overall environmental performance and the capture of resources which represent the best environmental outcome. This would resolve the current situation where local authority recycling performance is solely based on the weight of waste they reuse, recycle or compost/digest as a percentage of the total weight of waste they collect. This system encourages councils to “chase” the heavier waste materials, regardless of the overall environmental benefit, seen most clearly in the expansion of garden waste collections.

This could result in a major revision of the collection services offered by local authorities.
Taking this further, with emissions from waste services contributing in the region of 35% of an authority’s total carbon emissions, reviewing the carbon contribution of a total waste service could become an appropriate measure of environmental benefit. Carbon is often used as a proxy for environmental impact, particularly because materials and processes that have a high carbon footprint often involve wider environmental impacts due to high energy consumption, e.g. mining, processing, transport, etc. This would require the carbon impact of waste collection methodologies to be incorporated, incentivising the use of low-carbon vehicles powered by electricity, gas or other technological solutions.

Possible impacts from Chinese import restrictions

More recently there are concerns that the announcement from China to ban plastic waste and unsorted paper imports (as part of a ban on important 24 types of material) could see the UK stockpiling waste, or having to send waste to residual disposal routes instead. Until recently, China had lower standards for receiving recyclable waste material, making it an easy choice for the UK to help reach higher recycling rates and reduce landfill. However, with a ban enforced at the end of 2017, on plastics such as polyethylene terephthalate (PET) drinks bottles and all mixed paper, including increased quality control on cardboard, pressure will be put on the British recycling industry.

How will the market for secondary materials change in the next 5+ years?

The secondary materials market will continue to be about:

- Quality of materials and how they are collected – this will drive saleability, value, regulatory compliance and the development of waste as a reliable secondary material source.

- Ownership of materials along the value chain will be integral to the development of a coherent supply chain; strategic collection contracts will be developed with quality-based SLAs to provide a reliable feedstock for treatment and reprocessing facilities.
- Type of materials; the expansion of mixed plastics collections and food waste will drive increased recycling rates in the short term – provided markets can be found for the plastics.
- The adoption of carbon metrics will incentivise more focus on textiles and re-use, whilst the circular economy will drive Waste Electronic and Electrical Equipment (WEEE) collections to enable the extraction of critical raw materials in the longer term.
- Recent trends have seen municipal composition changing dramatically, with paper reducing and cardboard increasing due to reduced newsprint uptake and increased internet shopping. However, the reduction in paper may be slowed by the recent focus on plastic packaging and single use plastics which may be replaced by paper/board-based products.
- Plastics (petroleum based) are likely to reduce in the longer term, although this trend is closely linked to oil prices, an increase in plant-derived cellulose packaging and potential government initiatives.
- Infrastructure; with the impact of China's import restrictions and the potential effect of Brexit, it is likely that development will focus on treatment and reprocessing capacity. This will include MRFs and 'mini MRFs' to enable sorting of materials to high quality standards, along with enhancement of waste transfer and bulking sites.
- Further reprocessing facilities for plastics and food waste will resolve export issues and enable the production of energy from waste.
- The export market for RDF is considered to be stable for the next 5 years, but represents a significant UK investment opportunity.

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