Appendix B. Climate Emergency Action Plan – Carbon Assessment Methodology and Assumptions

Where possible all data is gathered from official government figures, to the most local possible level. Unfortunately, with the limited availability of data in some areas or the complex, untethered nature of some of the actions, with how they interact and interlink with other actions, it is not possible to allocate specific savings to each one separately. These targets are therefore noted in the main plan as "Included in total" as they contribute towards the overall goal of that section. However, where possible to specifically identify savings underneath each major action, these are also defined below. Total savings from each overall action, reflecting those used in the summary tables in the main document, are highlighted in bold.

The most up to date data is used for every action where available, however this can cause differences in some cases where some government figures are more up to date than others. This is accounted for as much as possible within the calculations to demonstrate the savings which are generated from the additional benefit derived from these actions.

The most recent DESNZ data for the borough of 2020 is used as the baseline total for this report.

Carbon Emissions Trajectory

Carbon emissions trajectories are used to identify the expected outcomes from the combined actions of the council and all residents. These are best estimates as it is impossible to make exact predictions.

Current business as usual (BAU) projections from SCATTER, following a methodology based on numerous government strategies and incorporated targets and using 2019 BEIS data, estimate a 10% reduction by 2030. This has changed from previous iterations as it is now based on a more bottom-up approach, in order to minimise double counting by ensuring savings from government strategy do not overlap with those from council actions. It also enables the council to focus more on the direct actions and impacts we can have as a council beyond national policy impacts. There are numerous approaches possible for this process as all are based on estimations, with both the current and previous approaches utilised by other councils successfully.

The government is continually reviewing policies and is likely to make additional changes, which will also be incorporated into our carbon accounting methodology and projections once they are realised. The carbon emissions BAU trajectory is expected to change year by year, as it will be impacted by new government policies, and national and global events (e.g. COVID-19 pandemic), therefore this should be used as a reference rather than an absolute figure.

For example, the proven effectiveness of working from for many companies during the pandemic in 2020 is expected to continue and provide a large decrease in emissions from commuting. However, this remains a live document which we review and will update as required, alongside BEIS updates which are released annually but backdated 2 years.

Transport

Targets here are based around the vital overall goal of reducing ICE (internal combustion engine) mileage, both for private and commercial purposes, along with a separate section for the overarching strategy. They are therefore split under these 3 primary areas (1A,B and C), with the sub targets all contributing towards the main goals by a percentage (eg contributing 10% of the 50% total reduction).

Targets here are all inevitably slightly interlinked, but this methodology has been chosen to minimise double counting where possible. These are stretched targets which are aimed for in order to minimise emissions

where possible, though there remains a deficit in some areas, such as reducing travel and train usage actions, where we recognise more action is needed to meet these figures.

Currently the total mileage covered by private ICE vehicles (excluding freight) is 475,240,000 miles. Therefore, a 50% reduction in this total mileage represents a saving of 237,620,000 miles, which is broken down against the total number of petrol/diesel cars and motorbikes in the borough, as each has a different level of emissions per mile travelled and average annual distance covered. By using these figures, the total savings for each vehicle type has been calculated and added together to get the total savings possible. In this way the estimate is more accurate than using an average savings per mile covered across each type.

This is outlined more clearly in the below table:

Project	Current amount (per year)	Average usage (per year)	Current total figure	Target total figure	Total Reduction	Carbon Saving Units	Carbon Saving per unit	Total Carbon Saving (tCO2e)
50% Reduction in petrol private car mileage	66100	4741	31,338,0100	156,690,050	156,690,050	kg/Miles	0.29103	45,601.50
50% Reduction in diesel private car mileage	33900	4741	160,719,900	803,59,950	80,359,950	kg/Miles	0.27901	22,421.22
50% Reduction in private motorbike mileage	38000	30	1,140,000	570,000	570,000	kg/Miles	0.16559	94.3863
50% Reduction in ICE vehicle mileage	138000		475,240,000	237,620,000	237,620,000	kg/Miles		68,117.12

Within this total saving of 68,117.12 tCO_2e, this total target is then split into a number of actions which will each contribute towards a percentage reduction of the initial total mileage.

Action 1A.1: 33% Reduction From EV Registration

- 33% of total ICE mileage will be reduced by switching to electric vehicles instead.
- 33% of the total 68,117.12 is **44,957.29 tCO_2e**
- Importantly, the initial total mileage figure excludes current EV mileage as this does not apply to ICE miles.
- This target has been arrived at following consultant analysis and expected EV registration numbers by 2030.

Action 1A.1.3 - Review the residential charge point infrastructure for those who have communal parking facilities such as flatted developments.

- This is currently anticipated to deliver at least 136 new charge points.
- Each socket is estimated to save 5775kg of CO_2e per year
- This therefore represents potential savings of **785 tCO_2e per year** (5775/1000*136)

Action 1A.1.5 - Support local businesses, including commercial property owners, to transition their commercial fleets to EV and encourage their employees to switch to EV for private use to achieve a 20% transition to EVs.

- In 2017 it was found that 40% of all vehicles in the UK can be considered as grey fleet. In Wokingham Borough that would mean that 40,000 cars are used predominantly for commuting and business travel (100,000 x 0.4).
- The target aims to support the transition of 20% of this fleet 8,000 cars to EV (40,000 x 0.2).
- Average commuting miles in the UK is 788 miles annually. Therefore this 20% travels 6,304,000 miles every year (8000 x 788).
- Assuming the majority of these cars are petrol the emissions produced from this travel is **1,834.6 tCO_2e per annum** ((6,304,000 x 0.29103)/1000). This is the amount that could be saved by transitioning 20% of commuting vehicles to EVs.
- More information will be available at a later stage as we identify the number of taxis businesses operating in in the borough and the feasibility of these transitioning to EV.

Action 1A.1.7 - Coordinate the installation of EV charging points into both council buildings and private or commercially owned land, in line with the EV network plan approved in the strategy.

- While the overall savings are included in the total, the total currently identified savings as of this report are based on the number of active sockets currently installed.
- There are currently 112 active sockets
- There are currently an additional 77 sockets planned.
- Each socket is estimated to save 5775kg of CO2 per year
- 189 * 5775/1000 = **1091 tCO2 per year**

Action 1A.2: 5% Reduction From Reduced Travel

- 5% of total ICE milage will be reduced by removing journeys from the road.
- For these targets this means removing entire car journeys as the user utilises car share opportunities instead.
- 5% of the total 68,117.12 is **6,811.71tCO_2e**
- However, current actions currently reach 5,577.34, as detailed below, meaning there is a deficit of 1,234.36 to be addressed in upcoming iterations.

Action 1A.2.1: Engage businesses to promote homeworking and remote working when possible to achieve 30% reductions of CO_2 emissions travelled from employees of local businesses by 2022

- There are a total of 60,800 Wokingham Borough residents employed in the following roles which are office based and therefore could sustain remote working behaviours which have been enforced through the COVID-19 lockdown measures in 2020.

	Wokingham (Numbers)
Managers, Directors And Senior Officials	12,600
Professional Occupations	27,100
Associate Professional & Technical	14,100
Administrative & Secretarial	7,000
Total	**60,800**

- Assuming 30% of the (18,240 people) office-based workforce can maintain remote working or active travel to and from work this could lead to huge annual reductions in local car travel and associated emissions.
- In England in 2018, the average person travelled 788 miles per year for commuting purposes by driving a car or van. 14.4 million miles are therefore travelled each year by 30% of this sector of the workforce (788 x 18,240).
- Multiplying this mileage by 0.29103KgCO_2 of emissions per mile by an average petrol car ((0.29103 x 14,400,000)/1,000) means that 4,183 tCO_2e could be saved per annum if sustained.

Action 1A.2.2 - Promote the Liftshare scheme through My Journey to help individuals and businesses develop bespoke travel policies

- The target is to achieve a 10% reduction in the number of car/bike trips to and from businesses within the borough by March 2025 by implementing a lift share scheme.
- Using the above data in 3.1, but based on a 10% figure instead, total savings for this target are **1,394 tCO_2e per annum**

Action 1A.3: 2% Reduction from Increased Public Transport Use

- 2% of total ICE mileage will be reduced by switching to use buses or trains instead.
- 2% of the total 68,117.12 is **2,724.68 tCO_2e per annum**
- This figure is based on doubling bus and train usage numbers, as detailed below.
- However, as there are no actions around trains at this time, these savings have been temporarily removed, meaning actions currently reach 173.73 as detailed below, meaning there is a deficit of 2,550.95 to be addressed in upcoming iterations, primarily from trains.

Action 1A.3.1: Double Bus Usage

- There were 2,800,000 bus passengers recorded for 2019 in Wokingham. The kilometres travel on local bus services accounted for 2,200,000 km/year. The average km per passenger per year is therefore 0.79 km.
- Buses emit 103.0 gCO_2 per passenger per km, multiplying this by the average km per passenger per year (0.79) equates to 81 gCO_2 emissions per passenger per year.
- The average petrol car emits 180.8 gCO2 per km. Multiplying this by the average km per bus passenger per year (0.79) equates to 142.9 gCO2 emissions per passenger per year.
- We are assuming residents are replacing a car journey with a bus journey for this action. Therefore, the new 2,800,000 bus passengers will have reduced their carbons emissions from a private vehicle (2,800,000 x 142.9 gCO2), this equates to 400.01tCO2 per year.
- Multiplying the emissions per bus passenger per year (81 gCO2) by the number of bus passengers recorded for 2019 (2,800,000) equates to 226.8 tCO2 per year.
- Therefore, the difference from switching from cars to bus for this many people would save (400.01-226.8)= 173.3 tCO_2e per annum.

Action 1A.3.9 - Re-optimising the routes and capacity for school buses by re-tendering the contracts.

- Initial 14 routes covered 93,750.49km per year
- Multiplied by the kg per km for euro6 buses (0.04) or 0.265 for one diesel route covering 6,054.33
- This equates to 5,114.22 $kgCO_2e$
- New 8 routes cover 52,042.83km per year
- Multiplied by the same emissions factors (including identical diesel route)
- This equates to 2,562.83 $kgCO_2e$
- Therefore the change has resulted in 2,551.38 $kgCO_2e$ of savings, or **2.55 tCO_2e per annum**

Action 1A.4: 10% Reduction From Increased Active Transport use

- 10% of total ICE milage will be reduced by switching journeys for active transport methods such as walking and cycling.
- 10% of the total 68,117.12 is **13,623.42 tCO_2e per annum**
- However, current actions currently reach 16,163.4, as detailed below, meaning there is a surplus here of 2,539.97 which could cover some of the previous sections' deficits (in terms of carbon accounting towards the overall savings estimates by 2030).

Action 1A.4.1 - To provide more primary school children with the opportunity to develop practical skills and an understanding of how to cycle safely, leading to greater chance of adoption, both now and in the future.

- Currently there are approximately 2000 children trained across all levels of bikeability at the boroughs primary schools each year.
- On average, children travel 1.6 miles to primary school[1]. Multiplying these figures together means 6,400 miles are travelled per day to and from school by these children ((1.6 x 2000) x 2).
- There are 190 days in an academic year meaning this small group of children will be travelling 1,216,000 miles per year (6,400 x 190). If assuming these children will all transition from being driven to and from school to cycling to and from school:
- Multiply this figure by the carbon emissions produced per mile driven in an average sized petrol car ((1,216,000 x 0.29103$KgCO_2e$)/1000) to find that **353.89 tCO_2e** emissions could be saved per academic year

Action 1A.4.2 - Encourage and support local schools to join Modeshift Awards scheme for active and sustainable travel to achieve a 10% reduction in the number of children being driven to school by March 2026.

- There are 21,757 children in the borough who attend a state primary or secondary school in the borough. 35.79% are driven to school equating to 7,786.8 pupils.
- A 10% reduction of those being driven is therefore 778.7 less pupils being driven to school.
- Children travel on average 3.2 miles a day to and from primary school in England. Multiplying this figure by the 10% reduction aimed for is 2491.8 miles travelled per day (778.7 x 3.2).
- This is then multiplied by 190 (school days) to calculate annual mileage by this cohort 473439.3 miles per academic year (2491.8 x 190).
- Finally this figure is then multiplied by the emissions per mile produced from an average sized petrol car shows potential savings of **137.7tCO_2e per annum** ((473439.3 x 0.29103)/1000).

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/476635/travel-to-school.pdf

Action 1A.4.3 - Role out the Healthy School Streets programme to help achieve a further 10% reduction in the number of children being driven to school by March 2026.

- See the calculations for Action 1.4.2 as this follows an identical calculation.

Action 1A.4.4 - Increase the uptake of cycling from local business by promoting the Love to Ride programme to reduce the CO2 emissions from a driven commute by 5%.

- There are 85,900 economically active residents in Wokingham Borough. We are assuming they all currently commute to work in this calculation.
- 63% of residents in Wokingham Borough usually drive to work, equating to 54,117 residents.
- A 5% reduction and shift to active transport for work would be 2,705 people who usually drive to work.
- The average annual mileage for commuting is 788 miles. Multiply these figures together equates to 2,131,540 miles a year (2705 x 788).
- Multiplying this figure by the emissions per mile of an average petrol car shows that **620 tCO_2e per annum** can be saved a year from this amount of people shifting their annual commute to zero emission modes ((2,131,540 x 0.29103)/1,000).

Action 1A.4.5 - Develop the Local Cycling and Walking Infrastructure Plan (LCWIP) to be borough wide and implement 50% LCWIP by 2030 to increase cycle modal share by 4% and increase walking modal share by 5%.

- The total annual mileage in the borough by all modes is 475,240,000.

Cycling

- National Modal Share by distance travelled for cycling is 1%. This equates to 4,752,400 miles in Wokingham Borough (475,240,000*0.01).
- The target increase to 5% share would mean a rise to 23,762,000 miles being cycled rather than driven (475,240,000*0.05)
- This is a difference of 19,009,600 miles (23,762,000-4,752,400)
- Multiplying this figure by the emissions per mile of an average sized petrol car means saving up to 5,532.36 tCO_2e per annum ((19,009,600 x 0.29103)/1,000)

Walking

- National modal share by distance travelled for walking is 3%. This equates to 14,257,200 miles a year in Wokingham Borough.
- An increase to 8% of modal share would be a further 23,762,000 miles a year walked instead of driven (4,752,400*5)
- This would mean 6,915.45 tCO_2e could be saved annually ((23,762,000 *0.29103)/1000)
- Therefore the total savings from this action would be 12,447.81 tCO_2e per annum

Action 1A.4.6 - Deliver engagement and cycle training events across the Borough to achieve a 2% increase in the number of Wokingham Borough residents regularly walking and cycling for leisure and utility by March 2022 (excluding over 60s).

Cycle

- In 2019 it is thought that 38% of Wokingham Borough residents cycle at least once a week. We have clarified this target by using only the working age population of the borough 103,000 as

children and over 60s are covered in other targets. 38% of this figure is 39,140 residents cycling at least once a week (103000 x 0.38).

- A 2% increase will be 2,060 more residents cycling regularly.
- The average length of a cycle ride in the UK is 3.3 miles. Therefore, weekly mileage from this 2,060 residents is 6,798 miles a week cycled (3.3 x 2060), assuming this is instead of driving.
- Multiplying this figure by the emissions per mile of an average petrol car and further multiplying this by 52 weeks in a year equates to annual emissions of these journeys if driven to be 102.88 tCO_2e per annum (((6798 x 0.29103)x 52)/1000).

Walking

- 92% of Wokingham Borough residents walk at least once a week which is 94,760 people.
- A 2% increase is 2,060 residents.
- Annually, the average walking miles for people living in 'rural towns and fringe' regions is 183 miles or 3.5 miles per week.
- Therefore this 2% increase in residents walking will save 376,980 miles (183 x 2060) which would have otherwise been driven (assumption).
- These miles, if driven, would emit a total of 109.71 tCO_2e per annum ((376,980 x 0.29103)/1000).
- Therefore the total savings from this action would be **212.59 tCO_2e per annum**

Action 1A.4.7 - More residents over 60 riding bikes for travel to achieve a 3% reduction in car use by residents over 60.

- 39,468 residents who are 60 or over according to the mid-2019 population estimates.
- Assuming an average annual mileage driven is 4741 miles. Total miles for this group is 187,117,788 a year (39,468 x 4741)
- A 3% reduction on this would represent a fall of 5,613,533.64 miles (187,117,788*0.03)
- Emissions for this amount of mileage is 1,633.71 tCO_2e per annum ((5,613,533.64 x 0.29103)/1000).

Action 1B: 22% decrease in road freight

- An Industrial Freight Management policy designed to reach this 22% reduction target would reduce Van and Lorry total mileage.
- This would save a total of **23,240.92 tCO_2e**, as detailed in the table below.
- There is also a new target around cargo bikes, though savings for this have yet to be attributed.

Project	Current amount (per year)	Average usage (per year)	Current total figure	Target total figure	Total Reduction	Carbon Saving Units	Carbon Saving per unit	Total Carbon Saving (tCO2e)
22% reduction in Van mileage	8,400	13,000	109,200,000	85,176,000	24,024,000	kg/Miles	0.41028	9,856.56
22% reduction in Lorry mileage	700	62,751	43,925,700	34,262,046	9,663,654	kg/Miles	1.38502	13,384.35

Renewable Energy Generation

Emissions from fossil fuel burning to supply electricity remains a significant contributor to the borough's emissions, as the majority is provided via the national grid and hence emissions are calculated based on the current composition of energy providers which feed in to this. Therefore, by generating our own renewable energy through large schemes such as solar farms, this can be fed back into the grid and reduce the overall requirement and composition of fossil fuel provision. Hence, this is the method used for calculating the savings possible, identifying how many tCO_2e the renewable generation in our borough will reduce the need for such alternatives.

Action 2.1 Increase the generation of renewable energy through investment in solar farms to generate 49,000 MWh per year

- The current trajectory for the solar farm estimates that 2 farms will generate approximately 49,000,000 KWh per annum of electricity by 2030.
- Using the UK Government GHG Conversion Factors[2], 0.19338 kg CO_2e is emitted for every KWh generated by the current grids composition (including fossil fuels).
- In addition transmission and distribution losses add an additional 0.01769 kg CO_2e emitted for every KWh, making a total of 0.21107 kg CO_2e.
- Hence, replacing these fossil fuel related emissions with 49,000,000 KWh generated from purely renewable sources, with 0 emissions, will save **10,342 tCO_2e** (0.21107 x 49,000,000 / 1000).
- Emissions here are associated with the generation of electricity at a power station and do not include transmission and distribution for simplicity, though this figure would be marginal.

Action 2.1.1 – Solar Farm 1 at Barkham

- This is estimated to deliver 29,000 MWh of the 49,000.
- Using the same above calculations this represents savings of 6,121 tCO_2e.

Action 2.1.2 – Solar Farm 2

- This is estimated to deliver 20,000 MWh of the 49,000.
- Using the same above calculations this represents savings of 4,221 tCO_2e.

Action 2.2 Increased renewable energy generation to generate equivalent to 1550 kWh per household

- The projected pathway data provided by SCATTER, refers to the anticipated generation calculated in 2030. Total small-scale solar PV is calculated in TWh generated, based on defined rates of total installed capacity (GW). The TWh/GW capacity generation efficiencies from 2017 - 2030 are taken from the National Grid's Two Degrees scenario (2019) for large scale solar PV, but the year on year rates of change are applied to the domestic / small scale solar PV recorded.
- The estimated annual generation for the borough by 2030 from the above via SCATTER is 106,938.43 mWh per annum.
- As of 2020 the borough generated 30,763 mWh of renewable electricity.
- This means a difference of 76,165 mWh.
- This will therefore account **for 16,078 tCO_2e per annum** (0.21107/1000 x 76,165)

[2] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022

Action 2.2.1 Set up a Community Energy Fund for Wokingham, and through this generate an average of 27,000 kWh/year of renewable energy from the installation of small-scale PV systems funded through this scheme.

- This energy generation relates to an estimated carbon saving of **5.69 tCO_2e per annum** (0.21107 x 27,000 / 1000)

Action 2.2.2 Support residents to reduce their energy usage and carbon emissions and increase the uptake of renewable energy installations

- It is estimated that 15,000 households apply for funding for the installation of PV by 2030.
- Typical small-scale UK installations are around 15 to 25 square metres. A 3kWp system could comprise 15 panels taking up an area of 20 square meters and will generate roughly 2,500kWh per annum[3]
- Therefore 15000 would generate 37,500,000 kWh.
- This equates to estimate carbon savings of **7,915 tCO_2e per annum** (0.21107 x 37,500,000/1000).

Action 2.2.3 Support local businesses to reduce their energy usage and carbon emissions and increase the uptake of renewable energy installations

- Through a combination of measures, a 5% reduction in emissions from industry and commercial buildings emissions would lead to a saving of 5.5kt, or **5,500 tCO_2e per annum.**
- This is as the current emissions are 110kt, so this is multiplied by 0.05 to find the above.
- This is on top of some of the additional and separate actions on retrofitting.

Savings this year:

- With the generation of 27,113 MWh renewable electricity in the last recorded year (2021)[4], the borough saved 5,722 tCO_2e against fossil fuel sources (27,113*0.21107).

Retrofitting Domestic and Commercial

Action 3.1 Gorse Ride Regeneration Project

- The Gorse Ride development consists of the state regeneration of 249 houses which will be design to net-zero carbon standards with no supply of domestic gas.
- There were approximately 70,000 households registered in the borough in 2019.
- It is assumed that the carbon footprint per house is 3.67 tCO_2e (256.7/70,000*1000).
- The 249 houses in this regeneration project will therefore provide savings of **913.83 tCO_2e per annum** once completed (249 x 3.67).

Action 3.2 Improve energy performance of council housing stock

- A bid for retrofitting 1,100 of council owned homes from EPC D to C has been successful.
- This represents a saving of 2.936 tCO_2e per house (detailed in 4.4 below).
- 1,100 * 2.936 = **3,229 tCO_2e per annum**

[3] Renewable Energy Sources, Carbon Trust 2018

[4] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1115981/Renewable_electricity_by_local_authority_2014-2021_Nov22update.xlsx

Target 3.3 By 2029 all local schools will be retrofitted

Council Baseline (2018)	Electricity kWh	Electricity tCO_2e	Gas kWh	Gas tCO_2e
Schools	9,284,409.41	1795.42	13,026,155	2605.23
			Total CO2 emissions schools	**4,400.65**

- Energy figures for schools for electricity are 9,284,409.4 kWh per annum and gas 13,026,155 kWh per annum as per 2018 baseline.
- Considerations for transmission and distribution factors have already been accounted for in the council estates and corporate portfolio carbon footprint.
- Therefore, electricity related emissions for schools are 2,373.10 tCO_2e and gas related emissions are 2,660.98 tCO_2e per annum.
- Therefore, total potential savings are **4,400.65 tCO_2e per annum.**

Target 3.4. 75% of Homes to be EPC C rating or above

- Government EPC figures show that there are currently 57,383 EPC certificates for the borough (2022)
- 27,485 of these are currently rated C or above, which is 47.89%
- Aligning this to the 70,000 homes figure from previous calculations, to account for homes missing certificates, this would relate to 33,600 homes.
- Reaching 75% of 70,000 would mean 52,500 homes at C rating or above.
- This is therefore an increase of 18,900 homes.
- As the majority of ratings below C are in the D category, this has been used to find the average savings from improvement.
- It is suggested that going from EPC rating D to C can reduce emissions by up to 80%.
- This would be savings of 2.936 tCO_2e per house, (out of the total 3.67 from, above).
- 2.936*18,900 is **55,490.4 tCO_2e per annum**.

Carbon Sequestration

Action 4.1 Cover 170 hectares with new trees in the form of woodlands, hedgerows and orchards

- This has a carbon sequestration potential of 7.83 tonnes of CO_2e equivalent per hectare in first year of planting, 13.7 tonnes thereafter within the research average.
- Therefore 170*13.7 = **2,329 tCO_2e per annum**

This is the estimated yearly saving, 2 years after project completion. Trees planted for the project will be UK and Ireland Sourced and grown. This will help with reducing the risk of pests and disease as well as reducing the carbon emissions related to transporting trees from overseas.

Action 4.2 Carbon sequestration by design - improving carbon sequestration rates in future land management decisions

Action 4.2.1 Develop the Wokingham Borough Tree Strategy to support long-term creation and retention of woodland and trees.

- Allocated sites within current iteration of the LPU sum to 460ha. On the basis that approximately a quarter of this is nudged towards being green infrastructure with a high carbon sequestration rate (mix of woodland and species rich grassland with roughly 8 tCO_2e per ha sequestration rate) and half the green infrastructure is delivered by 2030, the policy and strategy focus will cause 460 tCO_2e benefit by 2030.
- Alongside this, if the Local Nature Recover Strategy and Natural Flood Management approach can tilt the balance that an additional 20ha of land use change (at a similar sequestration rate to green infrastructure above) is supplied to the BNG and environmental services markets by 2030 then this will lead to another 160 tCO_2e per year.
- Total estimated carbon sequestration **660 tCO_2e per year**.
- Improving the retention rate of trees and encouraging planting of woodland on private land - The longer trees are standing the longer carbon is locked up.

Action 4.2.2 Include in the Local Plan Update policy for carbon sequestration potential.

- Assuming roughly 70ha of green infrastructure created in the LPU cycle. A nudge of 10% cover from high intensity maintenance grassland to low intensity species rich, brought about by good design guiding, could sequestrate a further **42 tCO_2e per year**.

Action 4.2.3 Develop the Local Nature Recovery Strategy to provide complementary funding source to aid land use change (LULUCF being a carbon sink)

- On assumption that an average of 2.5 units per ha (not including current woodland area) can be generated @ £15,000 per unit, the 5% uplift on a LNRS (over and above the national strategy area) would generate value on the biodiversity potential of £5,276,250

Action 4.2.4 Develop a Natural Flood Management partnership and scheme

- Within Natural England's Research Report 43, the change of use from arable land to wetland has examples of carbon sequestration rates of circa 8 to 17 tCO_2e per hectare per year.
- Working from figures in the report, on the basis that soil carbon loss under agriculture might be at a rate of 0.6% per year and carbon stocks for this habitat average 43 tCO_2e per hectare, natural flood management measures that prevent degradation might prevent 0.25 tCO_2e per hectare being released into the atmosphere.

Action 4.2.5 Work to transition Grassland Management to less frequent cutting scheme allowing wildflowers to bloom and set seed

- A goal of **642 tCO_2e per annum** would be targeted to be met in the period 2025 to 2030, similar to the below calculations.

Action 4.2.6 Work to transition Grassland Management to support the Restoring Biological Processes

- Converting 1/3 of the approx. 125ha of improved grassland within Environmental Localities portfolio to species rich grassland on a once a year cut could sequester an additional 242 tCO2e per year (33% of 125 x 5.87, for conversion rate of improved to pollen and nectar mix from NERR043).
- Converting rural highways verge to cut and collect, estimate of 4 tonnes per hectare would equate to 400 tonnes CO2e per year for 100% conversion. 5% pilot is estimated to have the potential to sequestrate 20 tonnes of CO2e per year.
- Therefore, a total of **642 tCO_2e per annum** would be sequestered**.**

Action 4.2.7 Implement Citizen Science Engagement for Hedgerow Restoration

- One mature oak tree is estimated to be 10.5 tCO_2e. If hedgerow restoration can be encouraged through use of a streamlined assessment and interpretation tool and this nudges to increase the % of hedgerow with oak standards up by just 1% in the borough, this will equate to (approximately) an additional 3,200 tCO_2e captured over the next 70 years.
- 300 extra open growing oak trees (or equivalent are planted by 2025 with a pro rata tCO_2e sequestration rate of **45 tCO_2e per annum.**

Savings this year:

- Alongside hedgerows and grassland management, the 40,242 trees planted since October have contributed towards offsetting at least an estimated 6,036 tCO_2e (40,242*0.15)
- This figure per tree is an estimation as it is impossible to exactly calculate and there are no figures available for this exact situation and an estimate must be made for the figure over time. The closest to our current case (in terms of young trees annually) is that over the first 10 years the young tree would sequester approximately 0.058 tonnes of carbon overall[5]. At the 10 year stage this becomes an average of 0.02kg per year and so over 5 years cumulates to 0.1 tonne sequestered. Therefore over 15 years this would exceed the 0.15 tonnes. However this will vary and is an average across many different species, conditions, tree lifespan etc, as individuals could live longer or shorter depending on the situation.

Waste & Recycling

The figures used here are calculated based on the premise that preventing the loss of recyclable material means less goes to landfill sites and less is produced, removing the emissions from these processes.

While there are still some emissions from the process of recycling the material itself, these are considerably lower and have been accounted for in the calculations as shown below. All figures are reduced to 2 decimal places for simplicity within this document, although more precise numbers were used to calculate totals, which is why there are some marginal discrepancies.

All figures are based on government figures on GHG reporting where available[6], or from strong online secondary data where required, with the references outlined in the appendix. These are generally in line with the WRAP Conversion Factors too, with these being referenced in the government data tables. While the recycling processes themselves may occur outside the borough, it is the decisions and actions of residents within the borough which allow such actions to happen, therefore meaning they fall into our scope. These savings are calculated to show the potential annual savings per year, therefore acting against the overall emissions and eventually contributing towards the net zero goal. Each of these has been done for the current year due to the considerable changes in actions and results from covid meaning these are the most accurate available, along with these not being within the scope anyway so not affecting the 2019 vs 2030 comparisons directly.

Action 6.1 - Achieve 70% recycling target.

[5] https://2ea.co.uk/planting-trees-understanding-its-role-in-carbon-offsetting/#:~:text=Young%20trees%20can%20absorb%20around,around%2021.7kg%20of%20CO2

[6] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022

- The current rate of recycling is 53% so a 17% increase will be required across all areas.
- Currently the total waste is 65,709, so 70% of this would be 45,996.
- The current recycling tonnage is 34,757.
- So a 17% increase to reach 70% represents an increase of 11,239 tonnes of waste going to recycling rather than landfill.
- 446.20 kgCO2e is emitted from mixed residual waste going to landfill.
- The average emissions from the waste within this being recycled within a closed loop is 21.28 kgCO2e
- 1,622.57 KGCO2e is emitted per tonne of raw material produced (average of others as no official figures available).
- 446.20+1,622.57-21.28 = 2047.49 kgCO2e
- 11,239 x 2047.49 = **23,011.74 tco2e saving per year**

Action 6.1.1 Implement a new waste and recycling collection system with improved facilities.

- Within this wider strategy, one element is to switch waste collections to bi-weekly to reduce costs and emissions.
- This will result in carbon savings of 2,415 tco2e per year, as calculated by the consultant eunomia. This is based on the same WRAP[7] figures used by the government figures we use for the rest of the calculations, so remains a strong estimate.
- This figure is based on the following breakdown, comparing goods being in a closed loop or equivalent compared to going to landfill:

Item	CO2e Saving	Saving per tonne	Tonnage Saving
Dry Recycling	1,750	1.146	1527.05
Residual Waste	888	0.446	1991.03
Organic Recycling	193	0.587	328.79
Contamination	-91		
Transport	-325		
Total	2,415		3846.87

Action 6.1.2 Improve residents' engagement with waste and recycling initiatives via partner Green Redeem

- By renewing garden waste we therefore expect a similar amount of green waste to be collected and recycled.
- Current amount is 11,748.67 tonnes
- 578.94 $KgCO_2e$ is emitted per tonne of garden waste going to landfill.
- 21.28 $KgCO_2e$ is emitted per tonne of garden waste being composted.
- As this is garden waste there is no raw material to substitute for.
- 11,748.67*(578.94-21.28)/1000= 6,551.76 tco2e saving per year

- An average of 825 people engaged per post on social media in the baseline year, which is 330 households (825/2.5 average people per household)
- If this many people were to follow the advice and subsequently increase their recycling amount and quality by 10% it would lead to:
- (0.22) * 0.1 * 330 = 7.31 tco2e saving per year
- 7.31+6,551.76 = A total of **6,559.07 tCO_2e savings per annum**.

[7] Carbon Waste and Resources Metric | WRAP

Action 6.1.3 Target low participation areas to increase food waste tonnage to increase participation above 70%

- Current amount is 6082.18 tonnes
- Based on the % change figures in 7.1 above, if this were to increase by 17% in line with all other recycling, this would increase to 7,116.15 tonnes (6082.18*1.17)
- This is an increase of 1033.97 tonnes
- 626.85 $KgCO_2e$ is emitted per tonne of food waste going to landfill.
- 21.28 $KgCO_2e$ is emitted per tonne of food waste being recycled.
- 680 KGCO2e is emitted per tonne of raw material produced on average in Europe.
- (680+626.85-21.28)*(1033.97/1000) = **1,329.24 tCO_2e savings per annum**.

Action 6.1.4 Increase & improve facilities for glass recycling

- Current amount is 3591.17 tonnes of glass recycled.
- The average UK household uses 500 glass bottles and jars every year[8], which equates to 113kg of glass (8oz per glass bottle)
- Again aiming for 70% of households to recycle all of this (or 70% in total for all households) would mean 5,537 tonnes of glass (113*70,000*0.7)/1000
- 8.93 $KgCO_2e$ is emitted per tonne of glass going to landfill.
- 21.32 $KgCO_2e$ is emitted per tonne of glass being recycled.
- 670 KGCO2e is emitted per tonne of raw material produced.
- (670+8.96-21.32)*(5,537-3591.17)/1000 = **1,279.65 tCO_2e savings per annum**.

Action 6.2.1 – 3% of total waste going to landfill by 2030

Assuming 27% of the remaining waste (after 70% goes to recycling) is used for combustion to produce energy rather than recycling then savings here arise from the prevention of landfill and related emissions and not having to burn fossil fuels.

- The remaining 27% would all be used for combustion
- Remaining amount is 0.27*65709 = 17,741.43 tonnes
- 21.32 $KgCO_2e$ is emitted per tonne from combustion
- 446.2 emitted if going to landfill as residual waste
- Nothing saved from production here.
- 17,741.43 *(446.2-21.32)= **7,537.97 tCO_2e savings per annum**.
- The current tonnage going to EfW is much higher as less is being recycled, as the recycled figure increases less will need to go to the energy.

Savings this year:

- The total tonnage last year was 71,624 and this has fallen to 65,709
- This is a reduction of 5,915 tonnes which has not been produced
- 1,622.57 KGCO2e is emitted per tonne of raw material produced (average of others as no official figures available).
- 1,622.57*5,915/1000= 9,594.13 tCO_2e saving

[8] https://www.recyclingbins.co.uk/recycling-facts/

- In addition there has been 34,757 tonnes of recycling
- 446.20 kgCO2e is emitted from mixed residual waste going to landfill.
- The average emissions from the waste within this being recycled within a closed loop is 21.28 kgCO2e
- 1,622.57 KGCO2e is emitted per tonne of raw material produced (average of others as no official figures available).
- (1,622.57+446.2-21.28)* 34,757/1,000= 71,164.61 tCO_2e saving

- 9,594.13+71,164.61 = 80,758.74 tCO_2e saving
- For the 70,000 households this is 1.15 tCO_2e each

Energy from waste:

- 26480 tonnes of waste going to EfW
- National average of 557kWh/t generated per tonne of waste input in 2020[1]
- This generates 14.75 gWh this year.

New Development

Action 7.6 From 2021, 100% council new development is built to carbon neutral standards

Action 7.6.1 All new council properties will be built to the highest efficiency standards from 2021

It is imperative that both new homes and non-residential in the council must be built to be low-carbon, energy and water efficient and climate resilient. Getting the design of the new homes right from the outset is vastly cheaper than forcing retrofit later. Government projections suggest that from 2025 at the latest, no new homes should be connected to the gas grid. They should instead be heated through low carbon sources, have ultra-high levels of energy efficiency alongside appropriate ventilation and, where possible, be timber-framed. Building new homes to net-zero carbon standards would not generate carbon savings, however, it will prevent any additional emissions.

Engagement and Behavioural Change

This section of the action plan focuses on promoting and accelerating the shift to more sustainable behaviours amongst our residents, businesses, schools and community organisations and will feed into the carbon savings achieved elsewhere on this action plan, such as increased use of public transport, as well as reducing out of scope emissions from purchases of goods and services. The majority of the actions are therefore listed as 'Neutral' for their carbon savings.

Council Emissions

Action 10.1. Reduce by 70% CO_2 emissions produced by council related travel by 2030

- A staff travel survey carried out in 2020 to WBC staff in 2020 showed that approximately 3,482,615 miles are driven to WBC workplaces annually (pre-covid).
- In addition, Council staff travelled an estimated 896,957 miles for council work this year.
- Therefore, total staff mileage is 4,379,572 per year.
- A 70% reduction in this total would be 3,065,700.4 less miles (4,379,572 x 0.7)
- This would therefore save **892.21 tCO_2e per annum** (3,065,700.4 x0.29103/1000).

Action 10.1.1 - Deliver a strategy to reduce grey fleet miles from work related trips by 30%

- Grey Fleet is a term used to describe the business miles travelled by an employee in their own vehicle. This 'fleet' of employee-owned cars is deemed 'grey' as the vehicles in use are in somewhat of a grey area of responsibility for the employer.
- Council staff travelled 896,957 miles for council work this year.
- 30% of this is 269,087.1 miles (896,957*0.3)
- Therefore this reduction would save **78.31 tCO_2e per annum** (269,087.1 x0.29103/1000).

Action 10.1.2 - Promote homeworking and remote working practices amongst council staff to reduce by 40% the CO2 emissions travelled from council staff to work by 2022.

- A staff travel survey carried out in 2020 to WBC staff in 2020 showed that approximately 3,482,615 miles are driven to WBC workplaces annually (pre-covid)
- These journeys cause the emission of approximately 1,013.54 tCO_2e each year ((3,482,615*0.29103)/1000).
- A 40% reduction of this would therefore represent **405.42 tCO_2e per annum** of savings (1,013.54*0.4)

Action 10.1.3 - Incentivise council staff to mode shift to active and sustainable transport to reduce by 30% the CO2 emissions from staff travelling to work by 2025.

- A 30% reduction would be as above but **304.06 tCO_2e per annum** of savings (1,013.54*0.3).

Action 10.2.1 Council's car fleet becomes entirely ultra-low emission by 2028.

- The council has currently 19 vehicles, of which 16 are owned and 3 are leased, as shown below:

Owned	
Hyundai 1800 2.5 CRDi 5 dr MPV	5000
Ford Connect 210 LWB 1.6 95ps Van	12000
Ford Ranger Pick-Up (54 reg.)	7000
Rodeo Denver Max D/C Pick-Up (2009)	7000
Ranger XL 4x4 TDCI	10000
Landini Agricultural Tractor	7675
Peugeot Expert Professional	7675
EV Van	7675
Ford Tourneo Connect 8-Seat Minibus	2400
Ford Transit Connect Van	7675
Vauxhall Vivaro 9 seat Minibus (2012)	7675
Ford Transit Tourneo 9-Seat Minibus (2009)	7675
Ford Transit 17-Seat Minibus	7675
Ford Tourneo Connect Trend 8-Seat Van	7675
Ford Transit 17-Seat Minibus	7675
Nissan E-NV200 Panel Van (Electric)	7675
Leased	
Vauxhall Vivaro Combi	7675
Ford Transit Connect 1.8	7675

- For vehicles with currently unknown mileage and average of known mileage was used = 7675. Please note the true value may be significantly lower.
- Total annual emissions are therefore **45.39 tCO_2e per annum**, following the GHG Accounting tool emission factors where this is used (this includes energy for the EV's).

Action 10.3 By 2030 All council CCS buildings to be retrofitted to carbon neutral standards

- The council estates / corporate property portfolio (CCS contract) energy usage figures are for electricity 24,862,000 kWh per annum and for gas 30,880,993 kWh per annum as per 2022/23. This data does not include energy figures for schools, as these are been addressed in target 15.
- Using the UK Government GHG Conversion Factors[9], 0.19338 kg CO_2e is emitted for every KWh generated by the current grids composition (including fossil fuels).
- In addition transmission and distribution losses add an additional 0.01769 kg CO_2e emitted for every KWh, making a total of 0.21107 kg CO_2e.
- The figure for gas is almost identical considering the transmission emissions, so this factor is used for both.
- Therefore, based on the below resulting emissions outlined in the table, the total carbon dioxide emissions council estates / corporate property portfolio excluding schools are **11,765.67 tCO_2e per annum (**24,862,000+30,880,993)*(0.21107/1000).

[9] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022

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