AECOM

London Streetspace Programme – Bishopsgate and nearby City Streetspace Schemes

Air Quality Modelling

Transport for London

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Delivering a better world

Quality information

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Non-Technical Summary

This report provides the results of an assessment of road traffic related air pollution impacts at selected sensitive locations due to a Transport for London (TfL) Streetspace schemes along Bishopsgate, Borough High Street and London Bridge in the City of London. The Schemes was introduced in June 2020 as an emergency response to the coronavirus and include a number of widened pavements and changes to traffic priorities. Significant changes are expected along Bishopsgate, with several sections along Bishopsgate only accessible to buses during peak hours and the banning of the several turns to divert traffic away from Bishopsgate.

The assessment is based on predicted traffic flows and speeds for a situation with and without the scheme for the year 2026. Based on the predicted changes to traffic and road layout with the proposed scheme in place, changes in pollutant concentrations are provided for selected residential properties, hotels and schools (known as receptors) within a defined study area. These buildings are located close to the road as these are the locations most likely to be affected by changes in air pollution.

The overall impact of the proposed schemes on annual mean nitrogen dioxide (NO_2) concentrations is considered to be negligible or slight at all of the selected receptors, with the exception of three receptors. One receptor, located on Byward Street is expected to experience a moderate adverse impact as a result of the scheme. This is due to an increase in traffic of ~5,000 vehicles along the adjacent section Byward Street. A moderate beneficial impact is expected at two receptors (R08 and R09) located on Gracechurch Street. Traffic flows along this street are expected to reduce by >15,000 vehicles as a result of the scheme. Along Bishopsgate, there are improvements in NO_2 concentrations due to the reductions in traffic flows which reduce emissions. Improvement in NO_2 concentrations are also expected along Borough High Street. Changes in particulate concentrations from the proposed scheme are predicted to be negligible at all receptors.

Modelled NO_2 and particulate concentrations are below the relevant air quality objective at all selected receptors with and without the scheme.

Overall, the proposed schemes are not significant in terms of traffic related air quality impacts.

1. Introduction

AECOM Limited (AECOM) has been appointed by Transport for London (TfL) to assess the impact on air quality as a result of changes to Bishopsgate, London Bridge, and Borough High Street which form part of the London Streetspace Programme (LSP) (here and after referred to as the scheme).

The scope of this assessment is as follows:

- Identify a selection of the closest potentially sensitive receptors to the proposed scheme;
- Predict concentrations of the main road traffic pollutants nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) at a selection of identified receptors with and without the proposed scheme based on traffic data for the year 2026; and
- Predict annual emissions of carbon with and without the proposed scheme for the year 2026.

1.1 Site Description

The scheme is located within the City of London. The scheme covers the area of Bishopgate from Commercial Street and Great Eastern Street to King William Street and Eastcheap. Bishopsgate is a major route within London, providing access to northern parts of London such as Tottenham. Liverpool Street Railway Station is also located to the west of Bishopsgate. There are also changes to cycle lanes and footpaths along London Bridge and Borough High Street.

1.2 Proposed Scheme

The LSP was introduced in May 2020 with the aim of providing temporary cycle lanes and additional footpaths for pedestrians to aid social distancing as a result of the COVID-19 pandemic, while also encouraging the use of sustainable transport (Transport for London, 2020). Many of the schemes which were introduced as part of the LSP are being continued despite the easing of COVID-19 restrictions as part of an experiment. The traffic schemes considered within this assessment are discussed below.

A number of traffic priority changes have been introduced along Bishopsgate (Transport for London, 2022). Sections of Bishopsgate between Cornhill and Threadneedle Street, and Liverpool Street and Middlesex Street are only accessible for buses during peak hours. Bus gates have been introduced at the entrance to these sections in both directions. A number of turns have been banned in order to divert traffic away from Bishopsgate, and footpaths have been widened to provide additional space for pedestrians. Smaller schemes are also expected along London Bridge and Borough High Street, with protected cycle lanes retained along London Bridge and several sections of pavement built out along Borough High Street between London Bridge Street and Southwark Street. The Bishopsgate scheme is the most significant scheme discussed within this report.

2. Planning Policy and Legislation

2.1 National Policy

2.1.1 Air Quality Legislation

The United Kingdom (UK) is no longer a member of the European Union (EU). Most EU legislation as it applied to the UK on 31st December 2020 is now a part of UK domestic legislation, under the control of the UK's Parliaments and Assemblies as a form of domestic legislation known as 'retained EU legislation'. This is set out in Sections 2 and 3 of the European Union (Withdrawal) Act 2018 (H.M Government, 2018). Section 4 of the European Union (Withdrawal) Act 2018 ensures that most remaining EU rights and obligations, including directly effective rights within EU treaties, continue to be recognised and available in domestic law after exit.

In Europe, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC (Council of European Communities, 2008) is transcribed into UK legislation by the Air Quality Standards Regulations (H.M Government, 2010), with amendments made in 2016. Under these regulations, the Government's Air Quality Strategy (Department of Environment Food and Rural Affairs (Defra), 2007) sets objective values for the purposes of local air quality management (LAQM). Under this regime, local authorities have a duty to carry out regular assessments of air quality against the objective values and if it is unlikely that the objective values will be met in the given timescale, they must designate an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) with the aim of achieving the objective values.

The UK's national air quality objective values for the relevant pollutants are displayed in Table 1.

Table 1 Air Quality Objective Values

Pollutant	Averaging Period	Value	Maximum Permitted Exceedances	Target Date
Nitrogen Dioxide (NO_2)	Annual Mean	40 µg/m^3	None	31/12/05
	Hourly Mean	200 µg/m^3	18 times per year	31/12/05
Particulate Matter (PM_{10})	Annual Mean	40 µg/m^3	None	31/12/04
	24-hour	50 µg/m^3	35 times per year	31/12/04
Fine Particulate Matter ($PM_{2.5}$)	Annual Mean	20 µg/m^3	None	2020

2.1.2 Clean Air Strategy

In 2019, the UK Government released its Clean Air Strategy 2019 (Defra, 2019), part of its 25 Year Environment Plan (Defra, 2018). The Strategy places greater emphasis on improving air quality in the UK and outlines how it aims to achieve this (including the development of new enabling legislation). This strategy focuses on NO_x, $PM2_5$, NH_3, SO_2 and non-methane volatile organic compounds (NMVOC). The 2019 Strategy broadens the focus to other areas, including domestic emissions from wood burning stoves and from agriculture. This shift in emphasis is part of a goal to reduce the levels of fine particulate matter ($PM_{2\ 5}$) in the air to below the World Health Organisation guideline level; far lower than the current EU limit value.

2.2 London Policy

2.2.1 The London Plan – Spatial Development Strategy for Greater London

The London Plan represents the overall strategic plan for London, and it sets out a fully integrated economic, environmental, transport and social framework for the development of the capital to 2031. It forms part of the development plan for Greater London. London boroughs' local plans need to be in general conformity with the London Plan. The latest version of the London Plan was published in March 2021 (Greater London Authority, 2022). The London Plan considers air quality in Policies SI1 (Improving air quality), SI2 (Minimising greenhouse gas emissions) and SI3 (Energy infrastructure). In relation to air quality, it is stated in Chapter 9: Sustainable Infrastructure that:

> *"The Mayor is committed to making air quality in London the best of any major world city, which means not only achieving compliance with legal limits for Nitrogen Dioxide as soon as possible and maintaining compliance where it is already achieved, but also achieving World Health Organisation targets for other pollutants such as Particulate Matter."*

The London Environment Strategy was published by the Mayor of London in May 2018 and sets out the Mayor's vision of London's environment to 2050 (GLA, 2018). The London Environment Strategy includes a number of policies and aspirations, with an accompanying implementation plan, setting out actions the Mayor is prioritising for the next five years to help implement the aims of this strategy.

Chapter 4 of this document relates to air quality. This chapter of the Strategy supersedes the 2010 Mayor's Air Quality Strategy and sets the ambitious target for London to have the best air quality of any major world city by 2050 and goes one step further than the previous strategy by requiring developments to be 'air quality positive' (GLA, 2010). To date, however, the underpinning guidance outlining the method of assessment and the effective approaches to be taken to ensure that larger developments are 'air quality positive', has not been published. Therefore, the minimum requirement remains for proposed developments to be air quality neutral.

2.2.2 Mayor's Transport Strategy and Transport Action Plan

In 2017, TfL produced 'Healthy Streets for London' (Transport for London, 2017). The Action Plan recognises that poor air quality is an issue, particularly in inner London, and that road transport is a key source. A range of measures are outlined to improve air quality including bringing forward and expanding the Low Emission Zone, tightening of Low Emission Zone standards for HGVs, buses and coaches, use of hybrid buses and retiring the oldest and most polluting taxis.

The Mayor of London published a new Transport Strategy for London (GLA, 2018) in 2018. This strategy is based on a Healthy Streets Approach that prioritises human health by changing the mix of transport in London to encourage walking, cycling and public transport. The Mayor aims for 80% of Londoners' trips to be made by public transport, cycling or walking by 2041. The Strategy was revised in 2022 and stated that significant progress had been made since 2018 in reducing NO_2 and PM and improving air quality for Londoners, owing mostly to the expansion of the ULEZ (GLA, 2022).

2.2.3 The Mayor's Air Quality Focus Areas (AQFA)

There are 187 AQFA in London which have been identified by the Mayor as areas that exceed the EU annual mean limit value for NO_2 and have high human exposure (London Atmospheric Emissions Inventory, 2019). These are priority areas for action by the GLA and boroughs.

Bishopsgate is located within AQFA 35, which covers Monument, Gracechurch Street, and Bishopsgate to Houndsditch. Borough High Street is located in AQFA 49. The modelled network extends into AQFA 34 (Farringdon Road and New Bridge Street), 68 (Old Street City Rd/Old St/Great Eastern St and Shoreditch High Street), 120 (Waterloo Road), 151 (Elephant and Castle to St Georges Circus and Kennington Lane), 157 (Tower Hill/Tower Gateway/Cable St/The Highway), 162 (Commercial Street), 163 (Aldgate and Aldgate East), and 183 (Embankment Charing Cross to Tower Hill).

2.3 Local Policy

2.3.1 Local Plan

The City of London adopted their Local Plan in 2015 (City of London, 2015) which provides a number of policies regarding planning in the City of London for the period of 2015-2026 and beyond. An updated local plan, which will provide policies valid until 2040, is currently in draft and will replace the Local Plan 2015 once published (City of London, 2022).

Core Strategic Policy CS15: Sustainable Development and Climate Change contained within the Local Plan 2015 includes measures relating to air quality, including:

> *"2. Requiring development to minimise carbon emissions and contribute to a City wide reduction in emissions: (i) adopting energy-efficiency measures; (ii) enabling the use of decentralised energy, including the safeguarded Citigen Combined Cooling Heating and Power (CCHP) network, CCHP-ready designs in areas where CCHP networks are not yet available,*

and localised renewable energy technologies; (iii) adopting offsetting measures to achieve the Government's zero carbon targets for buildings.

4. Requiring development to positively address: (i) local air quality, particularly nitrogen dioxide and particulates PM10 (the City's Air Quality Management Area pollutants);"

Additional development management policies relating specifically to air quality are outlined in Policy DM 15.6 and include:

1. *"Developers will be required to consider the impact of their proposals on air quality and, where appropriate, provide an Air Quality Impact Assessment.*
2. *Development that would result in deterioration of the City's nitrogen dioxide or PM10 pollution levels will be resisted.*
3. *Major developments will be required to maximise credits for the pollution section of the BREEAM or Code for Sustainable Homes assessment relating to on-site emissions of oxides of nitrogen (NOx).*
4. *Developers will be encouraged to install non-combustion low and zero carbon energy technology. A detailed air quality impact assessment will be required for combustion based low and zero carbon technologies, such as CHP plant and biomass or biofuel boilers, and necessary mitigation must be approved by the City Corporation.*
5. *Construction and deconstruction and the transport of construction materials and waste must be carried out in such a way as to minimise air quality impacts.*
6. *Air intake points should be located away from existing and potential pollution sources (e.g. busy roads and combustion flues). All combustion flues should terminate above the roof height of the tallest building in the development in order to ensure maximum dispersion of pollutants."*

2.3.2 Transport Strategy

A Transport Strategy for City of London was published in 2019 with policies outlined up to 2044 (City of London, 2019). The aim of the transport strategy is to provide accessibility for all whilst producing cleaner and quieter streets and improving air quality. Proposals 29-37 of the transport strategy focus on ensuring cleaner air and streets within the City. Proposal 29 introduces zero emission zones (ZEZs) within City of London, and it is stated that the City will support the introduction of the Central London-wide ZEZ. Proposals 30-33 discuss electric vehicles, with the installation of electric vehicle charging points proposed and the aim to introduce a full fleet of electric vehicle buses serving the City of London by 2030.

2.3.3 Local Air Quality Management

The latest Annual Status Report (ASR) for City of London was published in 2022. TheASR discusses monitoring that was undertaken in 2021 (City of London, 2022). The City of London currently has one declared AQMA, which covers the whole Borough. The AQMA was declared in 2001 for exceedances in the annual mean and hourly mean objective for NO_2, and the 24-hour mean for PM_{10}.

The Air Quality Strategy for the City of London was published in 2020 and covers the period between 2019 and 2024 (City of London, 2020). The aim of the strategy is to ensure that 90% of the City of London meets the health-based limit values and WHO Guidelines for NO_2 concentrations by 2025. This will be achieved by reducing emissions from vehicles by introducing planning policies to ensure new developments have a minimal impact on air quality.

The Council's latest AQAP is included within their Air Quality Strategy (City of London, 2020). A total of 65 actions were outlined across the following categories: Air Quality Monitoring; Leading By Example; Collaborating with Others; Reducing Emissions from Road Transports; Reducing Emissions from Non-Road Transport; and Public Health and Raising Awareness. These actions include ensuring that monitoring across the City is appropriate and publicly available, the roll-out of zero emission or electric vehicles within the Council's fleet, and to raise public awareness on air pollution through events and meeting with residents.

3. Baseline Conditions

3.1 Monitoring Data

A review of existing baseline air quality around the scheme has been undertaken. Data for the last seven years are shown in the tables below. The data have been obtained from the Council's latest ASR (City of London, 2022).

The data shows that annual and 1-hour mean concentrations of NO_2 have largely shown a decreasing trend, with the exception of 2020-2021 where concentrations increased at some sites, likely as a result of the easing of COVID-19 restrictions. NO_2 concentrations at all sites remain below the annual mean objective, with the exception of Walbrook Wharf. PM_{10} concentrations have decreased across most sites in recent years, with Aldgate school recording the same value in 2020 and 2021. Hourly exceedances appear to show a similar trend, with the exception of Aldgate School in 2019 where an increase in the number of hourly exceedances was recorded in comparison to 2018. Slight decreases in $PM_{2.5}$ concentrations have been recorded over recent years. There have been no exceedances of the objectives for PM_{10} or $PM_{2.5}$ since 2015.

Table 2. City of London NO_2 Monitoring Data, 2015 - 2021

Site	X, Y	Type	Distance to Scheme	Annual Mean Concentration (µg/m³) with numbers of exceedances of hourly objective in brackets						
				2015	2016	2017	2018	2019	2020	2021
The Aldgate School	533475, 181179	Urban Background, Automatic	0.4 km	**42** (0)	**42** (0)	38 (0)	32 (0)	33 (0)	22 (0)	23 (0)
Beech Street	532176, 181862	Roadside, Automatic	1.1 km	**<u>89</u>** **(212)**	**<u>85</u>** **(144)**	**<u>80</u>** **(67)**	**<u>69</u>** **(27)**	**<u>62</u>** (7)	29 (0)	31 (0)
Walbrook Wharf	532528, 180784	Roadside, Automatic	0.4 km	**<u>98</u>** **(203)**	**<u>92</u>** **(145)**	**<u>92</u>** **(126)**	**<u>87</u>** **(37)**	**<u>73</u>** (15)	**45** (0)	**46** (0)
Gracechurch Street Leadenhall	533040, 181109	Kerbside, Diffusion Tube	<0.1 km	-	-	**<u>66</u>**	**<u>62</u>**	**51**	33	36
Fish Street Hill	532839, 180714	Kerbside, Diffusion Tube	0.2 km	-	-	**<u>66</u>**	**<u>61</u>**	**43**	32	31
Liverpool Street	533190, 181534	Kerbside, Diffusion Tube	<0.1 km	-	-	-	**<u>71</u>**	**52**	35	35
Brushfield Street	533403, 181748	Roadside, Diffusion Tube	<0.1 km	-	-	-	-	-	-	23
150 Bishopsgate	533277, 181558	Kerbside, Diffusion Tube	<0.1 km	-	-	-	**<u>74</u>**	**48**	33	34

Notes
Exceedances of the NO_2 annual mean objective of 40 µg/m³ are shown in **bold**.
NO_2 annual means in excess of 60 µg/m³, indicating a potential exceedance of the NO_2 hourly mean objective are shown in **<u>bold and underlined.</u>**
The number of exceedances of the short term NO_2 values are shown in brackets below the annual mean concentrations. Exceedance of the NO_2 short term AQO of 200 µg/m³ over the permitted 18 hours per year are shown in **bold**.

Table 3. City of London PM_{10} Monitoring Data, 2015 – 2021

Site	X, Y	Type	Distance to Scheme	Annual Mean Concentration (µg/m³) with numbers of exceedances of hourly objective in brackets						
				2015	2016	2017	2018	2019	2020	2021
The Aldgate School	533475, 181179	Urban Background, Automatic	0.4 km	23 (3)	24 (11)	23 (8)	21 (3)	19 (7)	16 (1)	16 (1)
Beech Street	532176, 181862	Roadside, Automatic	1.1 km	28 (17)	25 (16)	23 (8)	24 (9)	22 (6)	18 (2)	15 (0)

Upper Thames Street	532834, 180691	Roadside, Automatic	0.2 km	**41** **(72)**	35 **(45)**	32 (30)	32 (25)	27 (14)	24 (9)	19 (6)

Notes

The number of exceedances of the short term PM_{10} values are shown in brackets below the annual mean concentrations.

Table 4. City of London $PM_{2.5}$ Monitoring Data, 2015 – 2021

Site	X, Y	Type	Distance to Scheme	Annual Mean Concentration (µg/m³) with numbers of exceedances of hourly objective in brackets						
				2015	2016	2017	2018	2019	2020	2021
Farringdon Street	531620, 181239	Kerbside, Automatic	1.4 km	22/17**	16**	16	16	14	12	12
The Aldgate School	533475, 181179	Urban Background, Automatic	0.4 km	-	15	14	12	12	12	11

Notes

**January – August 2015 (non-reference equivalent) / August – October 2015 (reference equivalent) site closed after October 2015 and relocated in July 2016.

3.2 Background Concentrations

Evidence from Defra's 2018 based background maps and local urban background monitoring sites show that concentrations of NO_2 and particulates are below the relevant objectives (Defra, 2022).

Within the study area, the highest NO_2 concentration from the 2026 background maps is 31.8 µg/m³, highest PM_{10} concentration is 15.4µg/m³ and the highest $PM_{2.5}$ concentration is 9.8 µg/m³. Further details on the background data used in the assessment can be found in Section 4.3.

4. Methodology

4.1 Traffic Data

Forecast traffic flows and speeds within the study area were provided from TfL from their ONE model. AECOM's traffic consultants applied factors to convert the ONE model peak hour data into 24-hour Annual Average Daily Traffic flows (AADT), composition (light vehicles (e.g. cars, taxis and light goods vehicles (LGV)), heavy goods vehicles (HGV) (e.g. buses, heavy duty vehicles (HDV)) and speed (kph). Traffic count data from nearby TfL automatic traffic counts and Department for Transport (DfT) have been used in this conversion. Specific factors were applied to roads where data are available, and a generic factor applied to all other roads.

The Traffic data have been provided for the following scenarios:

- **2026 Do Minimum (DM) –** Contains all committed schemes, except the Streetspace Schemes; and
- **2026 Do Something (DS) –** Contains all committed schemes including the Streetspace Schemes.

The AADT traffic data were screened following criteria in the Design Manual for Roads and Bridges (DMRB) LA105 Air Quality Guidance to identify those roads that had a change between DS and DM of either more than 1000 vehicles a day or more than 200 HDVs as a two-way flow (Highways England, 2019). The chosen study area focused on these roads likely to be affected by the scheme. The study area was extended to include all roads within 200m of the chosen receptors.

4.2 Receptors

The concentration of road traffic emitted pollutants at the roadside or at sensitive receptors is influenced by a number of factors. These include background pollution levels and the amount of traffic emissions, which is dictated by traffic flow rates, composition, and speed.

The air quality objective values for pollutants associated with road traffic were set by the Expert Panel of Air Quality Standards (and subsequently adopted as UK Air Quality Objectives) at a level below the lowest concentration at which the more sensitive members of society have been observed to be adversely affected by exposure to each pollutant. Therefore, all receptors that represent exposure of the public are of equal sensitivity as any member of the public could be present at those locations.

Commercial properties are not considered sensitive to changes in ambient pollutant concentrations and are legislated separately as part of occupational health and safety regulations. These are therefore not included in the assessment and the focus is on proposed and existing residential buildings and sensitive receptors, such as schools and nursing homes, as these are most sensitive to the annual mean objective values.

The air quality predictions have been completed for a selection of receptors close to the roadside on sensitive buildings within the proposed scheme extent and within the wider study area. The receptors have been selected from the current AddressBase Ordnance Survey data in conjunction with a review of aerial photography and publicly available mapping. Each of the receptors chosen represents the maximum level of exposure that could be experienced at other receptors in their vicinity.

Details of the selected receptors are shown in Table 5. Receptors have been modelled at the lowest possible height of relevant exposure, e.g. 1.5 m for ground floor level receptors, and an incremental increase based on the building for levels above ground-floor level of 3 m per story. The locations of the modelled receptors are also presented in Appendix A.

Table 5 Summary of Receptors

ID	X	Y	Receptor	Modelled Height (m)	Direction of Façade to roads
H01	532930.5	180286.1	Emblem House Clinic, Tooley Street	1.5	N
R01	533361.3	181738.1	Residential Flats above 232-238 Bishopsgate	7.5	E
R02	533151	181457	Residential Flats above 25 Wormwood Street	4.5	N
R03	532953.6	181207.3	Threadneedles Hotel, Residential Flats in Merchant Taylors Hall	4.5	S

ID	X	Y	Receptor	Modelled Height (m)	Direction of Façade to roads
R04	533138.6	181315.1	Residential Flats/Holiday Lets above 50 Bishopsgate	4.5	E
R05	533338.8	181650.4	Residential Flats above 194-200 Bishopsgate	4.5	E
R06	533298.5	181596.6	Residential Flats above 172 Bishopsgate	4.5	E
R07	532944.9	181126.8	Residential Flats above 74 Cornhill	4.5	N
R08	533006.1	181054.2	Club Quarters Hotel, Gracechurch Street	4.5	W
R09	533027.2	181063.5	Residential Flat above New Moon Public House, Gracechurch Street	4.5	E
R10	532961.9	181116.5	Residential Flat above 48 Cornhill	4.5	S
R11	532742.9	180891.9	Residential Flat above 129 Cannon Street	4.5	N
R12	532985.9	180834.8	Residential Flat above 9 Eastcheap	4.5	N
R13	533252.4	181561.1	Andaz Hotel, Liverpool Street	4.5	W
R14	533319.8	181625.7	Residential Flats above 189-190 Bishopsgate	4.5	SE
R15	533342.8	181566.4	Residential Flats 5 New St	1.5	N
R16	533427.3	181982.9	Residential Flats 6 Folgate Street	1.5	S
R17	533582.3	182071.1	Residential Flats above 148-150 Commericial Street	4.5	E
R18	533588.3	182038.4	Residential Flats above 159, 157 Commercial Street	4.5	W
R19	533614.6	181950.5	Residential Flats, Linnell House, 50 Folgate Street	1.5	S
R20	533640.3	182004.9	Serviced Flats 132 Commercial Street	4.5	E
R21	533671.4	181919.3	Residential Flats above 133 Commercial Street	4.5	W
R22	533682	181863.2	Residential Flat above 111 Commercial Street	4.5	W
R23	533739.9	181907.4	Residential Flats above 14 Hanbury Street	4.5	S
R24	533399.2	182283.8	Residential Flats above 55 Holywell Lane	4.5	S
R25	533422.2	182198.2	Residential Flats above 5-7 Great Eastern Street	4.5	W
R26	533429.2	182138.3	Residential Flats above 227-228 Shoreditch High Street	4.5	W
R27	533291.3	182344.9	Residential Flats above 36 Great Eastern Street	4.5	E
R28	533228.9	182244.2	Residential Flats above 54-56 Scutton Street	4.5	S
R29	533259.6	182177	Residential Flats above 24 Curtain Road	4.5	W
R30	533182.5	182093.6	Residential Flats above 93 Worship Street	4.5	N
R31	532978.7	182085.2	Residential Flats above 34 Worship Street	4.5	N&W
R32	532242.1	180823.9	Residential Flats, Queens Quay, Upper Thames St	4.5	S
R33	531827.1	180963.8	Residential Flat above 148 Queen Victoria Street	4.5	N
R34	532208.2	180444.3	Bear Pit Apartments, New Globe Walk	4.5	E
R35	532310.7	180390.4	Residential Flats, Anchor Terrace	1.5	E
R36	532293.7	180263.4	IBIS Styles Hotel, Southwark Bridge Road	4.5	E
R37	532368.9	180176.6	Residential Flats, 55 Thrale St	1.5	N
R38	532310.9	180143.7	Residential Flats, Lambert House, Southwark Street	7.5	S
R39	532436.5	180154.5	Residential Flats above 34 Southward Street	4.5	N
R40	532567.6	180133.9	Residential Flats above 11 Southward Street	4.5	D
R41	532677.4	180168.2	Residential Flats above 43 Borough High Street	4.5	SE

ID	X	Y	Receptor	Modelled Height (m)	Direction of Façade to roads
R42	532753.9	180235	Residential Flats above 4-6 London Bridge Street	4.5	S
R43	533114.8	180146.5	Residential Flats above 88A Tooley Street	4.5	E
R44	533023.9	180236.5	Residential Flats above 51 Tooley Street	7.5	SW
R45	532743.9	180778.9	7A Laurence Pountney Hill	1.5	W
R46	532557.3	180833.1	Residential Flats, 11-13 Dowgate Hill	1.5	W
R47	532646.1	181125.5	The Ned Hotel, Poultry	4.5	N
R48	533091.7	181575.6	Residential Flat above the Railway Tavern	7.5	W
R49	533033.6	181866.8	Apartments, 19 Sun Street	4.5	N
R50	533667.4	180938.3	Residential Flats, Prospero House, Portsoken St	4.5	S&W
R51	531668.4	180255.8	Residential Flats, 15 Burrell Street	4.5	E
R52	533073.3	180693.2	Residential Flats, 16 St Marys-At-Hill	4.5	E
R53	533417.1	180723.4	Tower View, Byward Street	4.5	N
R54	531635.7	179934.3	Residential Flats, 81 Blackfriars Road	4.5	W
R55	531667.3	179554.4	Buckstone Apartments, Blackfriars Road	4.5	E
R56	531753.8	179108.5	Residential Flats, St Georges Buildings, St Georges Road	1.5	S
R57	532077.7	179528.4	Residential Flats, Freestone Court, Borough Road	1.5	N
R58	532320	179403.1	55, Harper Road	1.5	N
R59	532154.1	181450.5	Residential Flats above 61 St Martins Le Grand	7.5	E
R60	532519.7	181253	Residential Flats above 10 Ironmonger Lane	4.5	E
R61	532477.6	179836.7	Residential Flats above 167 Borough High Street	4.5	W
R62	532556	180027	Residential Flats above 82 Borough High Street	4.5	W
R63	531377.6	179343	123 St Georges Road	1.5	SW
R64	532724.7	181265.1	Residential Flats above 7 Lothbury	4.5	N
R65	532303.4	179812.6	Residential Flats, Douglas Buildings	1.5	S
R66	532076.7	179734.8	Residential Flats, 118 Southwark Bridge Road	4.5	W
R67	531856.4	179516.8	Residential Flats, 67 Lancaster Street	1.5	E
R68	532232.7	179564.8	Student Accommodation, David Bomberg House	1.5	NW
R69	531680	179179.6	Residential Flats, Newman House, St Georges Road	1.5	N
S01	531973.6	180847	City of London School	1.5	E
S02	533493.6	181142.9	The Aldgate School	1.5	NE
S03	533443.1	181631.9	Northumbria University	1.5	N
S04	533658.3	181907.6	Bright Horizons Spitalfields Preschool	1.5	N
S05	532994.5	182118.4	Hopes and Dreams Nursery	1.5	E
S06	533245.8	182180.2	Broadgate Nursery	1.5	E
S07	533232.5	182324	WEA Adult Education Centre	1.5	N
S08	533563.8	181121.9	David Game College	1.5	E

4.3 Modelling Methodology

4.3.1 Air Quality Dispersion Input Data and Model Conditions

This assessment has used the dispersion model software 'ADMS-Roads' (5.0.1.3) to quantify pollution levels at selected receptors due to road traffic emissions. ADMS-Roads is a modern dispersion model that has an extensive published track record of use in the UK for the assessment of local air quality impacts, including model validation and verification studies (Cambridge Environmental Research Consultants (CERC), 2013).

Details of general model conditions set up in ADMS-Roads are provided in Table 6. Some of these conditions are summarised in detail below.

Table 6 General ADMS-Roads Model Conditions

Variables	ADMS-Roads Model Input: Road Traffic Model
Surface roughness at source	1.5 m
Surface roughness at meteorological site	0.2 m
Minimum Monin-Obukhov length for stable conditions	100 m
Receptor location	x, y coordinates determined by GIS, z = various.
Emissions	NO_x, PM_{10}, $PM_{2.5}$, CO_2
Emission factors	EFT Version 11 emission factor dataset.
Meteorological data	1 year (2021) hourly sequential data from Heathrow Airport meteorological station.
Receptors	Facades of selected receptors only.
Model output	Long-term (annual) mean NO_x concentrations.
	Long-term (annual) mean PM_{10} concentrations.
	Long-term annual mean $PM_{2.5}$ concentrations.

4.3.2 Meteorological Data

One year (2021) of hourly sequential observation data from Heathrow Airport meteorological station has been used in this assessment to correspond with the baseline year. The station is located approximately 25km southwest of the proposed scheme and experiences meteorological conditions that are representative of those experienced in inner London and within the air quality study area.

A wind rose for this site is presented in Figure 1.

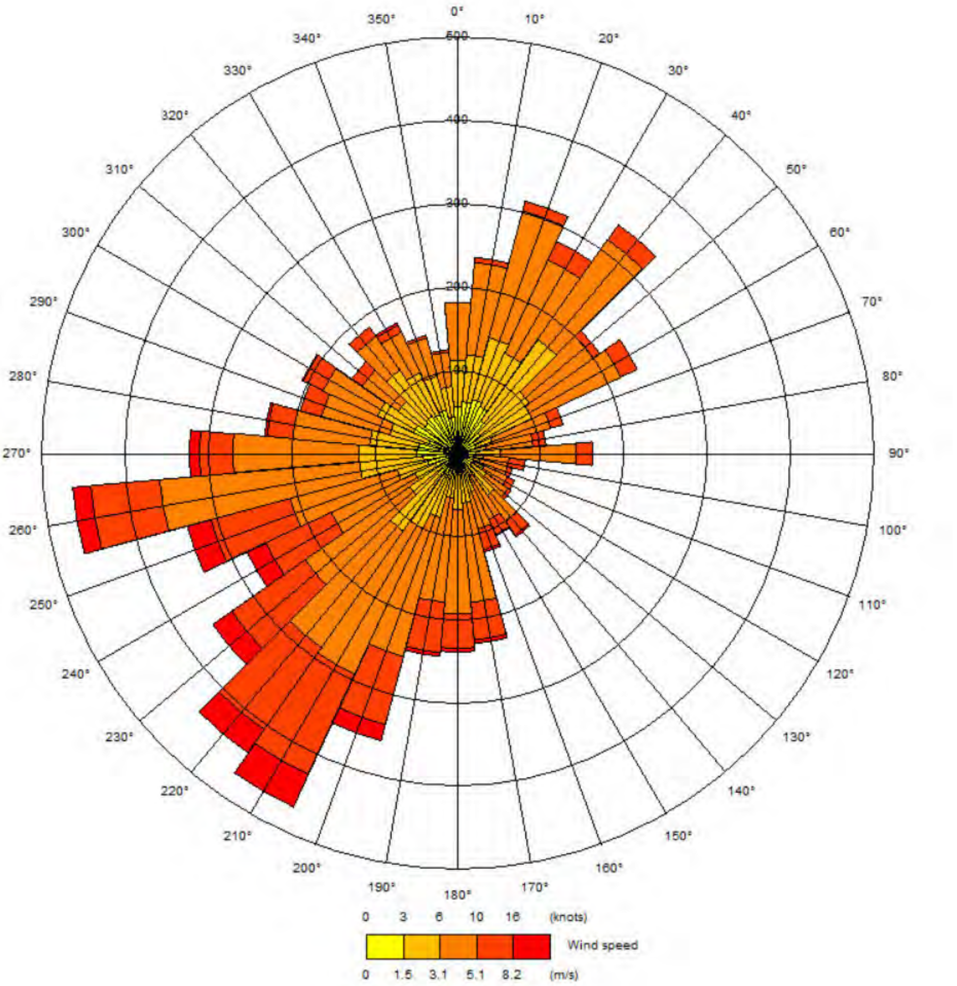

Figure 1 Wind Rose for London Heathrow Meteorological Site in 2021

4.3.3 Specific Local Conditions

In streets where there are tall buildings on each side, these can create a canyon like environment influencing the way pollutants are dispersed within the street. Depending on the weather conditions, this can lead to higher concentrations as pollutants become trapped for longer. Within the study area, a number of streets were identified as being street canyons and these are represented within the ADMS Roads model. These streets include sections of Bishopsgate, Threadneedle Street, Gracechurch Street, Norton Folgate, and Shoreditch High Street.

4.3.4 Background Data

Background data for NO_2, NO_X, PM_{10} and $PM_{2.5}$ concentrations for 2026 have been sourced from Defra's 2018-based background maps for receptors within the nearest 1 km x 1 km grid square. For grid squares containing Primary A roads, Trunk roads and Minor roads, these have been removed from the background to avoid double counting of these emissions.

A review was conducted to compare the Defra's mapped concentrations for 2021 with measured data from urban background sites in the same grid square, for the same year. As the Defra mapped concentrations were higher, an adjustment factor was calculated for each pollutant by taking an average from the comparison at local urban background monitoring sites. A review of the sites in City of London found that monitored levels were substantially below the mapped concentrations which resulted in an adjustment factor of 0.6. To be more conservative and more in line with other TfL Streetspace schemes, the adjustment factor was calculated from sites in neighbouring authorities. This adjustment factor was applied to the values for all grid squares across the study area to obtain background concentrations which better represent the monitored concentrations in 2026. The calculated adjustment factors are shown in Table 7.

Table 7 Background Adjustment Factor Calculation

Monitoring Site	X, Y and Grid Square	Pollutant	2021 Monitored Concentration (µg/m³)	2021 Defra Mapped Concentration (µg/m³)	Adjustment Factor
Camden – Bloomsbury	530123, 182014 530500_182500	NO_2	27	36.4	0.74
		NO_x	34.7	62.8	0.55
		PM_{10}	16	19.5	0.82
Westminster – Horseferry Road	529802, 178962 529500_178500	NO_2	24	29.0	0.83
		NO_x	30.9	45.8	0.67
		$PM_{2.5}$	10	12.3	0.82
WCC5	528512, 178593 528500_178500	NO_2	24	28.3	0.85
WCC12	527036, 182321 527500_182500	NO_2	23	29.3	0.78
WCC20	524887, 181979 524500_181500	NO_2	27	30.5	0.89
WCC23	525817, 181136 525500_181500	NO_2	27	31.7	0.85
Average		**NO_2**			**0.82**
		NO_x			**0.61**
		PM_{10}			**0.82**
		$PM_{2.5}$			**0.82**

Note
Data from WCC's diffusion tubes are unpublished

The same factor of 0.82 was used for NO_x to be in line with the adjustment factors for NO_2, PM_{10} and $PM_{2.5}$, as otherwise modelled NO_x values would be higher than the background.

The selected sensitive receptors and their adjusted background concentrations are shown in Appendix B. The data shows that the adjusted background concentrations are below the relevant annual mean air quality objectives for all pollutants at all receptors within the study area.

4.3.5 Model Verification

As no traffic data were provided for a baseline year, a comparison has been undertaken between the monitored data for 2021 and the 2026 Do Minimum model run using a 2021 fleet mix and emissions data. As a result of this comparison, the model output results have not been adjusted because the comparison suggested that the air quality model would be over-predicting if an adjustment factor had been applied.

4.3.6 Predicting Short Term Objectives

4.3.6.1 Predicting Short Term PM_{10} Objectives

The guidance document LAQM.TG(03) (Defra, 2003) sets out the method by which the number of days in which the PM_{10} 24-hour objective is exceeded can be obtained based on a relationship with the predicted PM_{10} annual mean concentration. The most recent guidance LAQM.TG(16) (Defra, 2021) and LLAQM.TG(16) (GLA, 2019) suggests no change to this method. As such, the formula used within this assessment is:

$$No.\,of\ Exceedances = 0.0014 * C^3 + \frac{206}{C} - 18.5$$

Where C is the annual mean concentration of PM_{10}.

4.3.6.2 Predicting Short Term NO_2 Objectives

Research projects completed on behalf of Defra and the Devolved Administrations (Laxen & Warner, 2003) (AEAT, 2008) have concluded that the hourly mean NO_2 objective is unlikely to be exceeded if annual mean concentrations are predicted to be less the 60 µg/m^3.

In 2003, Laxen and Marner concluded:

"…local authorities could reliably base decisions on likely exceedences of the 1-hour objective for nitrogen dioxide alongside busy streets using an annual mean of 60 µg/m^3 and above."

The findings presented by Laxen and Marner (2003) are further supported by AEAT (2008) who revisited the investigation to complete an updated analysis including new monitoring results and additional monitoring sites. The recommendations of this report are:

"Local authorities should continue to use the threshold of 60 µg/m^3 NO_2 as the trigger for considering a likely exceedance of the hourly mean nitrogen dioxide objective."

This means that where predicted concentrations are below 60 µg/m^3, it can be concluded that the hourly mean NO_2 objective (200 µg/m^3 NO_2 not more than 18 times per year) will be achieved.

4.4 Method for Assessment of Significance

4.4.1 Assessment of Significance

With regard to road traffic emissions, the change in pollutant concentrations with respect to future baseline concentrations has been described at receptors that are representative of exposure to impacts on local air quality within the study area. The absolute magnitude of pollutant concentrations in the "with" and "without" scheme scenario is also described and this is used to consider the risk of the air quality limit values being exceeded in each scenario.

For consideration of a change in annual mean concentration of a given magnitude, the EPUK and IAQM have published recommendations for describing the effects of such impacts at individual receptors as set out in Table 8 and Table 9 (EPUK & IAQM, 2017).

Table 8: Effects Descriptors at Individual Receptors – Annual Mean NO_2 and PM_{10}

Long Term Average Concentration at Receptor in Assessment Year (µg/m^3)	Change in Concentration Relative to Air Quality Assessment Level (AQAL) – NO_2 and PM_{10} (µg/m^3)				
	<0.2 (Imperceptible)	0.2 - <0.6 (Very Small)	0.6 - <2.2 (Small)	2.2 -<=4.0 (Medium)	>4.0 (Large)
<30.2	Negligible	Negligible	Negligible	Slight	Moderate
30.2 - <37.8	Negligible	Negligible	Slight	Moderate	Moderate
37.8 - <41.0	Negligible	Slight	Moderate	Moderate	Substantial
41.0 - <43.8	Negligible	Moderate	Moderate	Substantial	Substantial
≥43.8	Negligible	Moderate	Substantial	Substantial	Substantial

Table 9: Effects Descriptors at Individual Receptors – Annual Mean $PM_{2.5}$

Long Term Average Concentration At Receptor In Assessment Year ($\mu g/M^3$)	Change in concentration relative to Air Quality Assessment Level (AQAL) – $PM_{2.5}$ ($\mu g/m^3$)				
	<0.1 (Imperceptible)	0.1 - <0.4 (Very Small)	0.4 - <1.4 (Small)	1.4 -<=2.5 (Medium)	>2.5 (Large)
<18.9	Negligible	Negligible	Negligible	Slight	Moderate
18.9 - <23.6	Negligible	Negligible	Slight	Moderate	Moderate
23.6 - <25.6	Negligible	Slight	Moderate	Moderate	Substantial
25.6 - <27.4	Negligible	Moderate	Moderate	Substantial	Substantial
≥27.4	Negligible	Moderate	Substantial	Substantial	Substantial

A change in predicted annual mean concentrations of NO_2 or PM_{10} of less than 0.2 $\mu g/m^3$ is considered to be so small as to be imperceptible. Concentrations that are 11% - 21%, 21% - 50% and greater than 50% of the objectives have small, moderate or large impact respectively. A change (impact) that is imperceptible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

All of the relevant receptors have been selected to represent locations where people are likely to be present. The air quality objective values have been set at concentrations that provide protection to all members of society, including more vulnerable groups such as the very young, elderly or unwell. As such the sensitivity of receptors was considered in the definition of the air quality objective values, and therefore, no additional subdivision of human health receptors on the basis of building or location type is necessary.

4.4.2 Significance of Effects

The significance of the reported effects is then considered for the proposed scheme in overall terms. The potential for the scheme to contribute to or interfere with the successful implementation of policies and strategies for the management of local air quality are considered, if relevant, however the principal focus is any change to the likelihood of future achievement of the air quality objective values set out in Table 1 for the following pollutants:

- Annual mean nitrogen dioxide (NO_2) concentration of 40 $\mu g/m^3$;
- Annual mean particulate matter (PM_{10}) concentration of 40 $\mu g/m^3$;
- Annual mean fine particulate matter ($PM_{2.5}$) concentrations of 25 $\mu g/m^3$;
- 24-hour mean PM_{10} concentration of 50 $\mu g/m^3$ not to be exceeded on more than 35 days per year; and
- 1-hour mean NO_2 concentration of 200 $\mu g/m^3$ not to be exceeded on more than 18 times per year.

The achievement of local authority goals for local air quality management are directly linked to the achievement of the air quality objective values described above, and as such, this assessment focuses on the likelihood of achievement of these objectives as a result of the proposed scheme.

In terms of the significance of any adverse impacts, an effect is reported as being either ‘not significant’ or as being ‘significant’. If the overall effect of the development on local air quality or on amenity is found to be ‘moderate’ or ‘substantial’ this is deemed to be ‘significant’. Effects found to be ‘slight’ are considered to be ‘not significant’, although they may be a matter of local concern. ‘Negligible’ effects are considered to be ‘not significant’.

5. Predicted Impacts

5.1 Summary

The following sections present the results of the air quality assessment at selected receptors, providing the predicted pollutant levels with and without the scheme in place and the differences due to the scheme. A consideration of whether these changes are considered to be significant is provided.

5.2 Air Quality Concentrations

Table 10 provides the modelled annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations with and without the scheme, and the difference between them for each of the selected receptor locations for the model year of 2026.

Table 11 provides results of the significant impact descriptors for all three pollutants at selected receptor locations.

Figure 3 in Appendix BA shows the annual mean NO_2 concentrations in 2026 with the scheme in place. Figure 4 in Appendix BA shows the changes in annual mean NO_2 concentrations with and without the scheme in 2026.

The annual mean NO_2 objective value of 40 µg/m^3 is not exceeded at any of the selected sensitive receptor locations in 2026 either with or without the scheme. The highest predicted annual mean concentration with the scheme is 34.8 µg/m^3 at R53 (Tower View, Byward Street).

The greatest reduction in annual mean NO_2 concentration is on Bishopsgate itself, with a reduction of – 3.7 µg/m^3, found at R09 (Residential Flat above New Moon Public House) where concentrations are predicted to decline from 34.3 µg/m^3 to 30.6 µg/m^3, the AADT flows decrease by ~15,000 on the links adjacent to this receptor due to the scheme. NO_2 concentrations are predicted to reduce at all receptors along Bishopsgate due to the reduction of traffic during the day as a result of the bus gate.

The greatest predicted increase in annual mean NO_2 concentration is +2.9 µg/m^3, found at R53 (Tower View, Byward Street) where concentrations are predicted to increase from 31.9 µg/m^3 to 34.8 µg/m^3. This change is moderate adverse, with an AADT increase of over 4,000 on the road next to the receptor.

Annual mean NO_2 concentrations at receptors along Borough High Street are predicted to decrease as a result of the scheme. Changes in concentrations of between -1.9 µg/m^3 and -0.6 µg/m^3 are expected, with a maximum concentration of 25.2 µg/m^3 predicted at R41 (Residential Flats above 42 Borough High Street). The predicted reduction in NO_2 concentrations is due to a decrease in AADT of over 12,000 along Borough High Street (between St Thomas Street and Southwark Street).

Predicted PM_{10} and $PM_{2.5}$ concentrations meet the relevant objective values of 40 µg/m^3 and 20 µg/m^3 in 2026 for both scenarios. The highest annual mean PM_{10} concentration of 17.0 µg/m^3 is at receptor R26 (Residential Flats above 227 and 228 Shoreditch High Street). The highest annual mean $PM_{2.5}$ concentration is 10.6 µg/m^3 at R26 (Residential Flats above 227 and 228 Shoreditch High Street) and R27 (Residential Flats above 36 Great Eastern Street). Changes in PM_{10} and $PM_{2.5}$ are small/imperceptible and therefore these changes have a negligible impact.

Table 10 Annual Mean Air Quality Results With and Without Scheme (2026)

Receptor	NO_2 (µg/m³)			PM_{10} (µg/m³)			$PM_{2.5}$ (µg/m³)		
	Without Scheme	With Scheme	Change	Without Scheme	With Scheme	Change	Without Scheme	With Scheme	Change
H01	29.5	29.0	-0.6	15.5	15.3	-0.1	9.8	9.7	-0.1
R01	30.8	30.1	-0.7	15.5	15.3	-0.2	9.8	9.7	-0.1
R02	33.4	31.5	-1.8	15.9	15.6	-0.3	10.1	9.9	-0.2
R03	34.7	33.4	-1.4	15.7	15.3	-0.4	10.0	9.8	-0.2
R04	33.3	31.5	-1.8	16.0	15.6	-0.4	10.1	9.9	-0.2
R05	31.4	30.3	-1.2	15.6	15.4	-0.2	9.9	9.8	-0.1
R06	32.2	30.5	-1.7	15.9	15.5	-0.4	10.1	9.8	-0.2
R07	32.5	32.0	-0.5	15.1	14.9	-0.1	9.6	9.6	-0.1
R08	33.6	30.5	-3.1	16.0	15.4	-0.6	10.2	9.8	-0.4
R09	34.3	30.6	-3.7	16.2	15.4	-0.8	10.2	9.8	-0.4
R10	32.6	32.0	-0.6	15.1	15.0	-0.1	9.6	9.6	-0.1
R11	31.4	30.3	-1.1	15.7	15.7	<0.1	9.9	9.9	<0.1
R12	30.8	29.9	-0.9	15.8	15.6	-0.2	10.0	9.9	-0.1
R13	31.9	30.4	-1.5	15.7	15.4	-0.3	9.9	9.8	-0.2
R14	31.6	30.3	-1.2	15.7	15.4	-0.3	10.0	9.8	-0.2
R15	31.3	30.1	-1.3	15.6	15.2	-0.4	9.9	9.7	-0.2
R16	31.5	30.9	-0.6	15.7	15.6	-0.2	10.0	9.9	-0.1
R17	30.4	30.7	0.2	16.6	16.7	0.1	10.4	10.4	<0.1
R18	29.6	29.8	0.2	16.4	16.4	<0.1	10.3	10.3	<0.1
R19	31.0	31.1	<0.1	15.5	15.5	<0.1	9.9	9.9	<0.1
R20	29.9	30.2	0.3	16.4	16.5	0.1	10.3	10.3	<0.1
R21	32.9	33.0	0.1	16.0	16.0	<0.1	10.1	10.2	<0.1
R22	32.6	33.0	0.5	16.0	16.0	0.1	10.1	10.2	<0.1
R23	31.0	31.1	0.1	15.5	15.5	<0.1	9.9	9.9	<0.1

Receptor	NO_2 (µg/m³)			PM_{10} (µg/m³)			$PM_{2.5}$ (µg/m³)		
	Without Scheme	With Scheme	Change	Without Scheme	With Scheme	Change	Without Scheme	With Scheme	Change
R24	30.7	30.9	0.3	16.3	16.3	<0.1	10.2	10.2	<0.1
R25	30.1	30.1	-0.1	16.5	16.6	<0.1	10.3	10.4	<0.1
R26	31.8	30.2	-1.7	17.5	17.0	-0.6	10.9	10.6	-0.3
R27	31.2	31.7	0.5	16.8	16.9	0.1	10.5	10.6	<0.1
R28	27.5	27.8	0.3	15.8	15.8	0.1	9.9	10.0	<0.1
R29	27.6	28.0	0.4	15.8	15.9	0.1	10.0	10.0	0.1
R30	27.1	27.4	0.3	15.7	15.8	0.1	9.9	9.9	0.1
R31	30.7	31.0	0.3	15.7	15.8	0.1	9.8	9.9	0.1
R32	29.3	29.5	0.2	15.4	15.4	<0.1	9.8	9.8	<0.1
R33	27.9	28.2	0.3	15.2	15.3	0.1	9.7	9.7	<0.1
R34	28.3	28.2	<0.1	15.1	15.1	<0.1	9.6	9.6	<0.1
R35	29.0	29.3	0.2	15.3	15.4	0.1	9.7	9.8	0.1
R36	29.1	29.2	0.2	15.3	15.4	0.1	9.7	9.8	<0.1
R37	29.5	29.4	-0.1	15.4	15.3	-0.1	9.8	9.7	<0.1
R38	29.1	29.2	<0.1	15.2	15.2	<0.1	9.7	9.7	<0.1
R39	29.3	29.2	-0.1	15.4	15.4	<0.1	9.8	9.7	<0.1
R40	29.5	29.0	-0.5	15.5	15.3	-0.2	9.8	9.7	-0.1
R41	31.5	29.7	-1.9	16.1	15.5	-0.6	10.1	9.8	-0.3
R42	30.4	29.2	-1.3	15.6	15.3	-0.3	9.9	9.7	-0.2
R43	28.2	27.9	-0.2	15.0	15.0	-0.1	9.6	9.5	<0.1
R44	28.2	27.9	-0.3	15.0	15.0	-0.1	9.6	9.5	<0.1
R45	30.3	30.2	-0.1	15.5	15.5	<0.1	9.8	9.8	<0.1
R47	32.1	31.9	-0.2	15.0	14.9	<0.1	9.6	9.5	<0.1
R48	30.1	29.9	-0.2	15.2	15.2	<0.1	9.7	9.7	<0.1
R49	30.5	30.9	0.4	15.3	15.4	0.1	9.8	9.8	<0.1

Receptor	NO_2 (µg/m^3)			PM_{10} (µg/m^3)			$PM_{2.5}$ (µg/m^3)		
	Without Scheme	With Scheme	Change	Without Scheme	With Scheme	Change	Without Scheme	With Scheme	Change
R50	30.7	30.9	0.2	15.5	15.6	<0.1	9.8	9.9	<0.1
R51	28.3	28.7	0.4	15.3	15.4	0.1	9.8	9.8	0.1
R52	30.1	29.9	-0.1	15.6	15.6	-0.1	9.9	9.9	<0.1
R53	31.9	34.8	2.9	15.8	15.9	0.1	10.0	10.1	0.1
R54	24.3	24.4	0.2	15.3	15.4	0.1	9.7	9.7	<0.1
R55	24.9	25.1	0.2	15.4	15.6	0.2	9.8	9.9	0.1
R56	25.6	25.7	0.1	15.6	15.7	0.1	9.9	9.9	0.1
R57	24.8	26.4	1.6	15.7	16.0	0.3	9.8	10.0	0.2
R58	24.4	25.6	1.3	15.7	16.1	0.4	9.8	10.0	0.2
R59	32.5	32.5	<0.1	15.1	15.1	<0.1	9.6	9.6	<0.1
R60	32.0	31.7	-0.3	14.9	14.8	-0.1	9.5	9.5	<0.1
R61	26.1	25.2	-1.0	16.0	15.8	-0.2	10.0	9.9	-0.1
R62	30.3	29.5	-0.8	15.8	15.4	-0.3	10.0	9.8	-0.2
R63	25.5	26.4	0.9	15.7	16.0	0.3	9.9	10.1	0.1
R64	32.9	31.8	-1.1	15.2	14.9	-0.3	9.7	9.5	-0.2
R65	25.2	25.2	<0.1	15.8	15.8	<0.1	9.9	9.9	<0.1
R66	25.1	25.1	<0.1	15.7	15.8	0.1	9.8	9.9	0.1
R67	25.4	25.2	-0.2	15.4	15.5	0.1	9.7	9.8	0.1
R68	25.3	27.3	2.0	15.9	16.0	0.1	9.9	10.0	0.1
R69	25.2	25.8	0.6	15.5	15.7	0.2	9.8	9.9	0.1
S01	30.4	30.5	0.1	16.1	16.1	<0.1	10.2	10.2	<0.1
S02	32.1	31.7	-0.3	15.8	15.7	-0.1	10.0	10.0	-0.1
S03	30.5	29.9	-0.5	15.4	15.2	-0.2	9.8	9.7	-0.1
S04	31.8	31.9	0.1	15.7	15.7	<0.1	10.0	10.0	<0.1
S05	30.4	30.5	0.1	15.6	15.6	<0.1	9.7	9.8	<0.1

Receptor	NO_2 (µg/m³)			PM_{10} (µg/m³)			$PM_{2.5}$ (µg/m³)		
	Without Scheme	With Scheme	Change	Without Scheme	With Scheme	Change	Without Scheme	With Scheme	Change
S06	27.8	28.2	0.4	15.9	16.0	0.1	10.0	10.1	0.1
S07	27.8	28.1	0.3	15.8	15.9	<0.1	10.0	10.0	<0.1
S08	30.9	30.9	<0.1	15.5	15.4	-0.1	9.8	9.8	<0.1

Table 11. Air Quality Significance Effects Individual Location Descriptions, Impacts with Scheme, Annual Mean (2026)

Receptor	Effect Descriptors		
	NO_2	PM_{10}	$PM_{2.5}$
H01	Neglig ble	Negligible	Negligible
R01	Slight Beneficial	Negligible	Negligible
R02	Slight Beneficial	Negligible	Negligible
R03	Slight Beneficial	Negligible	Negligible
R04	Slight Beneficial	Negligible	Negligible
R05	Slight Beneficial	Negligible	Negligible
R06	Slight Beneficial	Negligible	Negligible
R07	Neglig ble	Negligible	Negligible
R08	Moderate Beneficial	Negligible	Negligible
R09	Moderate Beneficial	Negligible	Negligible
R10	Slight Beneficial	Negligible	Negligible
R11	Slight Beneficial	Negligible	Negligible
R12	Slight Beneficial	Negligible	Negligible
R13	Slight Beneficial	Negligible	Negligible
R14	Slight Beneficial	Negligible	Negligible
R15	Slight Beneficial	Negligible	Negligible
R16	Neglig ble	Negligible	Negligible
R17	Neglig ble	Negligible	Negligible
R18	Neglig ble	Negligible	Negligible
R19	Neglig ble	Negligible	Negligible
R20	Neglig ble	Negligible	Negligible
R21	Neglig ble	Negligible	Negligible
R22	Neglig ble	Negligible	Negligible
R23	Neglig ble	Negligible	Negligible
R24	Neglig ble	Negligible	Negligible
R25	Neglig ble	Negligible	Negligible
R26	Slight Beneficial	Negligible	Negligible
R27	Neglig ble	Negligible	Negligible
R28	Neglig ble	Negligible	Negligible
R29	Neglig ble	Negligible	Negligible
R30	Neglig ble	Negligible	Negligible
R31	Neglig ble	Negligible	Negligible
R32	Neglig ble	Negligible	Negligible
R33	Neglig ble	Negligible	Negligible
R34	Neglig ble	Negligible	Negligible
R35	Neglig ble	Negligible	Negligible
R36	Neglig ble	Negligible	Negligible
R37	Neglig ble	Negligible	Negligible
R38	Neglig ble	Negligible	Negligible

Receptor	Effect Descriptors		
	NO_2	PM_{10}	$PM_{2.5}$
R39	Neglig ble	Negligible	Negligible
R40	Neglig ble	Negligible	Negligible
R41	Slight Beneficial	Negligible	Negligible
R42	Slight Beneficial	Negligible	Negligible
R43	Neglig ble	Negligible	Negligible
R44	Neglig ble	Negligible	Negligible
R45	Neglig ble	Negligible	Negligible
R46	Slight Adverse	Negligible	Negligible
R47	Neglig ble	Negligible	Negligible
R48	Neglig ble	Negligible	Negligible
R49	Neglig ble	Negligible	Negligible
R50	Neglig ble	Negligible	Negligible
R51	Neglig ble	Negligible	Negligible
R52	Neglig ble	Negligible	Negligible
R53	Moderate Adverse	Negligible	Negligible
R54	Neglig ble	Negligible	Negligible
R55	Neglig ble	Negligible	Negligible
R56	Neglig ble	Negligible	Negligible
R57	Neglig ble	Negligible	Negligible
R58	Neglig ble	Negligible	Negligible
R59	Neglig ble	Negligible	Negligible
R60	Neglig ble	Negligible	Negligible
R61	Neglig ble	Negligible	Negligible
R62	Slight Beneficial	Negligible	Negligible
R63	Neglig ble	Negligible	Negligible
R64	Slight Beneficial	Negligible	Negligible
R65	Neglig ble	Negligible	Negligible
R66	Neglig ble	Negligible	Negligible
R67	Neglig ble	Negligible	Negligible
R68	Neglig ble	Negligible	Negligible
R69	Neglig ble	Negligible	Negligible
S01	Neglig ble	Negligible	Negligible
S02	Neglig ble	Negligible	Negligible
S03	Neglig ble	Negligible	Negligible
S04	Neglig ble	Negligible	Negligible
S05	Neglig ble	Negligible	Negligible
S06	Neglig ble	Negligible	Negligible
S07	Neglig ble	Negligible	Negligible
S08	Neglig ble	Negligible	Negligible

5.3 Carbon Emissions

Table 12 details the predicted annual emissions with and without the proposed scheme for Carbon for over the study area in 2021. These values are associated with changes due to traffic emissions in the study area and do not include embedded carbon related to construction or operation of the scheme (for example for traffic signals or street lighting).

Table 12 Carbon Emissions Across Study Area

Pollutant	Without Scheme (tonnes/year)	With Scheme (tonnes/year)	Change (tonnes/year)
Carbon (CO_2)	38,993	37,559	-1,434

In the study area, the modelling predicts that in 2026, annual emissions of carbon are predicted to decrease by 1,434 tonnes per year with the proposed scheme in place, compared to the situation without the scheme. This represents a small (3.7%) decrease in emissions with the scheme in place and is due to a small overall decrease in vehicle kilometres travelled across the wider area.

6. Conclusions

In 2026, modelled annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations are predicted to be below the objective values with and without the scheme at all selected receptors. The hourly mean objective for NO_2 is predicted to be met at all receptors.

There are slight beneficial changes to NO_2 concentrations predicted at receptors along Bishopsgate, Threadneedle Street, Gracechurch Street, Shoreditch High Street, Borough High Street, Eastcheap and Cannon Street due to reductions in traffic flows on these routes. There are two **moderate beneficial** changes predicted at receptors on Gracechurch Street, where significant decreases in traffic flows are predicted. There is one slight adverse and one **moderate** adverse change predicted to NO_2 concentrations at receptors along Byward Street and Dowgate Hill due to increases in traffic flows on and adjacent to these routes.

In other areas, there are a mix of very small and small increases and decreases in concentrations predicted, which are negligible according to the EPUK/IAQM criteria. There are small and very small increases and decreases in concentrations of PM_{10} and $PM_{2.5}$ predicted across the entire scheme, these are considered negligible at all selected receptors.

Overall, the scheme is not significant in terms of air quality impacts.

Based on the results of the assessment of the magnitude and changes to NO_2, PM_{10} and $PM_{2.5}$ concentrations, no specific mitigation measures related to the proposed scheme are required.

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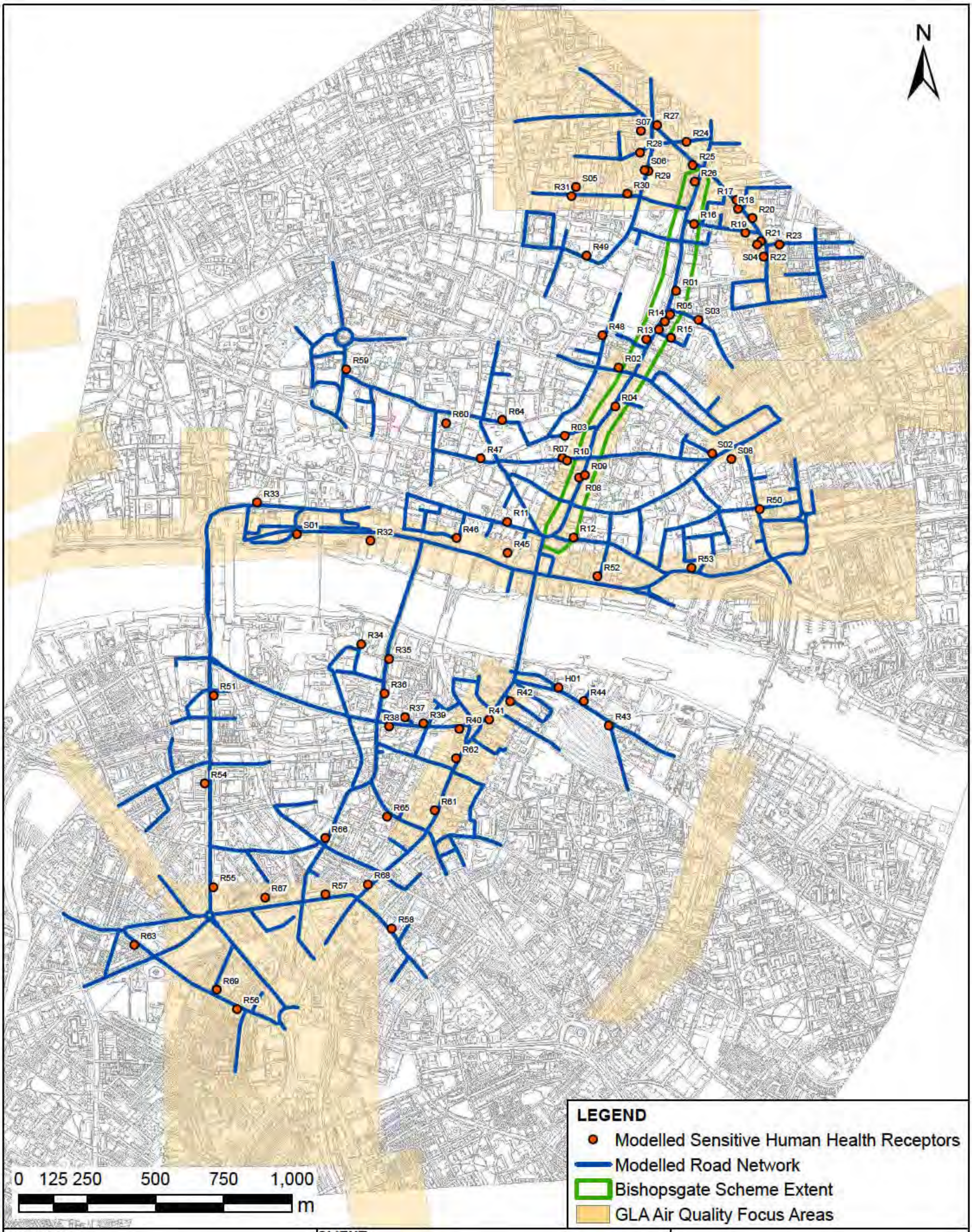
Appendix A Figures



PROJECT

Bishopsgate and nearby City StreetSpace Schemes
London Streetspace Programme

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NOTES

GLA Air Quality Focus Areas taken from data.london.gov.uk

SHEET TITLE Figure 2

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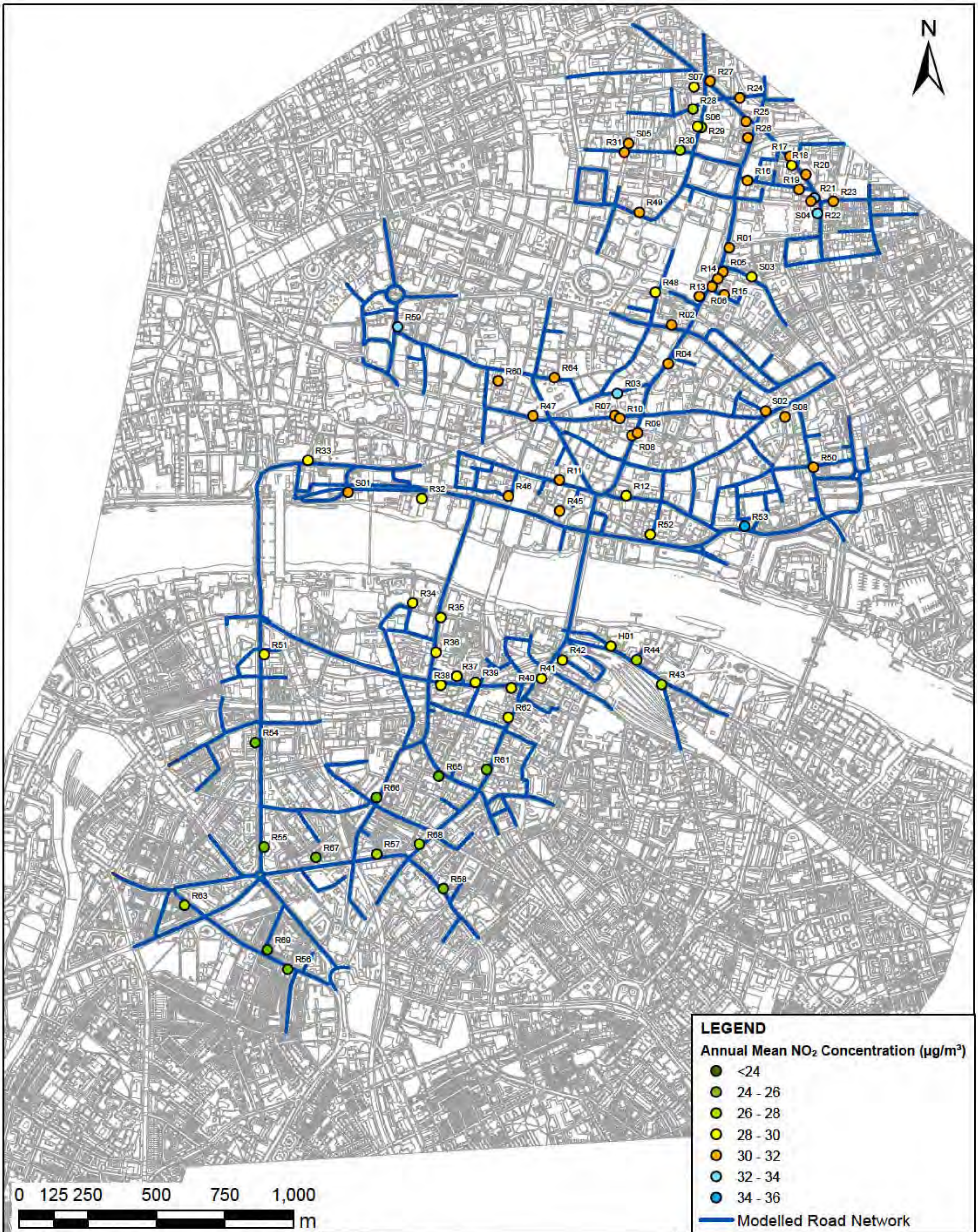

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Figure 3

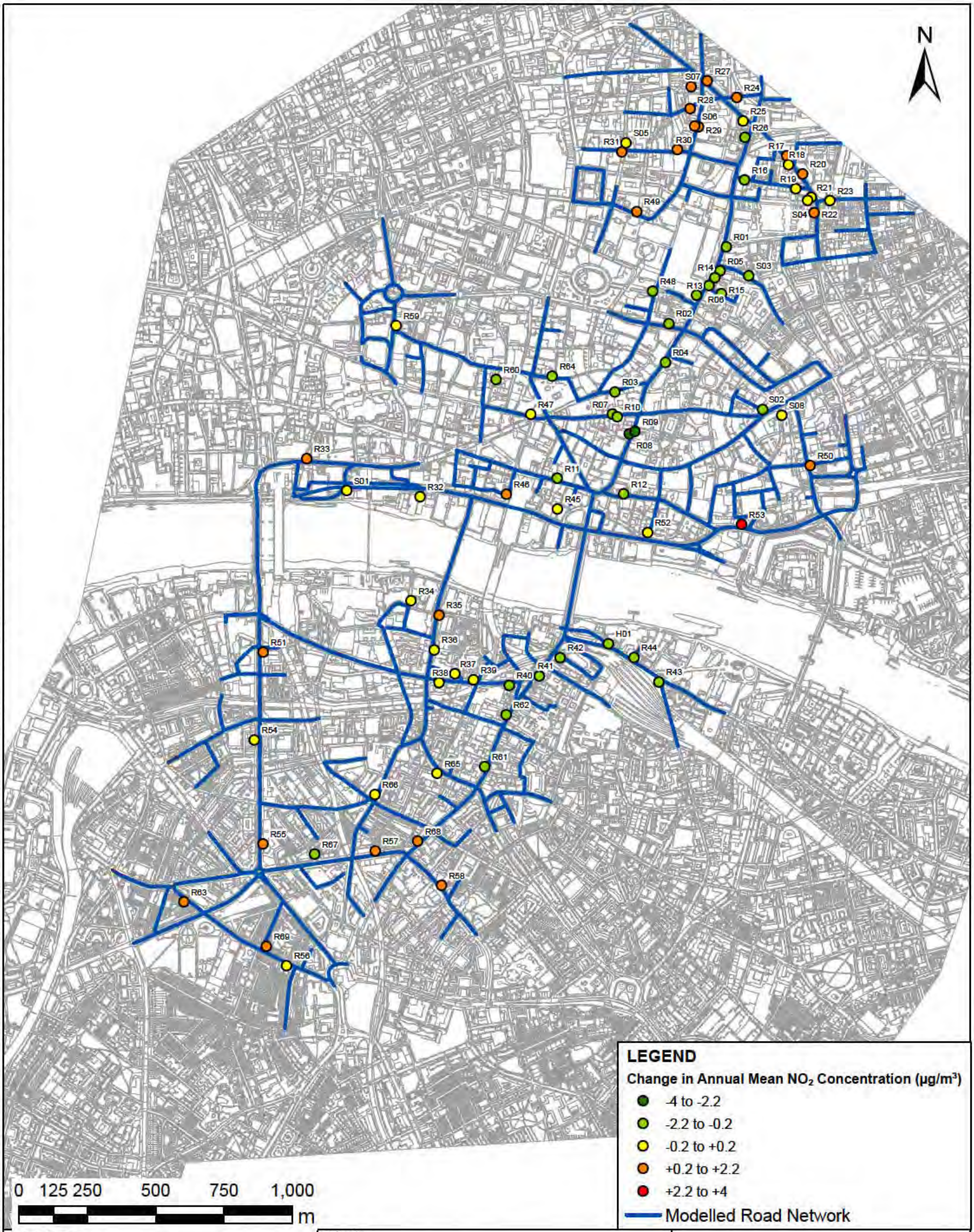

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Figure 4

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Appendix B Background Concentrations

Table 13 Modelled Annual Mean Background Concentrations

Receptor ID	X	Y	Grid Square	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
H01	532930.5	180286.1	532500_180500	27.3	14.8	9.4
R01	533361.3	181738.1	533500_181500	29.1	14.9	9.5
R02	533151	181457.0	533500_181500	29.1	14.9	9.5
R03	532953.6	181207.3	532500_181500	30.7	14.6	9.3
R04	533138.6	181315.1	533500_181500	29.1	14.9	9.5
R05	533338.8	181650.4	533500_181500	29.1	14.9	9.5
R06	533298.4	181596.6	533500_181500	29.1	14.9	9.5
R07	532944.9	181126.8	532500_181500	30.7	14.6	9.3
R08	533006.1	181054.2	533500_181500	29.1	14.9	9.5
R09	533027.2	181063.5	533500_181500	29.1	14.9	9.5
R10	532961.9	181116.5	532500_181500	30.7	14.6	9.3
R11	532742.9	180891.9	532500_180500	27.3	14.8	9.4
R12	532985.9	180834.8	532500_180500	27.3	14.8	9.4
R13	533252.4	181561.1	533500_181500	29.1	14.9	9.5
R14	533319.8	181625.7	533500_181500	29.1	14.9	9.5
R15	533342.8	181566.4	533500_181500	29.1	14.9	9.5
R16	533427.3	181982.8	533500_181500	29.1	14.9	9.5
R17	533582.3	182071.1	533500_182500	25.6	15.2	9.6
R18	533588.3	182038.4	533500_182500	25.6	15.2	9.6
R19	533614.6	181950.5	533500_181500	29.1	14.9	9.5
R20	533640.3	182004.9	533500_182500	25.6	15.2	9.6

Receptor ID	X	Y	Grid Square	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
R21	533671.4	181919.3	533500_181500	29.1	14.9	9.5
R22	533682.0	181863.2	533500_181500	29.1	14.9	9.5
R23	533739.9	181907.4	533500_181500	29.1	14.9	9.5
R24	533399.1	182283.8	533500_182500	25.6	15.2	9.6
R25	533422.2	182198.2	533500_182500	25.6	15.2	9.6
R26	533429.2	182138.3	533500_182500	25.6	15.2	9.6
R27	533291.3	182344.8	533500_182500	25.6	15.2	9.6
R28	533228.9	182244.2	533500_182500	25.6	15.2	9.6
R29	533259.6	182177.0	533500_182500	25.6	15.2	9.6
R30	533182.5	182093.6	533500_182500	25.6	15.2	9.6
R31	532978.7	182085.2	532500_182500	29.5	15.3	9.6
R32	532242.1	180823.8	532500_180500	27.3	14.8	9.4
R33	531827.1	180963.8	531500_180500	26.0	14.6	9.4
R34	532208.3	180444.3	532500_180500	27.3	14.8	9.4
R35	532310.7	180390.4	532500_180500	27.3	14.8	9.4
R36	532293.7	180263.4	532500_180500	27.3	14.8	9.4
R37	532368.9	180176.6	532500_180500	27.3	14.8	9.4
R38	532310.9	180143.7	532500_180500	27.3	14.8	9.4
R39	532436.5	180154.5	532500_180500	27.3	14.8	9.4
R40	532567.6	180133.8	532500_180500	27.3	14.8	9.4
R41	532677.4	180168.2	532500_180500	27.3	14.8	9.4
R42	532753.9	180235.0	532500_180500	27.3	14.8	9.4
R43	533114.8	180146.5	533500_180500	26.9	14.7	9.4
R44	533023.9	180236.4	533500_180500	26.9	14.7	9.4

Receptor ID	X	Y	Grid Square	NO_2 (μg/m³)	PM_{10} (μg/m³)	$PM_{2.5}$ (μg/m³)
R45	532743.9	180778.9	532500_180500	27.3	14.8	9.4
R46	532557.3	180833.1	532500_180500	27.3	14.8	9.4
R47	532646.1	181125.5	532500_181500	30.7	14.6	9.3
R48	533091.7	181575.6	533500_181500	29.1	14.9	9.5
R49	533033.6	181866.8	533500_181500	29.1	14.9	9.5
R50	533667.4	180938.3	533500_180500	26.9	14.7	9.4
R51	531668.4	180255.8	531500_180500	26.0	14.6	9.4
R52	533073.3	180693.2	533500_180500	26.9	14.7	9.4
R53	533417.1	180723.3	533500_180500	26.9	14.7	9.4
R54	531635.6	179934.3	531500_179500	23.0	14.9	9.5
R55	531667.3	179554.4	531500_179500	23.0	14.9	9.5
R56	531753.8	179108.5	531500_179500	23.0	14.9	9.5
R57	532077.7	179528.4	532500_179500	22.6	15.1	9.5
R58	532320.0	179403.1	532500_179500	22.6	15.1	9.5
R59	532154.1	181450.5	532500_181500	30.7	14.6	9.3
R60	532519.7	181253.0	532500_181500	30.7	14.6	9.3
R61	532477.6	179836.7	532500_179500	22.6	15.1	9.5
R62	532555.9	180027.0	532500_180500	27.3	14.8	9.4
R63	531377.6	179343.0	531500_179500	23.0	14.9	9.5
R64	532724.6	181265.1	532500_181500	30.7	14.6	9.3
R65	532303.4	179812.6	532500_179500	22.6	15.1	9.5
R66	532076.8	179734.8	532500_179500	22.6	15.1	9.5
R67	531856.4	179516.8	531500_179500	23.0	14.9	9.5
R68	532232.8	179564.8	532500_179500	22.6	15.1	9.5

Receptor ID	X	Y	Grid Square	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
R69	531679.9	179179.6	531500_179500	23.0	14.9	9.5
S01	531973.6	180847.0	531500_180500	26.0	14.6	9.4
S02	533493.6	181142.8	533500_181500	29.1	14.9	9.5
S03	533443.1	181631.9	533500_181500	29.1	14.9	9.5
S04	533658.3	181907.6	533500_181500	29.1	14.9	9.5
S05	532994.5	182118.4	532500_182500	29.5	15.3	9.6
S06	533245.8	182180.2	533500_182500	25.6	15.2	9.6
S07	533232.5	182324.0	533500_182500	25.6	15.2	9.6
S08	533563.8	181121.9	533500_181500	29.1	14.9	9.5

Appendix C Data and Assumptions

Data Provided

- 2022 OS mapping files from MasterMap® including TOPO layer from TfL in November 2022;
- AddressBase® layer with building points and uses provided by TfL in November 2022;
- Road scheme layout provided by TfL in pdf format on November 2022;
- PM (5pm - 6pm) peak traffic data from ONE model provided by TfL in October 2022 for 2026 for a future-base (DM) and sensitivity case (DS).

Assumptions

- Traffic data converted to 24-hour AADT format based on existing traffic count data in the study area provided by TfL and DfT.
- NOx, PM_{10} and $PM_{2 5}$ and CO_2 vehicle emission factors assumed for 2021 as per information in Defra's latest Emissions Factors Toolkit v11.0;
- Background NOx, NO_2, PM_{10} and $PM_{2.5}$ concentrations for the year 2026 taken from Defra's 2018-based background maps adjusted based on comparison with local monitoring data;
- Model verification not conducted as no baseline traffic data provided. As model was found to potentially over-predict concentrations, so no adjustment applied;
- Residential accommodation is assumed for ground floor (1.5m height) except where alternative information is known (for example where ground floor is commercial).