Enfield Council

LONDON BOROUGH OF ENFIELD

Air Dispersion Modelling Assessment, Volume 1 - Report

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TERMS, ABBREVIATIONS AND ACRONYMS

Term	Definition
Acid deposition	Mixture of air pollutants that deposit from the atmosphere leading to the acidification of freshwaters and soils.
Adjustment	Application of a correction factor to modelled results to account for uncertainties in the model (also sometimes referred to as a 'verification factor').
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	A policy target, generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air Quality Positive	The Air Quality Positive approach is a process of identifying and implementing ways to push development beyond compliance with both the Mayor of London's Air Quality Neutral benchmarks and the minimum requirements of an air quality assessment. The goal is for development to enhance air quality.
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive subgroups (see also air quality objective).
Air quality target	A policy or statutory target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Ambient air	Outdoor air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year.
AQMA	Air Quality Management Area.
Background concentration or deposition rate	The ambient level of pollution that is not affected by local sources of pollution.
Bryophytes	A group of plants that include mosses, liverworts and hornworts (see https://www.britishbryologicalsociety.org.uk/learning/about-bryophytes/)
Conservative	Tending to over-predict the impact rather than under-predict.
Critical level	Concentration of a pollutant in the ambient air above which direct adverse impacts on sensitive vegetation may occur.
Critical load	An estimate of exposure to pollutants, above which significant harmful effects on specified sensitive elements of the environment are likely to occur.

Term	Definition
Data capture	The percentage of all the possible measurements for a given period that were validly measured.
Defra	Department for Environment, Food and Rural Affairs.
Designated site	In this report this term is used when referring to a Special Area of Conservation, Special Protection Area or Ramsar site.
Effect	The consequence of an impact on a receiving feature at a receptor (human or ecological). See 'Impact'.
Exceedance	A period of time where the concentration of a pollutant is greater than the appropriate air quality standard.
GLA	Greater London Authority.
HDV	Heavy duty vehicle (all vehicles over 3.5 tonnes gross weight)
Human receptor	A location where a member of the public is likely to be present.
Impact	A change in pollutant level brought about by a change in activity, where the change in pollutant level has an effect on a receiving feature (human or ecological). See 'Effect'.
Kerbside	A monitoring location within one metre of the kerb of a busy road.
K_{eq}/ha/yr	Kilograms equivalent (of hydrogen ions) per hectare per year. Unit of acid deposition rate.
kgN/ha/yr	Kilograms of nitrogen per hectare per year. Unit of nitrogen deposition rate.
km	Kilometre, unit of length or distance (1km = 1,000 metres)
Lichen	A lichen is not a single organism; it is a stable symbiotic association between a fungus and algae and/or cyanobacteria (see https://britishlichensociety.org.uk/learning/what-is-a-lichen)
Limit value	A legally binding air quality parameter that must not be exceeded (see also air quality standard).
LAQM	Local Air Quality Management.
µg/m^3	Micrograms per cubic metre. Unit of concentration in terms of mass per unit volume. A concentration of 1µg/m^3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
m	Metre, unit of length or distance
Model adjustment	Following model verification, the process by which modelled results are amended. This helps to account for systematic error.
NH_3	Ammonia.

Term	Definition
Nitrogen deposition (N-deposition)	Nitrogen deposition is the input of reactive nitrogen to the biosphere from the atmosphere and can be deposited via gases, dry deposition and as wet deposition in precipitation.
NO_2	Nitrogen dioxide.
NOx	Nitrogen oxides (including nitrogen monoxide and nitrogen dioxide).
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
Ramsar site	A wetland site designated to be of international importance under the Ramsar Convention.
Relevant exposure	A human receptor has relevant exposure to ambient air pollutant concentrations where people are likely to be present over a period of time equal to or exceeding the averaging time period that is set for an air quality standard. For example, there will likely be relevant exposure to 1-hour, 24-hour and annual mean pollutant concentrations at a residential property since people are likely to be present over all of these averaging time periods which are set by standards for ambient air pollutants.
Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
Roadside	A monitoring location typically within one to five metres of the kerb of a busy road, this distance can be up to 15 metres in some cases.
SAC	Special Area of Conservation.
SPA	Special Protection Area.
TfL	Transport for London.
Uncertainty	A measure, associated with the result of a measurement, which characterises the range of values within which the true value is expected to sit. Uncertainty is usually expressed as the range within which the true value is expected to sit with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy' and has replaced it on recent European legislation.
Urban background	An urban location at a distance from sources and as such broadly representative of background conditions in urban areas, e.g., urban residential areas
Validation	Refers to the general comparison of model performance against monitoring data carried out by model developers.
Verification	Comparison of modelled results versus any local monitoring data at relevant locations.

1 INTRODUCTION

1.1.1. WSP has been commissioned by the London Borough of Enfield ('LBE') to undertake an assessment of the potential air quality impacts of the draft Local Plan 2019-2041 proposals. The results of the air quality assessment are to inform the Integrated Impact Assessment ('IIA') and Habitats Regulations Assessment ('HRA'), as part of the evidence base for the Regulation 19 stage in developing the draft Local Plan 2019-2041 ('the draft Local Plan')[1].

1.1.2. The air quality assessment focuses on:

- impacts with regard to air quality standards for the protection of public (human) health at locations with 'relevant exposure' within the borough; and
- impacts at 'designated sites' protected under the Conservation of Habitats and Species Regulations 2017 as amended (commonly referred to as 'the Habitats Regulations')[2], within 10km of the borough.

1.1.3. With regard to human health, the pollutants of interest are:

- nitrogen dioxide (NO_2); and
- particulate matter (PM_{10} and $PM_{2.5}$).

1.1.4. The following designated sites were identified at the Regulation 18 stage of the draft Local Plan[3] development (without the benefit of any traffic forecasts) as potentially being at moderate or high risk from adverse impacts, and are consequently accounted for in the assessment:

- Epping Forest Special Area of Conservation ('SAC'), to the east of the borough, with potential high risk;
- Lee Valley Special Protection Area ('SPA') / Ramsar site, to the south of the borough, with potential moderate risk; and
- Wormley-Hoddesdon Park SAC, to the north of the borough, with potential moderate risk.

1.1.5. The pollutants of interest are:

- annual mean nitrogen oxides ('NOx') concentrations;
- annual mean ammonia ('NH_3') concentrations;
- annual mean nitrogen deposition ('N-deposition'); and
- annual mean acid deposition.

1.1.6. The key pollutant source addressed by the air quality assessment is road traffic.

[1] Enfield Council. https://www.enfield.gov.uk/services/planning/new-enfield-local-plan
[2] The National Archives. *The Conservation of Habitats and Species Regulations 2017 – Statutory Instrument 2017 No. 1012* (https://www.legislation.gov.uk/uksi/2017/1012/contents/made)
[3] Enfield Council. *Enfield Local Plan Integrated Impact Assessment Appendices* (https://www.enfield.gov.uk/__data/assets/pdf_file/0016/11905/Integrated-Impact-Assessment-Appendices-LUC-2021-Planning.pdf)

1.1.7. The findings of the assessment are summarised at the end of this report together with recommendation for Air Quality Positive[4] development.

[4] Mayor of London. *London Plan Guidance Air Quality Positive February 2023*. (https://www.london.gov.uk/programmes-strategies/planning/implementing-london-plan/london-plan-guidance/air-quality-positive-aqp-guidance)

2 AIR QUALITY STANDARDS, CRITICAL LEVELS AND CRITICAL LOADS

2.1 OVERVIEW

2.1.1. Underpinning the air quality assessment are thresholds that have been set to protect public (human) health and sensitive features at designated sites. For human health, the standards have been set by the Government in legislation as objectives which apply at local level, and limit values and targets which apply at national level. For designated sites, standards have been determined by nature conservation bodies as critical levels and critical loads. A critical level is defined as the concentration of a pollutant in the ambient air above which direct adverse impacts on sensitive vegetation may occur. A critical load is defined as an estimate of exposure to pollutants, above which significant harmful effects on specified sensitive elements of the environment are likely to occur.

2.2 AIR QUALITY STANDARDS

2.2.1. The Air Quality (England) Regulations 2000[5] and the Air Quality (England) (Amendment) Regulations 2002[6] set objectives for ambient pollutant concentrations. The objective for human health applies where there is relevant exposure *"…at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present…"*.

2.2.2. The Air Quality Standards Regulations 2010[7] (as amended)[8], the Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019[9] and the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020[10] set legally binding limit values for concentrations in outdoor air of major air pollutants that affect public (human) health including NO_2, PM_{10} and $PM_{2.5}$. The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023[11] sets updated targets for $PM_{2.5}$.

2.2.3. The relevant air quality standards are given in **Table 2-1** below.

[5] The National Archives. *The Air Quality (England) Regulations 2000 – Statutory Instrument 2000 No.928* (https://www.legislation.gov.uk/uksi/2000/928/contents/made)
[6] The National Archives. *The Air Quality (England) (Amendment) Regulations 2002 – Statutory Instrument 2002 No. 3043* (https://www.legislation.gov.uk/uksi/2002/3043/contents/made)
[7] The National Archives.*The Air Quality Standards Regulations 2010 - Statutory Instrument 2010 No.1001*. (https://www.legislation.gov.uk/uksi/2010/1001/contents/made)
[8] The National Archives. *The Air Quality Standards (Amendment) Regulations 2016 - Statutory Instrument 2016 No.1184* (https://www.legislation.gov.uk/uksi/2016/1184/contents/made)
[9] The National Archives. *The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 No.74* (https://www.legislation.gov.uk/uksi/2019/74/contents/made)
[10] The National Archives. *The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 - Statutory Instrument 2020 No.1313* (https://www.legislation.gov.uk/uksi/2020/1313/contents/made)
[11] The National Archives. *Environmental Targets (Fine Particulate Matter) (England) Regulations 2023* (https://www.legislation.gov.uk/uksi/2023/96/contents/made)

Table 2-1 - Relevant air quality standards for human health

Pollutant	Concentration (µg/m³)	Measured as	Number of exceedances allowed in a calendar year	Set in regulations as
NO_2	40	Annual mean	None	Objective and limit value
NO_2	200	1-hour mean	No more than 18	Objective and limit value
PM_{10}	40	Annual mean	None	Objective and limit value
PM_{10}	50	24-hour mean	No more than 35	Objective and limit value
$PM_{2.5}$	20	Annual mean	None	Limit value
$PM_{2.5}$	10	Annual mean	None	Mayor of London target for 2030 (non-statutory, not in regulations) National target for 2040

2.3 CRITICAL LEVELS AND CRITICAL LOADS

2.3.1. Critical levels and critical loads that are applicable at the designated sites considered by this assessment were obtained from the Centre for Hydrology and Ecology's Air Pollution Information System (APIS)[12] and are set out in **Table 2-2** and **Table 2-3** respectively.

[12] Centre for Hydrology and Ecology. Air Pollution Information System (https://www.apis.ac.uk/)

Table 2-2 – Relevant critical levels for designated sites

Pollutant	Concentration ($\mu g/m^3$)	Measured as	Requirement	Applicable designated site
NOx	30	Annual mean	Critical level for the protection of sensitive vegetation and ecosystems.	All
NH_3	1 or 3	Annual mean	1µg/m³ (locations with lichens and/or bryophytes) 3µg/m³ (locations without lichens and/or bryophytes)	All

Table 2-3 – Relevant critical loads for designated sites

Nitrogen deposition Lower critical load (kgN/ha/yr) for the most sensitive feature	Acid deposition Critical loads (k_{eq}/ha/yr) for the most sensitive feature	Applicable designated site
10	Min: 0.142 Max: 1.730	Epping Forest SAC
15	Not sensitive	Lee Valley SPA/Ramsar
15	Min: 0.142 Max: 1.745	Wormley Hoddesdonpark Woods SAC

3 BASELINE CONDITIONS

3.1 LONDON BOROUGH OF ENFIELD

LOCAL AIR QUALITY MANAGEMENT

3.1.1. Under the Environment Act 1995 (as amended 2021)[13,14], LBE is responsible for local air quality management within the borough. This requires LBE to report annually to Defra on the current status of local air quality in terms of pollutants that are covered by the Air Quality Regulations. Where it is identified that an air quality standard may not be met, the local authority (in this case LBE) must declare an Air Quality Management Area (AQMA) and put in place an air quality action plan to bring about improvements. In 2001, LBE declared a borough-wide AQMA due to exceedances of the air quality standards for annual mean NO_2 and 24-hour mean PM_{10} (**Table 2-1**).

3.1.2. There are currently four Air Quality Focus Areas (AQFAs) within the borough, which have been identified by the Greater London Authority (GLA) as locations that exceed the annual mean limit value for NO_2 (**Table 2-1**) in locations where there is a high degree of human exposure[15]:

- AQFA 43 for the A406 North Circular Edmonton A1010 and Fore Street A1010
- AQFA 44 for Enfield Great Cambridge Road A10 junction Southbury Road A110
- AQFA 45 for Southgate Circus A111/A1004
- AQFA 46 for the A406 North Circular between Bowes Road and Great Cambridge Road.

3.1.3. AQFAs have been defined by the GLA to address concerns raised by London boroughs within their Local Air Quality Management (LAQM) review process and forecasted air pollution trends.

3.1.4. The Enfield AQMA and AQFAs are illustrated in **Volume 2**, **Figure A-1**.

LOCAL AIR QUALITY MONITORING

3.1.5. LBE currently operates a network of air quality monitoring devices to assist in its LAQM responsibilities. The network comprises four automatic monitoring stations which continuously measure NO_2 and PM_{10} in the ambient air to determine 1-hour, 24-hour and annual mean concentrations, and 28 passive diffusion tube locations which are used to determine concentrations of annual mean NO_2.

[13] The National Archives. *Environment Act 1995 c.25* (https://www.legislation.gov.uk/ukpga/1995/25/contents)
[14] The National Archives. *Environment Act 2021 c.30* (https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted)
[15] Greater London Authority. *London Atmospheric Emissions Inventory 2019 Air Quality Focus Areas* (https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory--laei--2019-air-quality-focus-areas#:~:text=The%20Focus%20Areas%20are%20locations,and%20forecasted%20air%20pollution%20trends)

3.1.6. The Enfield Council Air Quality Annual Status Report for 2021[16] includes the results of monitoring for the years 2017 to 2021 inclusive[17]. The data shows general decreasing trends in NO_2 and PM_{10} concentrations across Enfield.

Nitrogen Dioxide

3.1.7. The annual mean NO_2 concentrations recorded at the automatic monitoring locations between 2017 and 2021 are outlined in **Table 3-1**. The monitored annual mean NO_2 concentrations at the automatic monitoring locations exhibit a decreasing trend at all locations and since 2020 the monitored NO_2 concentrations have been below, and therefore meet, the air quality standard for annual mean NO_2 (40ug/m^3).

3.1.8. The annual mean NO_2 concentrations recorded at the 28 diffusion tube locations between 2017 and 2021 are reproduced in **Table 3-2**. The monitored annual mean NO_2 concentrations at the diffusion tube monitoring locations exhibit a decreasing trend at all locations and in 2021 the monitored NO_2 concentrations were below, and therefore met, the air quality standard for annual mean NO_2 (40ug/m^3).

Table 3-1 – Annual and 1-hour mean NO_2 concentration (µg/m^3) statistics at automatic monitoring locations

Site ID	Location	X	Y	Site type	2017	2018	2019	2020*	2021*
ENF1	Bush Hill Park	533881	195832	Urban background	27 (0)	26 (0)	22 (0)	18 (0)	18 (0)
ENF4	Derby Road	535056	192470	Roadside	38 (0)	35 (0)	37 (0)	28 (0)	24 (0)
ENF5	Bowes Road	529893	192224	Roadside	**45** (3)	**44** (0)	**41** (0)	30 (0)	30 (0)
ENF7	Prince of Wales School	536886	198497	Urban background	23 (0)	23 (0)	23 (0)	18 (0)	18 (0)

Concentration values shown in shown in **bold** exceed the air quality standard of 40µg/m^3

Values in brackets () are the number of exceedances of the 1-hour mean concentration of 200µg/m^3 where the air quality standard allows for no more than 18 exceedances in a year

*Concentrations for 2020 and 2021 will have been affected by COVID-19 restrictions

[16] London Borough of Enfield. *Enfield Council Air Quality Annual Status Report for 2021* (https://www.enfield.gov.uk/__data/assets/pdf_file/0011/30143/Air-quality-status-report-2022-Environment.pdf)
[17] The reader should note that monitoring data from 2020 and 2021 should be treated with caution, as pollutant concentrations were affected by COVID-19 restrictions.

Table 3-2 - Annual mean NO_2 concentration (µg/m^3) statistics at passive diffusion tube locations

Site ID	X	Y	Site type	2017	2018	2019	2020*	2021*
Enfield A	533659	192376	Urban background	32.4	-	-	-	-
Enfield 1A	532668	196555	Kerbside	-	39.7	**46.8**	**41.0**	39.0
Enfield 2	536634	196356	Industrial	30.0	-	-	-	-
Enfield 2A	529453	194332	Kerbside	-	37.5	37.1	30.8	32.2
Enfield 3	533881	195832	Urban background	23.2	-	-	-	-
Enfield 3A	531981	195305	Roadside	-	28.1	23.1	19.7	20.9
Enfield 4	530349	193283	Urban background	20.8	-	-	-	-
Enfield 4A	530966	192714	Roadside	-	30.0	30.1	27.6	26.3
Enfield 5	535126	196295	Urban background	24.5	-	-	-	-
Enfield 5A	534238	196314	Roadside	-	**42.5**	39.5	34.0	34.7
Enfield 6	526449	198404	Urban background	19.1	-	-	-	-
Enfield 6A	526449	198404	Urban background	-	19.7	14.0	13.2	12.0
Enfield 7	535460	199849	Roadside	27.6	23.3	20.6	17.3	16.0
Enfield 8	535056	192470	Roadside	35.6	-	-	-	-
Enfield 8A	534195	192806	Kerbside	-	**41.3**	**40.9**	39.9	37.3
Enfield 9A	529945	192118	Urban background	-	26.6	24.3	18.6	19.0
Enfield 10	530161	192032	Urban background	-	37.5	36.6	29.4	28.1
Enfield 11	530448	193845	Roadside	-	-	-	-	17.7
Enfield 12	530374	193289	Roadside	-	-	-	-	15.6
Enfield 13	533201	192083	Roadside	-	-	-	-	28.1
Enfield 14	533304	192130	Roadside	-	-	-	-	26.9

Site ID	X	Y	Site type	2017	2018	2019	2020*	2021*
Enfield 15	533322	192044	Roadside	-	-	-	-	33.2
Enfield 16	533684	191771	Roadside	-	-	-	-	23.7
Enfield 17	533766	192178	Roadside	-	-	-	-	33.9
Enfield 18	532165	192954	Roadside	-	-	-	-	30.8
Enfield 19	531878	192668	Roadside	-	-	-	-	27.5
Enfield 20	531173	192390	Roadside	-	-	-	-	25.7
Enfield 21	530968	192259	Roadside	-	-	-	-	28.8

Concentration values shown in shown in **bold** exceed the air quality standard of 40µg/m^3

Annual mean NO_2 concentrations exceeding 60µg/m^3 indicate that the air quality standard for 1-hour mean concentrations of 200µg/m^3 not to be exceeded more than 18 exceedances in a year is likely to have not been met

*Concentrations for 2020 and 2021 will have been affected by COVID-19 restrictions

Particulate Matter

3.1.9. The annual mean PM_{10} concentrations recorded at the automatic monitor between 2017 and 2021 have been reproduced in **Table 3-3** below. Since 2017, there has been an overall decrease in PM_{10} concentrations. No exceedances of the annual mean PM_{10} air quality standard of 40µg/m^3 have been recorded.

Table 3-3 - Annual mean PM_{10} concentration (µg/m^3) with number of 24-hour means >50 µg/m^3 in brackets

Site ID	Location	X	Y	Site type	2017	2018	2019	2020	2021
ENF5	Bowes Road	529893	192224	Roadside	24.0 (9)	18.0 (2)	19.0 (9)	15.0 (2)	15.0 (0)

DEFRA BACKGROUND CONCENTRATION DATA

3.1.10. National modelling[18] undertaken by Defra provides estimates of background concentrations of NOx, NO_2, PM_{10} and $PM_{2.5}$ across the UK on a 1km x 1km basis up to 2030. The background

[18] Defra (2021) *Background Mapping data for local authorities.* (https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018)

concentration ranges across Enfield are summarised in **Table 3-4**. The background concentrations are well below, and therefore meet, the respective air quality standards, except for $PM_{2.5}$ in 2030.

Table 3-4 - Defra predicted annual mean background concentrations (µg/m^3)

Year	NO_2	PM_{10}	$PM_{2.5}$
2019	13.3 to 30.2	15.0 to 20.7	10.1 to 13.6
2030	9.5 to 19.9	13.8 to 19.1	9.1 to 12.6

3.1.11. **Volume 2**, **Figure A-2** shows the annual mean $PM_{2.5}$ background concentrations for 2030 across Enfield. The air quality standard (London only) for 2030 (10µg/m^3) is exceeded across the urban part of the borough and in the vicinity of the M25, with concentration slightly below the standard in more rural and suburban areas to the west of the borough. It should be noted that the background annual mean $PM_{2.5}$ concentrations are predicted to exceed the 2030 air quality standard across much of London.

3.2 DESIGNATED SITES

3.2.1. APIS provides mapped pollutant concentration and deposition data for the UK. **Table 3-5** shows the NH_3 and NOx concentrations, and nitrogen and acid deposition rates for the designated sites.

3.2.2. Background annual mean NOx concentrations are within the critical level of 30µg/m^3 across all the designated sites. Background NH_3 is above the critical level of 1µg/m^3, and below 3µg/m^3 at all of the designated sites.

Table 3-5 – Mapped background levels for designated sites

Site	Designation	NH_3 (µg/m^3)	NO_X (µg/m^3)	N deposition (kgN/ha/yr)	Acid deposition (keq/ha/yr)
Epping Forest	SAC	1.61-2.32	12.12-27.12	15.58-31.25	1.42-2.72
Lee Valley	SPA/Ramsar	2.32	23.42-24.08	17.70-17.79	Not sensitive
Wormley Hoddesdonpark Woods	SAC	1.51	10.76-11.14	24.61-26.20	2.08-2.18

4 METHODOLOGY

4.1 AIR QUALITY MODELLING

MODEL SCENARIOS

4.1.1. The following scenarios have been modelled:

- **Baseline**: 2019 base year to enable verification of model predictions against LBE monitoring data and to indicate 'current' baseline conditions.
- **Projected Baseline**: Base year projected to 2041 in terms of emissions assumptions but without traffic growth, to enable the assessment of the draft Local Plan in-combination with other plans and projects.
- **Future Baseline**: 2041 including traffic growth (including that from committed developments) without the draft Local Plan, to enable the assessment of the draft Local Plan alone.
- **Draft Local Plan**: 2041including traffic growth (including that from committed developments) with the draft Local Plan.

MODEL SELECTION AND BEST PRACTICE ASSESSMENT TOOLS

4.1.2. For the prediction of pollutant concentrations arising from road traffic emissions, the dispersion model ADMS-Roads was used[19]. This model uses detailed information regarding traffic flows on the local road network, surface roughness, and local meteorological conditions to predict pollutant concentrations at gridded and discrete receptor locations.

4.1.3. The latest versions (at the time of assessment) of best practice assessment tools were used to build the model and process the outputs:

- Defra's Emissions Factors Toolkit[20] (EFTv.11) was used to generate emissions from roads for NOx, PM_{10} and $PM_{2.5}$.
- Air Quality Consultants Ltd's Calculator for Road Emissions of Ammonia (CREAM) [21] was used to generate emissions from roads for NH_3.
- Defra's NOx to NO_2 calculator[22] was used to convert modelled NO_x concentrations to total ambient NO_2 concentrations.
- Defra's background maps were used to assign background pollutant concentrations to modelled receptors.

[19] ADMS-Roads v5.0.0.1 (current version at time of assessment). For further details of the model software used, go to http://www.cerc.co.uk/index.php
[20] Defra (2021). *Emissions Factors Toolkit v11.0* (current version at time of assessment). (https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/)
[21] AQC (2020). *Calculator for Road Emissions of Ammonia v1A* (current version at time of assessment). (https://www.aqconsultants.co.uk/resources/calculator-for-road-emissions-of-ammonia)
[22] Defra (2020). *NO_x to NO_2 Calculator v8.1* (current version at time of assessment). (https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc)

METEOROLOGICAL DATA

4.1.4. Meteorological data, such as wind speed and direction, is used by dispersion models to determine pollutant transportation and levels of dilution due to the wind. Meteorological data for 2019 was used in the model from the Met Office observation station at Heathrow Airport. This station is considered to provide representative data for the assessment.

POLLUTANTS MODELLED

4.1.5. Annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ were considered in the modelling assessment as the pollutants of concern for human health. NOx, NH_3, nitrogen deposition and acid deposition were considered in terms of ecological receptors at the designated sites.

4.1.6. Local Air Quality Management Technical Guidance (LAQM.TG(22))[23] indicates that, where road traffic is the primary local source of emissions, the one-hour mean NO_2 air quality standard of 200µg/m^3 (not to be exceeded more than 18 times per year) is likely to be met at roadside locations where the annual mean concentration is less than 60µg/m^3. Following this guideline, the 1-hour mean NO_2 air quality standard was considered for roadside receptors within this assessment to determine possible locations that do not meet this air quality standard.

4.1.7. Predicted 24-hour mean concentrations of PM_{10} is available as an output option within the ADMS-Roads dispersion model for comparison against this air quality standard. However, maximum 24-hour mean concentrations are influenced by variations in daily traffic and the coincidence of periods of high traffic flow with poor dispersion conditions. An empirical relationship between exceedances of the 24-hour mean PM_{10} air quality standard and annual mean PM_{10} concentrations has been developed using monitored data, that captures the likely impacts of short-term variability in emissions from road traffic. LAQM.TG(22) provides this relationship to estimate the potential exceedances of the PM_{10} 24-hour mean air quality standard from the predicted annual mean PM_{10} concentration:

Number of 24-hour mean exceedances = -18.5 + 0.00145 × annual mean^3 + (206/annual mean)

4.1.8. Following this relationship, the 24-hour mean PM_{10} air quality standard was considered to determine possible locations that do not meet this air quality standard.

VEHICLE EMISSIONS FACTORS

4.1.9. Vehicle emissions data were derived for relevant years from the EFTv.11. The EFTv.11 provides forecasts up to and including the year 2030, taking account of expected changes in vehicle fleet composition, take up of low/zero emission technologies and phasing out of more polluting technologies. However, the EFTv.11 does not take into consideration the impact of the full Ultra Low Emission Zone (ULEZ) expansion to the North and South Circular Roads in 2021, nor the expansion of the ULEZ to the M25 in 2023. A 2030 emission year has been used for the 2041 Projected

[23] Defra (2022) *Part IV The Environment Act 1995 as amended by the Environment Act 2021 and Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Technical Guidance LAQM.TG(22).* (https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf)

Baseline, Future Baseline and Draft Local Plan scenarios. These limitations result in a conservative estimate of vehicle emissions due to all future improvements not being fully realised by the EFTv.11.

TRAFFIC DATA

4.1.10. Traffic data was provided from Transport for London (TfL) strategic transport models, facilitated by WSP. The network included Enfield and neighbouring boroughs to capture the designated sites of concern, outlined in **Table 2-3**. Roads were digitised by aligning the geometry and measuring the width of each road link using aerial photography and Ordnance Survey MasterMap geospatial data[24].

4.1.11. Traffic data used in the model are reproduced in **Volume 3**, **Appendix A.**

MODEL VERIFICATION

4.1.12. The ADMS-Roads dispersion model has been widely validated for this type of assessment and is considered to be fit for purpose. However, model validation undertaken by the software developer would not have included validation in the vicinity of Enfield.

4.1.13. In line with LAQM.TG(22), model verification was undertaken using local authority roadside monitoring data for the year 2019. Details of the verification calculations are given in **Volume 3**, **Appendix B**. It was found that the model systematically underpredicted the annual mean NO_2 concentrations and therefore was adjusted accordingly to bring the model more into line with monitored concentrations.

RECEPTORS

Human Receptors

4.1.14. Modelling was undertaken for a representative sample of human receptors within the borough, with particular focus along busy roads and at junctions routinely subject to congestion. The GLA's London Atmospheric Emissions Inventory (LAEI) map of annual mean NO_2 concentrations for 2019 was used in selecting these receptors. The LAEI map gives modelled concentrations for 20m x 20m grid squares covering the whole of London. Residential receptor locations, as identified from Ordnance Survey AddressBase Premium geospatial data[25], falling within grid squares where the LAEI predicted annual mean NO_2 concentration exceeds 32µg/m^3 (i.e. 80% or higher of the annual mean NO_2 air quality standard, applied as an indicator of where air pollution hotspots may occur) were selected. In addition, receptor locations representing medical premises (including hospitals and medical premises), nursing homes, schools and nurseries across Enfield were included. Additional receptor points were added at school and nursery playground boundaries that are close to roads to indicate exposure at these locations.

[24] Provided to WSP by LBE for use via Emapsite's Contractor Link. © Crown copyright and database rights 2024 Ordnance Survey 0100031673.
[25] Provided to WSP by LBE for use via Emapsite's Contractor Link. © Crown copyright and database rights 2024 Ordnance Survey 0100031673 and © Local Government Information House Limited copyright and database rights 2024 0100031673.

4.1.15. Sensitive receptors were also selected at the relevant Site Allocations, i.e., those that are allocated for housing or housing and mixed use. Sensitive receptors were not selected for other site allocations, i.e., burial, industrial, industrial and mixed use, nature recovery or sporting/ leisure.

4.1.16. Modelled impacts at human receptors were considered against the Indices of Multiple Deprivation (IMD) for 2019[26] to assist in targeting specific areas of concern with the aim to improve air quality in those areas. The Ministry of Housing, Communities and Local Government's (recently renamed to the Department for Levelling Up, Housing & Communities) IMD for 2019 are national statistics that provide an overall index incorporating seven weighted domains of deprivation:

- income;
- employment;
- education, skills and training;
- health deprivation and disability;
- crime;
- barriers to housing and services; and
- living environment.

4.1.17. The published data are grouped into discrete geographical areas. These are then organised into 'deciles' where decile 1 is the most deprived 10% of the population and decile 10 is the least deprived 10% of the population.

Ecological Receptors

4.1.18. Pollutant levels within the designated sites have been predicted at intervals along transects of points (i.e., ecological receptors) arranged perpendicular to and extending up to 200m from affected roads.

PROCESSING OF RESULTS

4.1.19. Annual mean NO_2 concentrations were derived from the model predicted NOx using Defra's NOx to NO_2 calculator.

4.1.20. For NH_3, no adjustment was undertaken as there were no appropriate monitoring data to allow model verification for this pollutant.

4.1.21. Nitrogen deposition was calculated as follows:

Step 1 – calculate dry deposition fluxes:

- *Dry NO_2 deposition flux ($\mu g/m^2/s$) = road source contributed NO_2 ($\mu g/m^3$) * dry NO_2 deposition velocity for short vegetation (0.0015m/s) or tall vegetation (0.003m/s)*
- *Dry NH_3 deposition flux ($\mu g/m^2/s$) = road source contributed NH_3 ($\mu g/m^3$) * dry NH_3 deposition velocity for short vegetation (0.02m/s) or tall vegetation (0.03m/s)*

Step 2 – convert dry deposition fluxes to dry deposition rates:

[26] Ministry of Housing Communities and Local Government *English indices of deprivation 2019.* (https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019)

- *Dry nitrogen deposition due to NO_2 (kg/ha/yr) = dry NO_2 deposition flux (µg/m^2/s) * 96*
- *Dry nitrogen deposition due to NH_3 (kg/ha/yr) = dry NH_3 deposition flux (µg/m^2/s) * 259.7*

Step 3 – calculate total dry deposition rate

- *Total dry nitrogen deposition (kg/ha/yr) = dry nitrogen deposition due to NO_2 (kg/ha/yr) + dry nitrogen deposition due to NH_3 (kg/ha/yr) + background nitrogen deposition for short or tall vegetation (kg/ha/yr)*

4.1.22. Acid deposition was calculated as follows:

Step 1 – calculate dry deposition fluxes:

- *Dry NO_2 deposition flux (µg/m^2/s) = road source contributed NO_2 (µg/m^3) * dry NO_2 deposition velocity for short vegetation (0.0015m/s) or tall vegetation (0.003m/s)*
- *Dry NH_3 deposition flux (µg/m^2/s) = road source contributed NH_3 (µg/m^3) * dry NH_3 deposition velocity for short vegetation (0.02m/s) or tall vegetation (0.03m/s)*

Step 2 – convert dry deposition fluxes to dry deposition rates:

- *Dry nitrogen deposition due to NO_2 (keq/ha/yr) = dry NO_2 deposition flux (µg/m^2/s) * 6.8*
- *Dry nitrogen deposition due to NH_3 (keq/ha/yr) = dry NH_3 deposition flux (µg/m^2/s) * 18.5*

Step 3 – calculate total dry deposition rate:

- *Total dry acid deposition (keq/ha/yr) = dry acid deposition due to NO_2 (keq/ha/yr) + dry acid deposition due to NH_3 (keq/ha/yr) + background acid deposition for short or tall vegetation (keq/ha/yr)*

4.2 ASSESSMENT CRITERIA

HUMAN RECEPTORS

4.2.1. The approach provided in the Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) guidance[27] has been used within this assessment to assist in describing the air quality effects of emissions from traffic.

4.2.2. The guidance recommends that the impact at each receptor is described by expressing the magnitude of incremental change in annual mean concentration as a proportion of the relevant air quality standard and examining this change in the context of the new total concentration and its relationship with the assessment criterion. This is summarised in **Table 4-1**. The guidance does not provide impact descriptors for 1-hour mean NO_2 concentrations or 24-hour mean PM_{10} concentrations.

[27] Environmental Protection UK and Institute of Air Quality Management (2017) *Land Use Planning & Development Control: Planning for Air Quality (version 1.2)*. (https://iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf)

Table 4-1 - Impact descriptors for individual receptors

Annual mean concentration at receptors in assessment year	% Change in concentration relative to air quality standard*			
	1	2-5	6-10	>10
75% or less of the air quality standard	Negligible	Negligible	Slight	Moderate
76-94% of the air quality standard	Negligible	Slight	Moderate	Moderate
95-102% of the air quality standard	Slight	Moderate	Moderate	Substantial
103-109% of the air quality standard	Moderate	Moderate	Substantial	Substantial
110% or more of the air quality standard	Moderate	Substantial	Substantial	Substantial

Notes

*The air quality standard given in **Table 1-1.**

Where the change in concentrations is <0.5%, the change is described as 'negligible' regardless of the concentration.

When defining the concentration as a percentage of the air quality standard, 'without Proposed Development' concentration should be used where there is a decrease in pollutant concentration and the 'with Proposed Development;' concentration where there is an increase.

Where concentrations increase, the impact is described as adverse, and where it decreases as beneficial.

DESIGNATED SITES

4.2.3. For designated sites, consideration of significance is in line with the IAQM guidance on air quality impacts on designated sites[28] (this guidance has regard to Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations[29]). The 1% change HRA screening criterion for ruling out a likely significant effect as given in the guidance was applied. For NOx and NH_3, if the change is less than 1% of the relevant critical level then the effect is deemed not significant. For nitrogen and acid deposition, if the change is less than 1% of the relevant lower critical load then the effect is deemed not significant. However, where a change is greater than 1% of the relevant critical level/load the effect cannot be discounted as not significant and must be considered by a qualified Ecologist.

[28] Institute of Air Quality Management (2020) *A guide to the assessment of air quality impacts on designated nature conservation sites* (https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf)
[29] Natural England (2018) *Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations* (https://publications.naturalengland.org.uk/publication/4720542048845824)

4.3 LIMITATIONS AND ASSUMPTIONS

TRAFFIC MODEL

4.3.1. Traffic modelling for the draft Local Plan at the Regulation 19 stage was based on the TfL London Highway Assignment Model (LoHAM) version P4.3, which is calibrated to 2016 traffic measurements. LoHAM version P4.3 provided a 'Reference Case Planning Forecast' scenario for 2041. Whilst this gives a robust representation of the future baseline against which to assess the full draft Local Plan scenario for 2041, there are some important limitations and uncertainties that should be considered when interpreting the results of the air quality assessment.

4.3.2. TfL gives the following description for LoHAM:

> *"LoHAM (London Highway Assignment Model) is a strategic model representing routeing and congestion of motorised highway trips on the road network in London and the surrounding area. The model routes trips through the highway network based on journey times and distance.*
>
> *LoHAM splits highway users into different vehicle types including car, taxi, private hire vehicles, light goods vehicles and other goods vehicles. It can reflect the separate movement of specific vehicle types, for example vehicles that comply with a policy measure and those that do not.*
>
> *Buses and cycles are represented to ensure the road space required by these users is taken into account".* [30]

4.3.3. LoHAM provides traffic data for the morning (AM) and evening (PM) peak periods, as well as the daytime period between (interpeak). To enable the air quality modelling, traffic model data that are representative of AM and PM peak hours on an average weekday have been converted by WSP using TfL factors to estimate annual average daily traffic (AADT) flows. This process inevitably adds some uncertainty since traffic data for time periods outside of these peak hours must be 'filled in' through a generalised process of factoring.

4.3.4. In spring 2023, TfL updated LoHAM to version P5.1. This is calibrated to 2019 traffic measurements and provides two new forecast scenarios for 2041, which account for the impact of Covid-19 on population and economic growth forecasts. The two scenarios are: 'the Planning Forecast' (which includes 9.8 million population by 2030, continued economic growth and commuting at 90% of pre-pandemic levels), and 'the Hybrid Forecast' (which includes 9.5 million population by 2030, lower economic growth and commuting at 75% of pre-pandemic levels). Of the two scenarios, the Planning Forecast predicts the highest levels of traffic. Compared to the LoHAM version P4.3, version P5.1 predicts lower levels of traffic for 2041 than are reflected in the draft Local Plan Regulation 19 stage assessment. Consequently, any predicted adverse air quality impacts at the designated sites may be overstated.

[30] Transport for London *Strategic transport models* (https://tfl.gov.uk/corporate/publications-and-reports/strategic-transport-and-land-use-models)

4.3.5. Another important consideration is the way the LoHAM routes traffic according to congested journey time, charging (e.g., ULEZ) and distance assumptions. The model algorithms represent real-world processes in a relatively simplistic manner by parameterisation. Uncertainty over vehicle routing across the model network increases with increasing distance from the point of origin and number of intervening junctions, such that small changes after a point in the network can be considered as model noise – i.e., random error. The traffic model for the draft Local Plan focusses on accuracy within the borough of Enfield but the model network stretches across London and beyond. Predictions of small changes of a few hundred AADT or less for traffic outside the borough are more likely to be model noise than within the borough, where the change could be either a small increase or decrease.

AIR QUALITY MODEL

4.3.6. The meteorological data used in dispersion modelling are generally representative of conditions across the study area. It is not practicable to account for all local influences on meteorology. As the modelling concerns the prediction of annual mean pollutant levels this limitation and associated uncertainty is acceptable (as opposed to predicting 1-hour mean levels where the levels of uncertainty would be much greater).

4.3.7. The air quality assessment relies on the accuracy of forecasts of emissions and background made by others. Whilst there are uncertainties associated with these data, it is assumed that the data are based on the best scientific evidence available at the time and as such are 'fit for purpose'. A particular limitation is that the data used in modelling do not permit predictions beyond 2030 without substantial uncertainty. Any improvements in the vehicle fleet resulting in lower emissions between 2030 and 2041 have not been reflected.

4.3.8. The greatest degree of uncertainty is in the prediction of NH_3 emissions for which the knowledge base is not as well developed as for NOx. Therefore, to ensure a robust assessment of future NH_3 and nitrogen deposition levels the Joint Nature Conservation Committee's Nitrogen Futures 'business as usual' scenario has been adopted [31].

APPROACH TO LIMITATIONS AND ASSUMPTIONS

4.3.9. There are uncertainties associated with both measured and predicted concentrations. The model (ADMS-Roads) used in this assessment relies on input data (including predicted traffic flows), which also have uncertainties associated with them, as outlined above. The model itself simplifies complex physical systems into a range of algorithms. In addition, local micro-climatic conditions may affect the concentrations of pollutants that the ADMS-Roads model will not be able to account for.

4.3.10. In order to reduce the overall level of uncertainty in the air quality modelling process and increase the confidence in predicted concentrations, the 2019 baseline model scenario was verified against ratified 2019 monitoring data collected by LBE. This model verification was carried out following

[31] JNCC (2020) *Nitrogen Futures* (https://data.jncc.gov.uk/data/04f4896c-7391-47c3-ba02-8278925a99c5/JNCC-Report-665-FINAL-WEB.pdf)

guidance set out in LAQM.TG(22). As the model has been verified against local monitoring data and adjusted accordingly, there can be reasonable confidence in the predicted concentrations.

OVERALL LIMITATION APPRAISAL

4.3.11. As outlined above, there are uncertainties related to the modelled traffic data, as well as monitored and modelled air quality data. Included in this is the use of 2030 backgrounds and 2030 emission factors, which do not take into consideration the ULEZ expansion to the A406 North and South Circular Roads in 2021 or to the M25 in 2023.

4.3.12. However, steps have been taken to reduce the overall level of uncertainty in the air quality modelling process and increase the confidence in the predictions by undertaking model verification.

4.3.13. Given the above, the assessment is considered to be conservative.

5 FINDINGS

5.1 IMPACTS AT EXISTING HUMAN RECEPTORS

BASELINE

5.1.1. In the Baseline scenario, the annual mean NO_2 air quality standard of 40µg/m^3 is exceeded and therefore not met at human receptors along the A406 (the North Circular), A109, A1110, A1003, A105, A111, A10, A1010, A1055, A1005, A110, B137, B154, and Silver Street and Victoria Road (just north of the A406). The highest modelled annual mean NO_2 concentration is 57.5µg/m^3 at residential premises on Taplow Road, which is close to the A406/A10 junction. The 1-hour mean NO_2 air quality standard is met across all modelled receptors.

5.1.2. The air quality standard of 40µg/m^3 for annual mean PM_{10} is met at all modelled receptors. The highest modelled annual mean PM_{10} concentration is 26.0µg/m^3 at residential premises on the A406 (Angel Road). The 24-hour mean PM_{10} air quality standard is met at all receptors.

5.1.3. The air quality standard of 20µg/m^3 for annual mean $PM_{2.5}$ is met at all modelled receptors. The highest modelled annual mean $PM_{2.5}$ concentration is 16.8µg/m^3 at residential premises on the A406 Angel Road.

FUTURE BASELINE

5.1.4. In the Future Baseline scenario, the annual mean NO_2 air quality standard of 40µg/m^3 is met at all modelled human receptors. The highest modelled annual mean NO_2 concentration is 33.4µg/m^3 at residential premises in the vicinity of Taplow Road, which is close to the A406/A10 junction. The 1-hour mean NO_2 air quality standard is met at all receptors.

5.1.5. The air quality standard of 40µg/m^3 for annual mean PM_{10} is met at all modelled receptors. The highest modelled annual mean PM_{10} concentration is 23.8µg/m^3 at residential premises along the A406 Angel Road. The 24-hour mean PM_{10} air quality standard is met at all receptors.

5.1.6. The annual mean $PM_{2.5}$ air quality standard of 20µg/m^3 is met at all modelled receptors in the Future Baseline scenario. The highest modelled annual mean $PM_{2.5}$ concentration is 15.2µg/m^3 at residential premises on the A406 Angel Road.

5.1.7. The Mayor of London's non-statutory target for 2030 of 10µg/m^3 is not met at the majority of modelled receptors, with the exception of some schools and play areas in the more rural northern and eastern parts of Enfield. The exceedances are because the background concentrations, predicted by Defra, are above 10µg/m^3 across much of Enfield; this is illustrated in **Volume 2**, **Figure A-2**. Also, the latest predicted year for background data is 2030, so any reductions in vehicle exhaust emissions of $PM_{2.5}$ that could occur after 2030 are disregarded.

DRAFT LOCAL PLAN

5.1.8. In the Draft Local Plan scenario, the annual mean NO_2 air quality standard of 40µg/m^3 is met at all modelled receptors. The highest modelled annual mean NO_2 concentration is 34.4µg/m^3 at residential premises in the vicinity of Taplow Road, which is close to the A406/A10 junction. The 1-hour mean NO_2 air quality standard is met at all receptors.

5.1.9. The annual mean PM_{10} air quality standard of 40µg/m^3 is met at all modelled receptors. The highest modelled annual mean PM_{10} concentration is 23.9µg/m^3 at residential premises along the A406 Angel Road. The 24-hour mean PM_{10} air quality standard is met at all receptors.

5.1.10. The annual mean $PM_{2.5}$ air quality standard of 20µg/m^3 is met at all modelled receptors. The highest modelled annual mean $PM_{2.5}$ concentration is 15.2µg/m^3 at residential premises along the A406 Angel Road. As with the Future Baseline scenario, the Mayor of London's target for 2030 of 10µg/m^3 is not met at the majority of the modelled human receptors across Enfield.

5.1.11. With reference to the EPUK/IAQM guidance, 'slight adverse' impacts are predicted in relation to annual mean NO_2 at residential premises on Taplow Road, which is close to the A406/A10 junction. 'Moderate adverse' impacts are predicted at residential dwellings on Great Cambridge Road, while 'negligible' impacts are predicted across most of the rest of Enfield as seen in **Volume 2**, **Figure A-3**.

5.1.12. The impacts on PM_{10} and $PM_{2.5}$ concentrations are negligible for all receptors included in the assessment when considering statutory air quality standards.

5.1.13. The impacts on annual mean $PM_{2.5}$ concentrations relative to the 2030 air quality standard for London (a non-statutory target) range from 'substantial adverse' to 'moderate beneficial', although the majority are 'negligible'. When assessing impacts, the impact descriptors take into consideration the background concentrations combined with the percentage change in concentration relative to air quality standard (i.e. the change due to the draft Local Plan). Therefore, as per **Table 4-1**, the higher the total concentration (i.e. including background), the smaller the change needed to trigger a more severe impact descriptor. These impacts are shown in **Volume 2**, **Figure A-4**. **Table 5-1** identifies the locations within Enfield where the impacts are not negligible.

Table 5-1 – Locations with human receptors where non-negligible impacts on annual mean $PM_{2.5}$ relative to the 2030 London target of 10µg/m^3 are predicted

Impact	Location
Substantial beneficial	None
Moderate beneficial	Bowes Rd (A105 to Brownlow Road), Church Street (London Road to Cecil Rd), Uplands Park Rd, Bramley Rd
Slight beneficial	None
Slight adverse	The Alders (including pay area), Grange Park Primary School on World's End Ln, Bincote Rd, Hadley Rd (including Cedar Park Nursery), Forty Hill (including Worcesters Primary School)
Moderate adverse	A1005 Ridgeway, Theobalds Park Rd, Whitewebbs Lane, Capel Manor College off Bullsmoor Lane, East Lodge Ln, Lavender Hill (A1005 to Lavender Gardens), Browning Rd, Baker St (including Enfield County School for Girls Lower School), Forty Hill, Carterhatch Ln, Copse Close (near the A10), Holmsdale (near the M25), A1010, Ordnance Rd (including Chesterfield Primary School), Prince of Wales Primary School on the A1055 Mollison Ave, Ark John Keats Academy on Bell Ln, Brimsdown Ave, Green St (including Brimsdown Primary School), Durants Rd, A110, Silver St (between A110 and Portcullis

Impact	Location
	Lodge Rd), Churchbury Ln, A1055 Mollison Ave, A1055 Meridian Way, Lincoln Rd, Wellington Rd (including The Raglan Schools), A105, Green Dragon Lane, Chaseville Park Rd (including Eversley Primary School), Prince George Ave, Hounsden Rd, A111, A1004, A1003 Waterfall Rd near junction with Morton Way, A1003 at junction with Station Rd, A1110, B1452, A406, Oakthorpe Rd (including St Anne's Catholic High School for Girls), Princes Ave, Hazelwood Ln (including Hazelwood Junior School), Firs Ln, Winchmore School off Farm Rd, Silver St, Northern Ave, Victoria Rd, B154 Church St, Ford's Grove, Plevna Rd, Winchester Rd, Bury St, Bounces Rd (including St Edmonds Catholic Primary School), Grosvenor Rd (including Eldon Junior School), B137, Raynham Rd (including Raynham Primary School), York Rd, Wilbury Way
Substantial adverse	Lancaster Rd (between Weardale Gardens and Browning Rd), Bull's Cross/Whitewebs Lane, Bullsmore Rd (including Capel Manor Primary School), B154 Church St (between A10 and Hasebury Rd), B154 Church St (between Victoria Rd and A1010), The Raglan Junior School (at corner of Wellington Rd and Raglan Rd), Main Ave (near Millais Rd), Lincoln Rd (at corner with Percival Rd), A110 Southbury Rd (between Clydach Rd and Eaton Rd, including George Spicer Primary School), Willow Rd (south of Orchard Way), A110 (between London Rd and Genotin Rd), Baker St (including Enfield Grammar School), Carterhatch Ln, A105 (at junction with Ford's Grove and Station Rd)

5.1.14. A full list of receptors, pollutant concentrations and impacts is included in **Volume 3**, **Appendix C**.

INDICES OF MULTIPLE DEPRIVATION

5.1.15. The impacts of any predicted increases in NO_2 and $PM_{2.5}$ concentrations have been combined with the IMD data to determine areas of high deprivation, high population exposure and poor air quality.

5.1.16. **Volume 2**, **Figure A-3** shows the NO_2 impacts overlayed with the IMD data. The areas where NO_2 impacts are slight adverse and moderate adverse are all in the more deprived areas of Enfield.

5.1.17. **Volume 2**, **Figure A-4** shows the IMD data together with the predicted impacts for annual mean $PM_{2.5}$ when assessing against the 2030 London air quality standard. The areas where 'slight' or 'moderate' beneficial impacts are predicted, are all located in the less deprived areas of Enfield. The areas where 'slight adverse' impacts are predicted are spread across Enfield in both the more deprived and least deprived areas. 'Moderate adverse' and 'substantial adverse' impacts are predicted generally in the most deprived areas of Enfield.

5.2 FUTURE EXPOSURE AT SITE ALLOCATIONS

5.2.1. The annual mean NO_2 air quality standard of 40µg/m^3 is met at all modelled receptors that represent worst-case exposure at draft Local Plan site allocations. The highest modelled annual mean NO_2 concentration is 31.0µg/m^3 at SA36 on Bowes Road (allocated for mixed use and residential development). The 1-hour mean NO_2 air quality standard is met at all site allocations.

5.2.2. The annual mean PM_{10} air quality standard of 40µg/m^3 is met at all site allocations. The highest modelled annual mean PM_{10} concentration is 24.3µg/m^3 at SA17 on the A406 Angel Road (allocated for mixed use and residential development). The 24-hour mean PM_{10} air quality standard is met at all site allocations.

5.2.3. The annual mean $PM_{2.5}$ air quality standard of 20µg/m^3 is met at all site allocations. The highest modelled annual mean $PM_{2.5}$ concentration is 15.4µg/m^3 at SA17 on the A406 Angel Road (allocated for mixed use and residential development).

5.2.4. The London target for annual mean $PM_{2.5}$ concentrations in 2030 of 10µg/m^3, is not met at the majority of the site allocations, with the exception of SA45 and SA.11d which are located in the Hadley Wood and Crews Hill areas respectively. The exceedances are largely attributable to Defra's predictions for background concentrations above 10µg/m^3 across much of Enfield; this is illustrated in **Volume 2**, **Figure A-2**.

5.3 IMPACTS AT ECOLOGICAL RECEPTORS (DESIGNATED SITES)

5.3.1. **Volume 2**, **Figure A-5** to **Figure A-20** show the locations where increases in pollutant level exceeds the HRA screening threshold of 1% of the critical level/load, with the Draft Local Plan alone in 2041. All the locations are within woodland areas of Epping Forest SAC; the impacts at the other designated sites do not meet this threshold and as such are not considered to give rise to a likely significant effect .

5.3.2. The impacts that exceed the 1% threshold occur close to roads where increased traffic with the Draft Local Plan has been predicted by the traffic model. The most spatially extensive impacts over the 1% threshold are seen along transects adjacent to the A110 Whitehall Road; extending up to approximately 45m within the SAC boundary at the corner of Whitehall Road and Brook Road.

5.3.3. It should be noted that the 1% threshold is exceeded at all designated sites with the Draft Local Plan in-combination with other plans and projects.

5.3.4. A full list of ecological transects, predicted pollutant concentrations/deposition rates, changes and comparisons against the critical level/load are presented in **Volume 3**, **Appendix D**.

6 SUMMARY AND RECOMMENDATION

6.1 SUMMARY

6.1.1. WSP has undertaken an assessment of the potential air quality impacts of the draft Local Plan 2019-2041 proposals to inform the IIA and HRA, as part of the evidence base for the Regulation 19 stage in developing the draft Local Plan.

6.1.2. A quantitative assessment was undertaken using ADMS-Roads to predict future concentrations of and changes in NO_2, PM_{10} and $PM_{2.5}$ at human receptors, and levels of and changes in NOx, NH_3, nitrogen deposition and acid deposition at ecological receptors.

6.1.3. The air quality standards that currently apply for NO_2, PM_{10} and $PM_{2.5}$ are predicted to be met at all modelled receptor locations, including site allocations. However, the 2030 annual mean $PM_{2.5}$ standard for London of 10µg/m^3 is not met at the majority of modelled receptors across the borough due to the assumed background concentrations which exceed or are close to exceeding the air quality standard.

6.1.4. The impacts of the draft Local Plan on annual mean NO_2 concentrations are 'negligible' at the majority of modelled receptors, with the exception of residential premises on Taplow Road where impacts are predicted to be 'slight adverse' and at residential dwellings on Great Cambridge Road, where impacts are 'moderate adverse'. However, despite these impacts the air quality standards for annual mean and 1-hour mean NO_2 are met.

6.1.5. The impacts of the draft Local Plan on PM_{10} and $PM_{2.5}$ concentrations are 'negligible' at all modelled receptors when considering the air quality standards that are currently applicable. However, for annual mean $PM_{2.5}$ concentrations against the 2030 air quality standard for London, the impacts range from 'substantial adverse' to 'moderate beneficial', although the majority are 'negligible'.

6.1.6. The predicted changes in NH_3, nitrogen deposition and acid deposition have triggered the HRA screening threshold of 1% at ecological receptors within woodland areas of Epping Forest SAC. Considering the draft Local Plan alone, these impacts are limited to a few metres within the designated site boundary. The impacts at the other designated sites do not meet the threshold and so are not considered to give rise to a likely significant effect. The 1% threshold is predicted to be exceeded at all designated sites with the draft Local Plan when considered in-combination with other plans and projects.

6.2 RECOMMENDATION

6.2.1. The assessment has identified potential air quality issues in implementing the draft Local Plan.

6.2.2. These include potential adverse impacts on annual mean $PM_{2.5}$ concentrations when compared to the Mayor of London's 2030 target. The Mayor of London's non-statutory target for 2030 and the statutory national target for 2040 of 10µg/m^3 is not met at the majority of modelled receptors for both without and with the draft Local Plan, with the exception of some schools and play areas in the more rural northern and eastern parts of Enfield. The exceedances are because the background concentrations, predicted by Defra, are above 10µg/m^3 across much of Enfield; this is illustrated in **Volume 2**, **Figure A-2** i.e. the draft Local Plan is not the main cause of these exceedances, rather it is due to the contribution of other local sources to total $PM_{2.5}$ concentrations.

6.2.3. Other air quality issues are the limited impacts on NH_3, nitrogen deposition and acid deposition within the margins of Epping Forest SAC. Further details on this can be found in the Enfield Local Plan Habitat Regulations Assessment (HRA)[32]. Ongoing HRA work[33] has concluded that the draft Local Plan and Enfield's own measures to reduce air pollution from road traffic will not have a significant impact on the SAC alone in relation to air quality. Furthermore, it is considered that in-combination effects from the draft Local Plan are not significant and, provided that mitigation measures introduced by Epping Forest District Council are fully implemented, there will be no in-combination effect on the SAC.

6.2.4. In line with the London Plan, an Air Quality Positive Statement will be required at those site allocations subject to masterplan or Environmental Impact Assessment (EIA). Air quality positive design principles seek to enhance air quality and minimise exposure through building design and measures to influence travel behaviour towards zero emissions modes (amongst other measures). We recommend that the principles of the Air Quality Positive guidance are adopted by developers for all other site allocations in the draft Local Plan, regardless of whether the site allocation is subject to masterplan or EIA.

[32] LUC (2023) *Enfield Local Plan Habitats Regulations Assessment publication stage (Regulation 19 consultation)*
[33] Ongoing work is being undertaken with Natural England to minimise any impacts.

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