HOARE LEA (H.) wsp Ryder

NHS Barts Health NHS Trust

Whipps Cross Hospital Redevelopment

Barts Health NHS Trust

Environmental Statement Volume 1 - Chapter 5: Air Quality

Part 1 of 3

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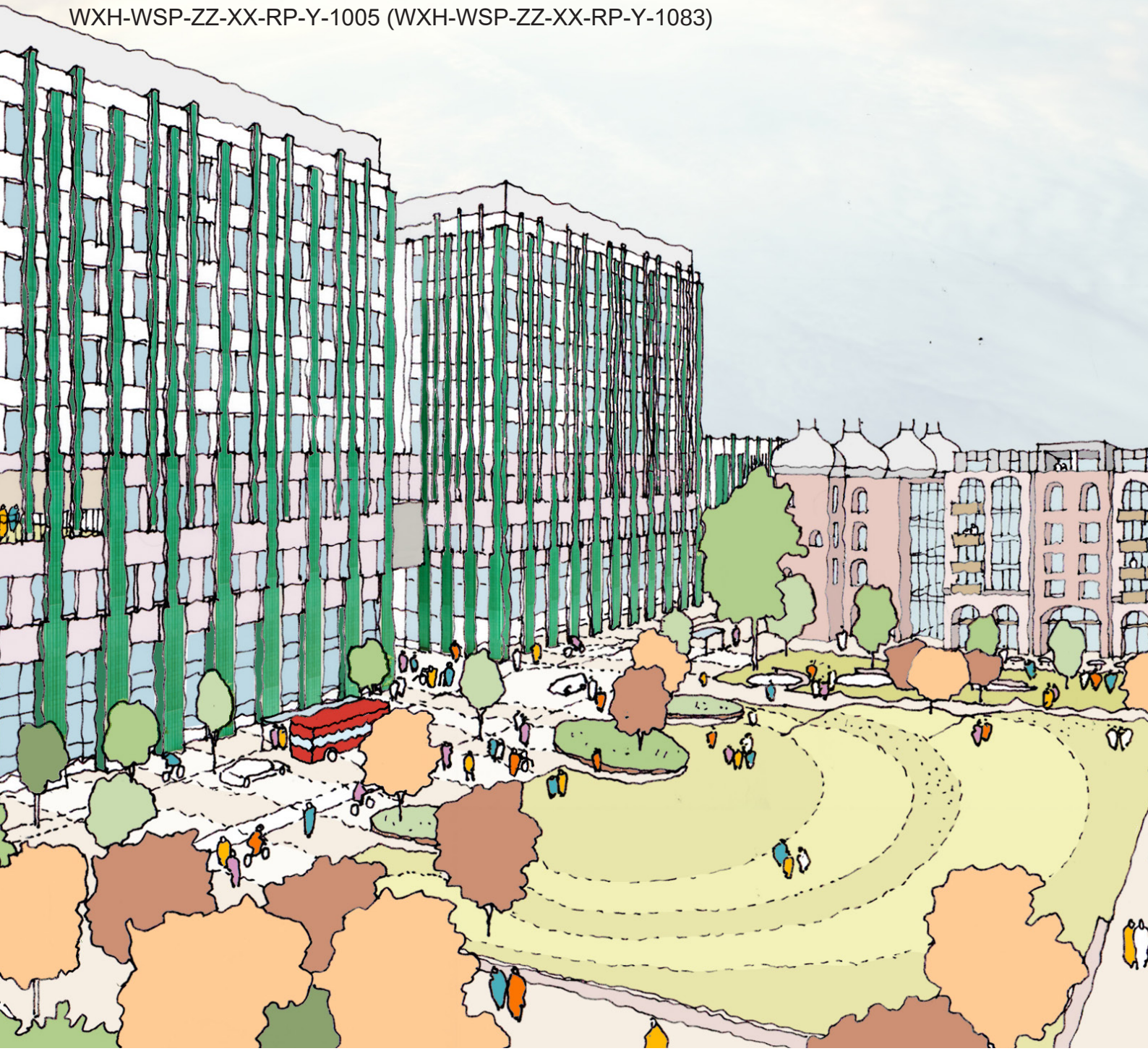

Barts Health NHS Trust

WHIPPS CROSS HOSPITAL REDEVELOPMENT

Environmental Statement Volume 1
Chapter 5 - Air Quality

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APRIL 2021

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Barts Health NHS Trust

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TABLES

5. AIR QUALITY

5.1. INTRODUCTION

5.1.1. This chapter reports the outcome of the assessment of likely significant effects arising from the Proposed Development in terms of local air quality. It assesses the following potentially significant effects due to:

- Increased dust deposition affecting people and property, and sensitive habitats and plant communities at ecological sites, caused by construction phase activities;
- Changes in long-term (annual mean) concentrations of local air pollutants affecting human health, caused by changes in road traffic emissions during construction and operational phases;
- Changes in short-term (1-hour mean) concentrations of local air pollutants affecting human health, caused by short-term operation of the hospital standby diesel generators; and
- Changes in long-term (annual mean) local air pollutant levels at ecological sites with sensitive habitat features.

5.1.2. This chapter (and its associated figures and appendices) is intended to be read as part of the wider ES, with particular reference to **Chapter 8: Ecology and Nature Conservation**, and **Chapter 14: Transport and Access**.

5.1.3. This chapter is supported by the following figures and appendices:

- **Figure 5.1**: Study Area for Construction Dust Impacts;
- **Figure 5.2**: Study Area for Local Air Quality Impacts;
- **Figure 5.3**: Baseline;
- **Figure 5.4**: Hybrid Planning Application 1 Local Air Quality Impacts at Human Receptors;
- **Figure 5.5**: Hybrid Planning Application 1 Local Air Quality Impacts at Ecological Receptors;
- **Figure 5.6**: Hybrid Planning Application 2 Local Air Quality Impacts at Human Receptors;
- **Figure 5.7**: Hybrid Planning Application 2 Local Air Quality Impacts at Ecological Receptors;
- **Appendix 5.1**: Scoping Opinion Comments and Responses - Air Quality;
- **Appendix 5.2**: Hybrid Planning Application 1 Traffic Data;
- **Appendix 5.3**: Hybrid Planning Application 2 Traffic Data;
- **Appendix 5.4**: Details of Air Quality Modelling of Road Sources;
- **Appendix 5.5**: Details of Air Quality Modelling of Point Sources;
- **Appendix 5.6**: Hybrid Planning Application 1 Local Air Quality Impacts at Human Receptors;
- **Appendix 5.7**: Hybrid Planning Application 1 Local Air Quality Impacts at Ecological Receptors;
- **Appendix 5.8**: Hybrid Planning Application 2 Local Air Quality Impacts at Human Receptors; and
- **Appendix 5.9**: Hybrid Planning Application 2 Local Air Quality Impacts at Ecological Receptors.

5.2. CONSULTATION, SCOPE, METHODOLOGY AND SIGNIFICANCE CRITERIA

CONSULTATION UNDERTAKEN TO DATE

5.2.1. **Table 5-1** provides a summary of the consultation activities undertaken in support of the preparation of this assessment.

Table 5-1 – Summary of Consultation Undertaken

Body / organisation	Individual / stat body / organisation	Meeting dates and other forms of consultation	Summary of outcome of discussions
LBWF, Natural England, NHS St Barts	Various	Scoping Opinion, 8 January 2021	**Appendix 5.1** provides a summary of comments received in the Scoping Opinion and identifies where and how these have been addressed in the ES.
LBWF	Alan Urquhart - Air Quality Officer Air Quality & Environmental Protection	Email correspondence on 07 and 29 January 2021	LBWF: Welcomes baseline nitrogen dioxide (NO_2) survey but recommends use of 2019 LBWF data. Will require particulate monitoring during demolition and construction. Agreed that receptors as set out in paragraph 5.2.10 of the EIA Scoping Request are appropriate. Welcomes zero emissions heat and power in the energy emissions strategy.
Natural England City of London, Conservators of Epping Forest LBWF	Marc Turner – Senior Planning Adviser Thames Solent Team, Natural England (NE) Dr Jeremy Dagley - Head of Conservation Open Spaces Department, Conservators of Epping Forest (CoEF) Kelvin Bathie – Principal Planning Policy Officer at LBWF, Lead officer on Green Environment	Virtual meetings on 15 January and 26 February 2021	Discussed and agreed approach to assessment of air quality impacts on Epping Forest SAC/SSSI: ▪ Undertake baseline monitoring of NO_2 concentrations to provide supporting baseline data, including 3 months prior to submission of the planning application, and 6 months thereafter ▪ Focus on long term impacts only, due to changes in road traffic emissions. Pre-COVID 19 baseline traffic data for 2019 to be used. Short-term contributions from standby generator emissions can be scoped out. ▪ Consider the impacts in terms of changes in nitrogen deposition with account of oxides of nitrogen (NO_x) and ammonia (NH_3) emissions, and acid deposition. ▪ Changes in background levels of nitrogen deposition and ammonia to be informed by the Joint Nature Conservation Committee (JNCC) Nitrogen Futures report (**Ref. 5.1**). ▪ In-combination impacts to be considered. ▪ Significance of effect to be determined by Ecology Consultant. ▪ Agreed that Hybrid Planning Application 1 (2027 opening year) would give rise to reductions in traffic on roads within 200 metres (m) of the SAC/SSSI and Ancient Woodland due

Body / organisation	Individual / stat body / organisation	Meeting dates and other forms of consultation	Summary of outcome of discussions
			to reduction in car parking provision and would have a modest beneficial impact. Therefore, no requirement to consider the impacts in 2027.

SCOPE OF THE ASSESSMENT

5.2.2. The scope of this assessment has been established through an ongoing scoping process. Further information can be found in **Chapter 4: EIA Methodology**. **Appendix 5-1** includes Scoping Opinion comments and how these have been addressed in the air quality assessment.

ELEMENTS SCOPED OUT OF THE ASSESSMENT

5.2.3. The elements shown in **Table 5-2** are not considered to give rise to likely significant effects with the Proposed Development and have therefore not been considered within this assessment.

Table 5-2 – Elements Scoped Out of the Assessment

Element scoped out	Justification
Construction traffic air quality impacts for Hybrid Planning Application 2	Construction traffic will primarily be influenced by the construction of class C3 and E elements which are subject to outline planning consent. Construction traffic for Hybrid Planning Application 2 are incorporated within the with Proposed Development traffic data for 2027, as included in **Appendix 5-2**. For 2027, lower traffic flows are forecast with the Proposed Development than without - even with the construction traffic included.
Emissions from operation of Non-Road Mobile Machinery (NRMM).	Emissions from NRMM would be limited in accordance with Greater London Authority (GLA) requirements and would result in potential short-term, temporary, negligible impacts which are unlikely to give rise to a significant effect.
The Proposed Development includes E land-use classes (i.e. restaurants / cafes) that may result in odorous emissions from commercial kitchens.	Air extraction systems from commercial kitchen areas will have appropriate odour control. A significant effect is highly unlikely.

ELEMENTS SCOPED INTO THE ASSESSMENT

Construction Phase

5.2.4. The following elements are considered to have the potential to give rise to likely significant effects during construction of the Proposed Development and have therefore been considered within this assessment:

- Increased dust deposition affecting people and property at residential, school and hospital premises, and sensitive habitats and plant communities at ecological sites including Ancient Woodland and Epping Forest SAC/SSSI, caused by construction phase activities;
- Changes in annual mean concentrations of local air pollutants affecting human health at residential, school and hospital premises, caused by changes in road traffic emissions with Hybrid Planning Application 1; and
- Changes in annual nutrient nitrogen and acid deposition rates at ecological sites within sensitive ecological habitats including Ancient Woodland and Epping Forest SAC/SSSI.

Operational Phase

5.2.5. The following elements are considered to have the potential to give rise to likely significant effects during operation of the Proposed Development and have therefore been considered within this assessment:

- Changes in annual mean concentrations of the local air pollutants NO_2, PM_{10} and $PM_{2.5}$ at residential, school and hospital premises, caused by changes in road traffic emissions;
- Changes in 1-hour mean concentrations of the local air pollutant NO_2 at residential, school and hospital premises, caused by short-term operation of the hospital standby diesel generators; and
- Changes in annual mean concentrations of NO_x and NH_3, and nutrient nitrogen and acid deposition rates at ecological sites within sensitive ecological habitats including Ancient Woodland and Epping Forest SAC/SSSI.

EXTENT OF THE STUDY AREA

5.2.6. At the time of the EIA Scoping Request an initial study area for air quality of 2km radius around the Site was assumed. Subsequently, information has become available to refine the study area to be appropriately proportionate to the impacts that have been scoped into the air quality assessment. The initial 2km study area has been retained for reporting of baseline conditions only. Two refined study areas have been defined for the reporting of the assessment of impacts presented in this ES Chapter, as follows:

- In accordance with the Institute of Air Quality Management (IAQM) guidance for construction dust (**Ref. 5.2**), the study area for construction dust impacts, as illustrated in **Figure 5-1: Study Area for Construction Dust Impacts**, extends to 350m from the Site boundary and 50m of roads likely to be used by construction traffic - up to 500m from the Site entrance(s).
- Well established understanding of the extent of perceptible local air quality impacts from road traffic emissions means that the study area for local air quality impacts, as illustrated in **Figure 5-2: Study Area for Local Air Quality Impacts**, is limited to within 200m of roads that would experience a notable change in traffic conditions. Qualifying roads have been defined according to the following indicative criteria as given in Environmental Protection UK (EPUK)/IAQM planning guidance for air quality (**Ref. 5.3**):

  - A change of 100 or more in Annual Average Daily Traffic (AADT) flow of light duty vehicles (LDV); and
  - A change of 25 or more in AADT flow for heavy duty vehicles (HDV).

  In addition, and in agreement with Natural England, a change threshold of 50 AADT for all vehicles when considering the impact of the Proposed Development alone has also been applied to roads within 200m of Epping Forest SAC/SSSI.

METHOD OF BASELINE DATA COLLATION

Desk Study

5.2.7. A desk-based review of information and data in the public domain has been undertaken to determine baseline air quality conditions and identify sensitive receptors. The sources of information referred to include:

- LBWF's Air Quality Annual Status Report for 2019 (**Ref. 5.4**), including data for 2019 from LBWF's monitoring sites and reports on progress in local authority implementation of measures to improve local air quality;
- The Environment Agency's Public Register for Environmental Permitting Regulations – Installations (**Ref. 5.5**), to identify any regulated activities that emit substantial quantities of air pollutants and could have a bearing on local air quality within the study area;
- The GLA's London Atmospheric Emissions Inventory (LAEI) 2016 (**Ref. 5.6**), including information on the contributions to local air pollutant levels within the borough from different emissions sources (such as road transport, domestic combustion etc) and across borough modelled predictions for ambient air quality for 2016;
- The Department for Environment, Food and Rural Affairs (Defra) UK AIR Air Information Resource, including geographical data on Air Quality Management Areas (AQMA) (**Ref. 5.7**) and background local air pollutant concentrations (**Ref 5.8**);
- Ordnance Survey OpenData map products (**Ref. 5.9**) and Google Earth (**Ref. 5.10**), to identify existing adjacent land uses and sensitive human receptors;
- Defra's Multi-Agency Geographic Information for the Countryside (MAGIC) (**Ref. 5.11**) to identify designated ecological sites with potential sensitivities to air pollution;
- The JNCC's Air Pollution Information System (APIS) (**Ref. 5.12**), to indicate the potential presence of habitat features at identified designated ecological sites that are sensitive to air pollution and likely baseline conditions; and
- Spatial data from the Natural England Open Data Geoportal (**Ref. 5.13**) for ecological sites including Ancient Woodland, SSSI and SAC designations.

Baseline NO_2 Diffusion Tube Survey

5.2.8. To supplement LBWF monitoring data and gain insight into pollutant levels within the Epping Forest SAC/SSSI, a baseline survey to determine NO_2 concentrations was undertaken. The survey involved the placement of passive diffusion tubes, as provided and analysed by Gradko International Limited, at locations shown in **Figure 5-3: Baseline** over the period from 10 December 2020 to 17 March 2021. As the survey was undertaken over a period of approximately three months, it was necessary to adjust the results to give an estimate of annual mean concentrations. Annualisation was undertaken in accordance with methodology given in the Mayor of London's London Local Air Quality Management Technical Guidance 2019 (LLAQM.TG(19)) (**Ref. 5.14**). The process has generated concentrations reflecting pre-COVID conditions for 2019.

ASSESSMENT METHODOLOGY

Construction Phase

Construction Dust Assessment

5.2.9. Dust will be generated during the construction phase from demolition and construction activities – usually when dry surfaces are exposed and disturbed. Dust impacts include increased soiling

(obscurence and/or discolouration) of exposed surfaces - such as window cills and vegetation - and increased ambient PM_{10} concentrations. The effects include annoyance/nuisance, and harm to human health and sensitive ecology. The magnitude of dust impact is very difficult to quantify but is known to diminish with increasing distance from demolition and construction activities, to become nugatory within a few hundred metres. The determination of significant effect due to dust impact is also not straightforward as there is no legislated or widely accepted environmental standard for dust *per se*. It is therefore usual to undertake qualitative assessment of construction dust impacts on the bases of established industry experience and best practice.

5.2.10. The assessment of dust impacts was undertaken in accordance with the Mayor of London's guidance on the control of dust during construction and demolition (**Ref. 5.15**). The assessment methodology follows the IAQM guidance for construction dust (**Ref. 5.2**). This is used to determine the risks of potential dust and PM_{10} impacts from four activities:

- Demolition, including deconstruction and removal of existing buildings and structures and general site clearance;
- Earthworks, including groundworks, excavation, levelling and landscaping;
- Construction, including erection of buildings and structures; and
- Track-out, associated with construction traffic and in-particular the risk of vehicles exiting the construction site carrying out and depositing mud and debris onto local road.

5.2.11. The assessment accounts for the likely nature and scale of each of these activities and the sensitivity of the area to increased dust and PM_{10} levels, to assign a level of risk. The risk is simply described as ‘low’, ‘medium’ or ‘high’. The level of risk is used to inform the level of mitigation to be applied throughout the construction phase.

Local Air Quality Impacts due to Construction Traffic Emissions

5.2.12. Construction traffic information (**Appendix 5-2**) was screened using the indicative criteria described previously under ‘Extent of the Study Area’. Expected increases in traffic flow in the peak construction year of 2023 exceed the criteria on:

- A104 Lea Bridge Road between Hospital Road and A114 Whipps Cross Road;
- A114 Whipps Cross Road; and
- James Lane.

5.2.13. Consequently, detailed dispersion modelling was undertaken to estimate the contributions from emissions associated with road vehicles (‘road source’) to ambient pollutant levels. This was done at representative high sensitivity human and ecological receptor locations within 200m, without and with the Proposed Development for the year 2023. Discussion on this methodology is continued below.

Operational Phase

Local Air Quality Impacts due to Operational Traffic Emissions

5.2.14. Operational traffic information (**Appendix 5-2** for Hybrid Planning Application 1, and **Appendix 5-3** for Hybrid Planning Application 2) was screened using the indicative criteria described above (see ‘Extent of the Study Area’).

5.2.15. The expected changes in traffic flows with the Proposed Development Hybrid Planning Application 1 in the opening of 2027, are reductions on all roads. These reductions are largely associated with the

reduced car parking capacity with the new Hospital (for further details see **Appendix 14.3 - Transport Assessment**). Consequently, a detailed assessment of the air quality impacts for 2027 was not undertaken - with any impacts likely to be of modest benefit only.

5.2.16. By contrast, the changes in traffic flows for full opening year of 2038 for the full Proposed Development (i.e. Hybrid Planning Application 1, and Hybrid Planning Application 2) are increases in traffic, with one or more of the indicative criteria (above under 'Extent of the Study Area') exceeded on the following roads:

- James Lane;
- A114 Whipps Cross Road;
- A104 Lea Bridge Road between A114 Whipps Cross Road and Snaresbrook Road;
- A104 Woodford New Road to the A406 North Circular; and
- A406 North Circular to the east of the junction with the A104 Woodford New Road.

5.2.17. ADMS-Roads (**Ref. 5.16**) dispersion modelling software was used to estimate the road source contributions to ambient annual mean concentrations of NO_x, PM_{10} and $PM_{2.5}$ at relevant human and ecological receptor locations, which are discussed later in **Section 5.4**. The modelling used baseline and forecast traffic data relating to the Proposed Development (see **Appendix 5-2** for Hybrid Planning Application 1 and **Appendix 5-3** for Hybrid Planning Application 2). Land-use information was derived from Ordnance Survey map data, design drawings, and representative meteorological data for 2019 from London City airport (**Appendix 5-4**) was used for modelling.

5.2.18. The following scenarios were modelled:

- 2019 baseline traffic flows, to represent existing conditions within the study area without the Proposed Development and enable the verification of ADMS-Roads model predictions;
- 2023 without and with the Proposed Development at the time of peak construction; and
- 2038 without and with the Proposed Development.

5.2.19. Whilst the opening year scenario is based on traffic data for 2038, Defra's Emissions Factors Toolkit which was used to estimate vehicle emissions of NO_x, PM_{10} and $PM_{2.5}$ (**Ref. 5.17**) is limited to 2030 as the latest year. With vehicle emissions of NO_x and particulate matter decreasing over time this implies that the modelled 2038 scenario provides a robust and conservative assessment of years between the earliest completion year of 2035 and 2038. Vehicle emissions of NH_3 have been estimated using Air Quality Consultants Ltd 'Calculator for Road Emissions of Ammonia' (CREAM) (**Ref. 5.18**). NH_3 results from vehicle emissions control systems that are installed to reduce NO_x emissions. As with passing time these systems become more prevalent across the vehicle fleet, vehicle emissions of NH_3 are forecast to increase. Ammonia is itself harmful to vegetation and is also an important component of nutrient nitrogen deposition. Modelling of nitrogen deposition without accounting for the contribution from NH_3 is therefore likely to underestimate any impacts - particularly in the future when NO_x emissions are lower than at present.

5.2.20. Technical details of the modelling methodology - including model verification, and derivation of total ambient pollutant concentrations and nitrogen and acid deposition rates at relevant receptor locations - are provided in **Appendix 5-4**.

5.2.21. The modelled baseline and verification were undertaken for 2019 when traffic flows were representative of pre-COVID-19 conditions. Furthermore, traffic forecasting was undertaken using 2019 base data including traffic counts. The assessment is not therefore affected by any reduction in traffic flows during COVID-19 travel restrictions.

Local Air Quality Impacts due to Hospital Standby Generator Emissions

5.2.22. The onsite energy centre will routinely supply heat and electrical power using 'zero-emission' heat pump, thermal storage and photovoltaic technologies (for further details see the Energy Statement, submitted as a supporting planning document). Combustion plant will be limited to standby diesel generators, which are required to ensure continuity of electrical power to the new Hospital in the rare event of a power grid outage.

Five 3,750kVA (or 3,000kW electrical output) diesel generators will be housed in a low building in the northern part of the Site, opposite MSCP (detail) (see Drawing number WXH-RYD-HH-ZZ-DR-A-1077). The exhaust gases from operation of the plant will discharge vertically (upwards) from flues located above MSCP (detail).

5.2.23. In the event of an emergency up to four generators would operate, with one in reserve. Routine testing will occur on monthly and annual bases. In monthly testing the power output will be equivalent to three generators running simultaneously for a period of approximately one hour. Annual testing will involve running each generator in-turn at full capacity for three to four hours, with a break before the next generator is tested.

5.2.24. ADMS 5.2 (**Ref. 5.19**) dispersion modelling software was used to estimate the generator source contributions to 1-hour mean NO_2 concentrations at relevant human receptors and over the area within and surrounding the Site out to 1km from the flue stack. Models have been run for monthly and annual testing.

5.2.25. Land-use information was derived from Ordnance Survey map data, design drawings, and representative meteorological data for the period 2017 to 2019 inclusive from London City airport was used for modelling.

5.2.26. In accordance with Environment Agency guidance (**Ref. 5.20**), statistical analysis using the hypergeometric probability distribution has been applied to determine the likelihood of an exceedance of the 1-hour mean standard (see **Table 5-9** later in this chapter for the relevant standards), based on the maximum predicted 1-hour mean concentration.

5.2.27. Technical details of the modelling methodology are given in **Appendix 5-5**.

Air Quality Neutral Assessment

5.2.28. It is a Mayor of London policy requirement for new development within Greater London to be at least air quality neutral (policy details are outlined later in **Section 5.5**). Current GLA methodology (**Ref. 5.21**) has been applied to determine the air quality neutrality of building and transport emissions. The method compares building and transport emissions related data for the Proposed Development against benchmarked thresholds.

5.2.29. For buildings, benchmarked emissions thresholds for NO_x and PM_{10} are based on total gross (internal) floor area for each land use class included in the Proposed Development and fixed basic emissions benchmark values that have been pre-determined by the GLA. The calculated building emissions are based on operation of on-site combustion plant. The only combustion plant with the Proposed Development will be the Hospital standby diesel generators which are expected to routinely operate for testing purposes only (see **Appendix 5-5** for details). If the difference between the calculated building emissions and benchmarked emissions threshold is negative then the building emissions are air quality neutral.

5.2.30. For transport, the benchmarked emissions thresholds for NO_x and PM_{10} can be determined for land use classes A1 (retail), B1 (business) and C3 (residential dwellings) only. GLA pre-determined trip lengths and emissions factors (given for cars only) are applied in the calculation. For the Proposed Development, trip lengths and emissions factors for Outer London were applied to determine benchmarked emissions thresholds for C3 land use. For other land uses, including C2 (hospital), the methodology allowing comparison against TRAVL (Trip Rate Assessment Valid for London) benchmarks has been followed. Vehicle trip data from **Appendix 14.3 - Transport Assessment** were used. If the difference between the calculated transport emissions and benchmarked emissions, or the calculated vehicle trip rate and TRAVL trip rate is negative then the transport emissions are air quality neutral.

5.2.31. For a development to be air quality neutral there is no allowance for negative building emissions to offset positive transport emissions - or *vice versa*. A development proposal that is not air quality neutral for buildings and transport will require mitigation on-site/directly to reduce the relevant emissions or, if this is not possible, by off-setting. Agreement with the relevant planning authority on such mitigation is required.

5.2.32. The assumptions made for the air quality neutral assessments for Hybrid Planning Application 1, which includes C2 and D1 (medical and health services) land uses, and Hybrid Planning Application 2 are given in **Table 5-3** and **Table 5-4** respectively.

Table 5-3 – Hybrid Planning Application 1: Air Quality Neutral Assessment Assumptions

Element	Emissions or vehicle trips assumptions	Gross (internal) floor area for land use class, or number of residential units if C3	Benchmarked emissions threshold, or TRAVL trip rate
Building emissions	NO_x: 2,582.5 kg/year PM_{10}: 507.5 kg/year (for calculation details see **Appendix 5-5**)	C2 (excluding ancillary): 85,000m^2 Hospital standby diesel generators are not applicable to D1 use	NO_x: 5,823 kg/m^2/year PM_{10}: 507 kg/m^2/year
Transport emissions	C2: 1,346,850 two-way vehicle trips/year (based on information in **Appendix 14.3 - Transport Assessment**, data for car/van driver, taxi, motorcycle /scooter /moped, ambulance and delivery trip generation) D1*: 105,120 two-way vehicle trips/year (based on information in **Appendix 14.3 - Transport Assessment**, data for car/van driver, taxi, motorcycle /scooter /moped trip generation)	C2 (excluding ancillary): 85,000m^2 D1* (excluding ancillary): 3,288m^2	C2: 19.5 vehicle trips/m^2/year D1*: 46.1 vehicle trips/m^2/year

* Air Quality Neutral guidance is based on historic land use classes. Class D1 is used in the air quality neutral calculation to cover current class E land use

Table 5-4 – Hybrid Planning Application 2: Air Quality Neutral Assessment Assumptions

Element	Emissions or vehicle trips assumptions	Gross (internal) floor area for land use class, or number of residential units if C3	Benchmarked emissions threshold, or TRAVL trip rate
Building emissions	Not applicable (on-site zero emissions sources for heating, cooling and electrical power)	Not applicable	Not applicable
Transport emissions	NO_x: 1,009.1 kg/year PM_{10}: 173.2 kg/year (based on GLA pre-determined C3 trip data for Outer London and emissions factors, and 250,755 two-way trips/year based on based on information in **Appendix 14.3 - Transport Assessment**, data for car/van driver and motorcycle trip generation)	1,500 residential units	NO_x: 2,329.5 kg/year PM_{10}: 400.5 kg/year

SIGNIFICANCE CRITERIA

Construction Dust Impacts

5.2.33. The IAQM guidance for construction dust (**Ref. 5.2**) considers the potential impacts in terms of level of risk and recommends that the likely significance of effect is determined after identification of appropriate mitigation. As the appropriate mitigation should minimise the risk of adverse impacts, the residual effect is likely to be 'minor' at worst.

Local Air Quality Impacts due to Construction and Operational Traffic Emissions

5.2.34. For impacts on local air quality from changes in road traffic emissions, the approach provided in the EPUK /IAQM planning guidance for air quality (**Ref. 5.3**) was followed in describing the potential impacts on local air quality and determining the likely significance of effect.

5.2.35. The impact for each receptor is described in terms of the change in annual mean pollutant concentration relative to the standard (see **Table 5-9** later in this chapter for the relevant standards). **Table 5-5** has been adapted from the guidance and explains how the impact descriptor is determined.

Table 5-5 – Impact Descriptors for Individual Receptors

Annual mean concentration at receptor in assessment year	% Change in concentration relative to the standard			
	1	2 - 5	6 -10	>10
75% or less of the standard	Negligible	Negligible	Low	Medium
76-94% of the standard	Negligible	Low	Medium	Medium
95-102% of the standard	Low	Medium	Medium	High
103-109% of the standard	Medium	Medium	High	High
110% or more of the standard	Medium	High	High	High

Notes:

Where the change in concentration is less than 0.5% relative to the standard, the impact is described as 'negligible' regardless of the concentration.

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

An increase in concentration is 'adverse'. A decrease in concentration is 'beneficial'

5.2.36. For human receptors, the EPUK /IAQM planning guidance for air quality (**Ref. 5.3**) notes that the criteria in **Table 5-5** should be used to describe impacts at individual receptors and should be considered as a starting point to make a judgement on significance of effects, as other influences may need to be accounted for. The EPUK/IAQM guidance states that the assessment of overall significance should be based on professional judgement, taking into account several factors, including:

- The existing and future air quality in the absence of the Proposed Development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

5.2.37. To consider local air quality at new locations with relevant exposure that are introduced by the Proposed Development, the London Councils' Air Pollution Exposure Criteria (APEC) (**Ref. 5.22**) were applied. These criteria are reproduced in **Table 5-6**. Whilst it is not possible to comment on the significance of effect for new receptor locations (as there is no 'without Proposed Development' scenario as far as new receptors are concerned), the criteria indicate the likely acceptability of introducing new exposure and if mitigation should be considered or required in determination of acceptability.

Table 5-6 - London Councils' Air Pollution Exposure Criteria

APEC level	Applicable range annual average NO_2	Applicable range PM_{10}	Recommendation
A	>5% below national objective	Annual Mean >5% below national objective 24-hour mean >1 day less than the national objective	No air quality grounds for refusal; however, mitigation of any emissions should be considered.
B	Between 5% below or above national objective	Annual Mean Between 5% below or above national objective 24-hour mean Between 1 day above or below the national objective	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered e.g., maximise distance from pollution source, proven ventilation systems, parking considerations, winter gardens, internal layout considered, and internal pollutant emissions minimised.
C	>5% above national objective	Annual Mean >5% above national objective 24-hour mean >1 day more than the national objective	Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated. Worker exposure in commercial/ industrial land uses should be considered further. Mitigation measures must be presented with air quality assessment, detailing anticipated outcomes of mitigation measures.

5.2.38. For ecological receptors, an impact threshold of 1% of the critical level/load has been applied to indicate impacts due to the Proposed Development alone that are likely to have negligible effect. The significance of effect for ecological receptors is discussed and reported in **Chapter 8: Ecology and Nature Conservation**.

Local Air Quality Impacts due to Hospital Standby Generator Emissions

5.2.39. Local air quality impacts due to routine testing of the Hospital standby diesel generators will only be significant if there is a reasonable probability that the 1-hour NO_2 standard is exceeded (see **Table 5-9** later in this chapter for the relevant standards). According to Environment Agency guidance (**Ref. 5.20**), where the probability is:

- *"1% or less - exceedances are highly unlikely*
- *less than 5% - exceedances are unlikely as long as the generator plant operational lifetime is no more than 20 years*
- *more than or equal to 5% - there's potential for exceedances and the regulator will consider if acceptable on a case by case basis"*

EFFECT SIGNIFICANCE

5.2.40. The following terms have been used to define the significance of the effects identified and apply to both beneficial and adverse effects:

- **Major effect**: where the Proposed Development could be expected to have a large improvement or deterioration on receptors
- **Moderate effect**: where the Proposed Development could be expected to have a noticeable improvement or deterioration on receptors;
- **Minor effect**: where the Proposed Development could be expected to result in a small improvement or deterioration on receptors; and
- **Negligible**: where no discernible improvement or deterioration is expected as a result of the Proposed Development on receptors, including instances where no change is confirmed.

5.2.41. Effects that are classified as **moderate or above** are considered to be **significant**. Effects classified as below **moderate** are considered to be **not significant**.

5.3. BASELINE CONDITIONS

5.3.1. LBWF declared a whole borough Air Quality Management Area (AQMA) in 2001, due to widespread exceedances of air quality standards for annual mean NO_2 and 24-hour mean PM_{10} concentrations (included in **Table 5-9** later in this chapter). These exceedances were attributed to road traffic emissions. LBWF has established air quality monitoring sites for NO_2 and particulate matter, and publishes its findings on an annual basis in accordance with its duties for London Local Air Quality Management.

5.3.2. According to LBWF's latest available air quality annual status report (**Ref. 5.4**), exceedances of the annual mean NO_2 objective persist to this day at locations with residential premises and schools alongside major roads and near busy road junctions. Exceedances of the 1-hour mean NO_2 objective were recorded by LBWF for 2014 and 2015 (but not since) at the Crooked Billet Interchange, which is beyond the study area. Exceedances of the 24-hour mean PM_{10} objective have not been recorded by LBWF since 2014.

5.3.3. There are no GLA Air Quality Focus Areas (AQFA) within the study area. There are six within a 2km radius from the Site, including two within the London Borough of Redbridge (LBR), which are shown in **Figure 5-3: Baseline**:

- Leyton High Street/Green Road/Lea Bridge Road (LBWF);
- Lea Bridge Road from Orient Way to Avondale Road (LBWF);
- Walthamstow Central and Hoe Street to junction with Forest Road (LBWF);
- Hermon Hill (LBR);
- A12 Eastern Avenue at Wanstead to the east and west of the road tunnel (LBR); and
- Leyton town centre area (LBWF).

5.3.4. The AQFA were defined by the GLA where annual mean NO_2 concentrations exceeded the EU limit value (same standard as the air quality objective) in locations where there is high human exposure. The latest set of AQFA were updated as part of the 2016 London Atmospheric Emissions Inventory update (**Ref. 5.23**). The purpose of the AQFA is to enable targeted measures to reduce NO_2 concentrations and London Boroughs are required to have regard to AQFAs when developing an Air Quality Action Plan to address any AQMA declaration.

5.3.5. There are two LBWF monitoring locations within the study area for local air quality impacts, which are shown in **Figure 5-3: Baseline**. These locations are at roadside on the Whipps Cross roundabout (LBWF site ID 1) and on James Lane, near Leytonstone School (LBWF site ID 30). Here, annual mean NO_2 concentrations for 2019 were below the objective although the concentration at James Lane was only just below. Within 2km of the Site there are a further 32 monitoring locations, including one LBR site ID CM4 on Gardner Close (**Ref. 5.24**); these are shown in **Figure 5-3: Baseline**. Annual mean NO_2 concentrations for 2019 at eight of sites within 2km of the Site exceeded the objective in the following locations:

- Boundary Road and Hoe Street (LBWF site ID 3);
- Leyton Library (LBWF site ID 15);
- Forest Road at the junction with Wood Street (LBWF site ID 37);
- Leytonstone High Road at the junction with West Street (LBWF site ID 43);
- Lea Bridge Road, Bakers Arms (LBWF site ID 47);
- South Grove (LBWF site 50); and
- Selbourne Road (LBWF site ID's 51 and 52).

5.3.6. LBWF has noted gradual improvement in air quality in years up to 2018, but with similar concentrations in 2018 and 2019 at some locations (**Ref. 5.4**).

5.3.7. The main local sources of air pollutants in the immediate vicinity of the Site are road traffic, particularly on the A104 Lea Bridge Road and the A114 Whipps Cross Road, emissions from domestic and commercial gas boilers and emissions from the Whipps Cross Hospital energy centre, within the Site.

BASELINE NO_2 DIFFUSION TUBE SURVEY

5.3.8. WSP carried out a diffusion tube monitoring survey for a three-month period from Thursday 10 December 2020 to Tuesday 16 March 2021 to provide more localised detail on baseline conditions for both human and ecological receptors in the vicinity of the Site. Diffusion tube locations are shown in **Figure 5-3: Baseline**. The annualised results of this survey are given in **Table 5-7.**

5.3.9. To examine the impact of the COVID-19 pandemic on the measured concentrations, comparison was made with roadside continuous monitoring data at Defra's Harringay roadside Automatic Urban and Rural Network monitoring station for the same period in 2020-2021 and also in 2019 (before COVID-19). The comparison showed that the approach to the annualisation of survey data to 2019 made appropriate adjustment for the temporary impact of COVID-19 travel restrictions.

5.3.10. Locations 1 to 7 are at roadside within areas with residential population exposure. Locations 'A' to 'P' are within or adjacent to the Epping Forest SAC/SSSI and Ancient Woodland.

Table 5-7 – NO_2 diffusion tube survey results

ID	X	Y	Location	Receptor type location is representative of	Annual mean NO_2 concentration ($\mu g/m^3$), representative of 2019
1	538875.1	188094.6	Roadside on corner of Peterborough Road and James Lane (lamp column opposite Glade Food and Wine)	Human	29.1
2	538438.3	188660.0	Roadside on Lea Bridge Road (signpost at junction with Peterborough Road)	Human	35.7
3	538507.5	188730.5	Roadside on Lea Bridge Road (lamp column outside number 900 Lea Bridge Road)	Human	48.2*
4	538917.2	189012.5	Roadside on Lea Bridge Road (signpost at junction with Foresters Drive)	Human	32.5*
5	538846.0	188424.4	Roadside on Hospital Road (signpost outside eye treatment centre)	Human	31.0
6	538308.7	188576.2	Roadside on Lea Bridge Road (parking signpost outside number 808 Lea Bridge Road)	Human	45.7
7	538656.2	188914.5	Roadside on Wood Street (parking sign outside Beuleigh Court)	Human	38.2*
A	539331.9	188459.2	Roadside on Whipps Cross Road, adjacent to Ancient Woodland (on signpost at junction with James Lane)	Ecological	30.6
B	538891.0	188706.5	Roadside on Whipps Cross Road, adjacent to Ancient Woodland (on signpost on at junction with Hospital Road)	Ecological	35.0
C	539718.2	188080.2	Roadside on Whipps Cross Road at boundary of SAC/SSSI (Green Man Interchange sign)	Ecological	28.4
D	539694.9	188150.1	Set back from Whipps Cross Road within the SAC/SSSI (wooden post)	Ecological	27.8*
E	539612.2	188250.0	Near roadside on Whipps Cross Road just within SAC/SSSI (City of London Park sign)	Ecological	29.1

ID	X	Y	Location	Receptor type location is representative of	Annual mean NO_2 concentration ($\mu g/m^3$), representative of 2019
F	538840.7	188831.5	Roadside on Whipps Cross Road, just south of junction with Lea Bridge Road and adjacent to SAC boundary (lamp column)	Ecological	35.9
G	538957.7	189007.3	Roadside on Lea Bridge Road adjacent to SAC/SSSI (lamp column opposite Foresters Drive)	Ecological	33.1
H	539085.7	189086.1	Path off Snaresbrook Road, near junction with Lea Bridge Road, just within SAC/SSSI (wooden post)	Ecological	22.9*
I	539534.9	189077.8	Roadside on Snaresbrook Road at car park adjacent to SAC/SSSI (post)	Ecological	24.1
J	539530.0	189046.3	On south side of Snaresbrook Road car par and within SAC/SSSI (park sign)	Ecological	20.6*
K	539425.6	189303.3	Roadside on Oakhurst Gardens adjacent to SAC/SSSI (lamp column outside 11 Forest Close)	Ecological	20.8
L	539128.4	189595.9	Roadside on Woodford New Road adjacent to SAC/SSSI (forest sign north of 'My Shish Restaurant and Lounge')	Ecological	22.6
M	539089.1	189550.8	On St Peters Path close to Woodford New Road (south of 'My Shish Restaurant and Lounge'	Ecological	21.7*
N	538996.0	189577.1	On St Peters Path off Forest Rise just within SAC/SSSI (post)	Ecological	20.6*
O	539737.0	188182.9	Off Whipps Cross Road, within SAC/SSSI (post set back from D)	Ecological	22.4
P	539046.7	189566.1	On St Peters Path off Forest Rise just within SAC/SSSI (post between M and N)	Ecological	20.9*

Notes:

Concentrations marked with an asterisk '*' are based on less than 3 months of data where tubes were missing on the monthly changeover site visit.

ID	X	Y	Location	Receptor type location is representative of	Annual mean NO_2 concentration ($\mu g/m^3$), representative of 2019
Annualisation has been carried out in accordance with LLAQM.TG(19) methodology (**Ref. 5.13**) using background data from London Bexley, London Bloomsbury, London Haringey Priory Park South and London Eltham continuous monitoring stations. Diffusion tubes (20% TEA/water) supplied and analysed by Gradko International Ltd. Bias adjustment factor of 0.91 has been applied.					

MODELLED 2019 BASELINE

5.3.11. Baseline local air quality conditions have been modelled at human and ecological receptors within the study area shown in **Figure 5-2: Study Area for Local Air Quality Impacts**. All results are included in **Appendix 5-6**.

5.3.12. The highest predicted annual mean NO_2 concentrations at any human receptor is 34.3µg/m^3 at receptors 1 and 2, which represent residential properties on James Lane opposite the Site. The nearest LBWF monitoring location is site ID 30, which is also on James Lane, where the monitored NO_2 concentration for 2019 is 37.6µg/m^3. Annual mean NO_2 concentrations at human receptors along Lea Bridge Road have been predicted to be between generally between 30 and 34 µg/m^3. At other human receptors concentrations are generally slightly lower. The modelled NO_2 concentrations generally accord with monitoring data for 2019.

5.3.13. With regard to predicted PM_{10} and $PM_{2.5}$ concentrations, these are all well below current legislated standards. In the case of $PM_{2.5}$, the annual mean concentrations range between 13 and 14.8 µg/m^3, which – in common with most of London – is above the World Health Organisation (WHO) guideline limit of 10µg/m^3 (**Ref. 5.25**).

5.3.14. Concentrations of NO_x and NH_3 exceed their respective critical levels across all nature conservation sites within the study area and nitrogen and acid deposition rates exceed the critical loads for both woodland and heathland sensitive habitats. The concentrations and deposition rates are most elevated at the roadside. All results are for the baseline are included in **Appendix 5-7**.

FUTURE BASELINE

5.3.15. In future years, lower concentrations of NO_2 and other local air pollutants are expected, particularly after 2021 following the planned extension of the London Ultra-Low Emissions Zone (ULEZ) to cover the areas within the A406 North Circular Road and A405 South Circular Road, which will deter by a daily charging regime those road vehicles not meeting strict emissions standards.

5.3.16. Modelled future baseline concentrations of NO_2, PM_{10} and $PM_{2.5}$ at human receptors for 2023 and 2038 are included in **Appendix 5-6** and **Appendix 5-8** respectively. Concentrations are predicted to be lower at all human receptors for 2023 and 2038 than 2019. This is due to Defra/Department for Transport/Transport for London forecast changes to the vehicle fleet where the proportion of in service low/zero emissions vehicles increases over time (**Ref. 5.16**). It is predicted that baseline annual mean $PM_{2.5}$ concentrations will still exceed the WHO guideline limit (**Ref. 5.25**) by 2038 although this could be because the current set of Defra vehicle emissions factors (**Ref. 5.16**) used in

this assessment do not forecast emissions beyond 2030 and do not account for the potential impact of the imminent London ULEZ expansion.

5.3.17. Concentrations of NO_x are predicted to decrease over time but continue to exceed the critical level across the study area in 2023, but by 2038 exceedances are limited to within approximately 100m from the roadside. Concentrations of NH_3 are predicted to increase slightly over time and continue to exceed the critical level throughout the study area. Predicted nitrogen and acid deposition rates decrease over time although continue to exceed the critical loads. All results are for the future baseline are included in **Appendix 5-7** and **Appendix 5-9** for 2023 and 2038 respectively.

5.4. SENSITIVE RECEPTORS

5.4.1. The sensitive receptors selected in this assessment are representative of:

- Human receptors where members of the public are likely to be present and are sensitive to dust deposition/soiling (harming amenity and property) and changes in local air pollution (affecting health) - including residential, school and hospital premises; and
- Ecological receptors with features that are sensitive to impacts from dust, on ambient NO_x and NH_3 concentrations and resultant changes in nutrient nitrogen and acid deposition rates.

5.4.2. Human receptors have been represented in two different ways: as specific receptor points on the nearest façade to the dominant emissions source (qualifying road or Hospital standby generators), and as a grid of points extending up to 1km either side of the Hospital standby generator flue stack. The purpose of the two different representations is to primarily capture the impacts at specific locations (receptor points) which represent closest proximity exposure to the predicted changes in local air quality, and – in the case of grid points – across a wider area to capture the highest impacts on 1-hour mean NO_2 concentrations from the generator flue stack emissions. All human receptors are modelled at 1.5m above ground level, which represents the average human breathing zone, with additional façade receptors at height to represent upper floor levels where appropriate. As applicable air quality standards (see **Table 5-9** later in this chapter) are only relevant in the external environment where members of the public are likely to be routinely present, indoor and workplace air quality has not been considered (workplace environments are subject to separate occupational health standards).

5.4.3. Ecological receptors have been represented by transects of receptor points at ground level, extending from the nearest designated ecological site boundary to a qualifying road to up to 200m within the designated ecological site.

5.4.4. Sensitive receptors are summarised in **Table 5-8** and for ease of reporting are grouped by location. Human and ecological receptor points are illustrated in **Figure 5-4: H1 Local Air Quality Impacts at Human Receptors**, **Figure 5-5: H1 Local Air Quality Impacts at Ecological Receptors**, **Figure 5-6: H2 Local Air Quality Impacts at Human Receptors**, and **Figure 5-7: H2 Local Air Quality Impacts at Ecological Receptors**.

Table 5-8 – Sensitive Receptors

Location	Human	Ecological
Whipps Cross Road, south of James Lane	Residential, receptors 45 and 46	Epping Forest SAC/SSSI, transects 24 – 34 Ancient Woodland, transects 35 – 37
James Lane	Residential, receptors 1 and 2 Leytonstone School receptor 3	Ancient Woodland transects 38 and 39
Whipps Cross Road, north of James Lane	Hospital unit, receptors 22 and 23	Epping Forest SAC/SSSI, transects 10 – 23 Ancient Woodland transects 40 – 45
Lea Bridge Road	Residential, receptors 5 - 15	Epping Forest SAC/SSSI, transects 1 – 9
Woodford New Road	Residential, receptors 18 and 19	Epping Forest SAC/SSSI, transects 48 – 61, 89 – 108 Ancient Woodland, transects 46 and 47
Forest Road	None	Epping Forest SAC/SSSI, transects 62 – 65
North Circular	None	Epping Forest SAC/SSSI, transects 66 – 88
Whipps Cross Hospital Site (new and refurbished)	Receptor grids at 1.5m above ground level, and new Hospital building roof levels at 20.8m and 47.8m Retained old Hospital buildings, receptors 20, 21, 24 – 29	None
Around the Whipps Cross Hospital Site boundary	On Peterborough Road: ▪ Barclay Primary School, receptor 4 ▪ Residential, receptors 30 – 34 On West End Avenue: ▪ Residential, receptors 35 and 36 On Halford Road: ▪ Residential receptors 37 – 39 On Fulready Road: ▪ Residential receptors 40 - 44	None

5.5. LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

LEGISLATIVE FRAMEWORK

5.5.1. The applicable legislative framework is summarised as follows:

- The Environmental Protection Act 1990 (**Ref. 5.26**) in the construction stage. The Act provides the following definitions of statutory nuisance relevant to dust and particles:
  "Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance"; and
  "Any accumulation or deposit which is prejudicial to health or a nuisance".
  Statutory nuisance provisions are relevant to (amongst other things) the control of dust from construction sites and odour from wastewater treatment works. There are no statutory limit values for dust above which 'nuisance' is deemed to exist. Nuisance is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred. The party responsible for the premises giving rise to the emissions is responsible for ensuring use of Best Practicable Means to avoid a statutory nuisance.
- The Environment Act 1995 (**Ref. 5.27**). Under Part IV local authorities must review and document local air quality within their area by way of staged appraisals and respond accordingly, with the aim of meeting the air quality objectives defined in the Regulations. Where the objectives are not likely to be achieved, an authority is required to designate an AQMA. For each AQMA the local authority is required to draw up an Air Quality Action Plan to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.
- The Air Quality (England) Regulations 2000 (as amended) (**Ref. 5.28** and **Ref. 5.29**). Sets objectives for ambient pollutant concentrations. The objective 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."*
- The Air Quality Standards Regulations 2010 (as amended) (**Ref. 5.30** and **Ref. 5.31**). Sets legally binding limit values for concentrations in outdoor air of major air pollutants that impact public health such as PM_{10}, $PM_{2.5}$ and NO_2. The limit values are numerically the same as the objectives.

5.5.2. The relevant ambient air quality standards to this assessment are given in **Table 5-9**.

Table 5-9 – Relevant Air quality Standards

Pollutant	Concentration in micrograms per cubic metre (µg/m³)	Measured As	Number of Exceedances Allowed in a Calendar Year	Requirement
Nitrogen dioxide (NO_2)	40	Annual mean	None	In regulations as an objective for local authorities and mandatory limit value for national government
	200	1-hour (hourly) mean	No more than 18	In regulations as an objective for local authorities and

Pollutant	Concentration in micrograms per cubic metre (µg/m³)	Measured As	Number of Exceedances Allowed in a Calendar Year	Requirement
				mandatory limit value for national government
Nitrogen oxides (NO_x)	30	Annual mean	None	Set for the protection of sensitive vegetation
Particulates less than 10 micrometres in diameter (PM_{10})	40	Annual mean	None	In regulations as an objective for local authorities and mandatory limit value for national government
	50	24-hour (daily) mean	No more than 35	In regulations as an objective for local authorities and mandatory limit value for national government
Particulates less than 2.5 micrometres in diameter ($PM_{2.5}$)	25	Annual mean	None	In regulations as a mandatory limit value for national government
	10	Annual mean	None	WHO guideline. The Mayor of London's policy commitment to achieve this by 2030

POLICY

5.5.3. The relevant policy comprises:

- National Planning Policy Framework (**Ref. 5.32**). This includes policy considerations concerning development and air quality, in-particular that:
  - Paragraph 180 *"…decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development."*
  - Paragraph 181 *"…decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, …"* and furthermore that *"Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*
- Air Quality Strategy for England, Scotland, Wales and Northern Ireland (**Ref. 5.33**). The Air Quality Strategy provides a framework for reducing air pollution in the UK with the aim of meeting the air quality standards that are set as objectives.

- Clean Air Strategy 2019 (**Ref. 5.34**). This sets out the measures, which aim to reduce emissions from all sources of air pollution, making air healthier to breathe, protecting nature and boosting the economy. The Strategy also provides goals to cut public exposure to airborne particulate matter, as per the recommendation made by the World Health Organisation.
- The London Plan 2021: The Spatial Development Strategy for Greater London (**Ref. 5.35**). Policy SI 1 of the London Plan is the key policy specific to the improvement of air quality with Greater London. In particular:

  "1) Development proposals should not:
  a) lead to further deterioration of existing poor air quality
  b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits
  c) create unacceptable risk of high levels of exposure to poor air quality"

  The policy also sets out that all new development *"must be at least Air Quality Neutral"* and larger developments that are subject to EIA *"should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach"* stating that *"a statement should be submitted"* to demonstrate this.
- The London Environment Strategy (**Ref. 5.36**). This aims for *"London will have the best air quality of any major world city by 2050, going beyond the legal requirements to protect human health and minimise inequalities."* Chapter 4 addresses air quality and sets out objectives, policy items and proposals to (amongst other things): reduce exposure to harmful pollution; tackle health inequality; achieve compliance with limit values as soon as possible; reduce emissions from transport and phase out use of fossil fuels; reduce freight movements through better use of consolidated trips; prevent or reduce emissions from NRMM; reduce emissions from construction and demolition sites; and meet the WHO guideline limit for $PM_{2.5}$ by 2030.
- The Waltham Forest Local Plan (**Ref. 5.37**). The LBWF is currently preparing a new Local Plan for 2020-2035. Document LP1 sets out Strategic Policies which have yet to be finalised. Improvement of air quality is addressed across several policies, with focus on reducing emissions from road transport. Of particular relevance are:

  - Policy 83 - The Epping Forest and the Epping Forest Special Area of Conservation addresses new development within 6km of the SAC and requires *"…that adequate measures are put in place to avoid or mitigate any potential adverse effects through contribution to the mitigation of recreational and air quality impacts on the Epping Forest SAC"*; and
  - Policy 90 – Air Pollution requires that new development *"…meets, and where possible improves upon, air quality neutral standards over its lifetime and does not contribute to a decrease in air quality during the construction or operation stage"*; *"Ensuring development is air quality positive in air quality focus areas"*; *"Assessing existing air quality and avoiding locating sensitive uses in areas exposed to air pollution"*; "*Minimising exposure to air pollution through the considered positioning and design of new development, …"*; *"Incorporating on-site measures to improve air quality…"* but if not possible then *"…off-site measures to improve local air quality may be acceptable, providing equivalent air quality benefits can be demonstrated"*.

GUIDANCE

5.5.4. The following guidance documents have been used during the preparation of this chapter:

- IAQM: Guidance on the Assessment of Dust from Demolition and Construction (**Ref. 5.2**)
- EPUK/IAQM: Land Use Planning and Development Control - Planning for Air Quality (**Ref. 5.3**);
- Mayor of London: London Local Air Quality Management Technical Guidance LLAQM.TG(16) (**Ref. 5.14**);
- Mayor of London: The Control of Dust and Emissions During Construction and Demolition - Supplementary Planning Guidance (**Ref. 5.15**);
- Environment Agency: Specified generators: dispersion modelling assessment (**Ref. 5.20**);
- GLA: Air Quality Neutral Planning Support (**Ref. 5.21**);
- London Councils: Air Quality and Planning Guidance (**Ref. 5.22**);
- Defra: Local Air Quality Management Technical Guidance LAQM.TG(16) (**Ref. 5.38**);
- Environment Agency Diesel generator short term NO_2 impact assessment (**Ref. 5.20**);
- IAQM: A guide to the assessment of air quality impacts on designated nature conservation sites (**Ref. 5.39**); and
- Air Quality Consultants Ltd: Ammonia Emissions from Roads for Assessing Impacts on Nitrogen-sensitive Habitats (**Ref. 5.40**).

5.6. ASSESSMENT OF POTENTIAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS

CONSTRUCTION PHASE

Table 5-10 – Dust Impacts: Assessment of Potential Effects, Additional Mitigation, Residual Effects and Monitoring During Construction

Sensitive receptor	People and property, and sensitive habitats and plant communities at ecological sites.
Potential effects	Assessment of Potential Dust Emissions Magnitude *Demolition phase* A planning application for prior notification of the proposed demolition of the Former Nurses' Accommodation blocks was approved by LBWF in July 2020. **Hybrid Planning Application 1:** The total volume of buildings to be demolished is <20,000m^3, with potentially dusty construction material (e.g. concrete). It understood that demolition activities will at times occur more than 20m above ground level on the basis that the former waste facility has a brick chimney 46m in height. Crushing and screening activities are also expected to occur on-site. Therefore, the potential dust emission magnitude is 'large' for demolition activities. **Hybrid Planning Application 2:** the total volume of buildings to be demolished is greater than 50,000m^3, with demolition activities occurring at greater than 20m above ground level. The potential dust emission magnitude during the demolition *phase* is therefore 'large'. *Earthworks stage* **Hybrid Planning Application 1:** The total area of the Site is approximately 55,000m^2 (i.e. >10,000m^2) and the soil type is loamy and clayey and therefore potentially dusty. Given the size of the Site, and in the absence of more detailed information, the total material to be moved is estimated to be between 20,000 and 100,000 tonnes and it may require more than 10 heavy earth moving vehicles to be active at any one time. The potential dust emission magnitude during the earthworks stage is therefore 'large'. **Hybrid Planning Application 2:** The total area of the Site is greater than 10,000m^2. There may be more than 10 heavy earth moving plant active at any one time. The potential dust emission magnitude during the earthworks stage is therefore 'large'. *Construction phase* **Hybrid Planning Application 1:** The total volume of buildings to be constructed on the Site will be more than 100,000m^3 with potentially dust construction materials being used. The potential dust emission magnitude during the construction phase is therefore 'large'. **Hybrid Planning Application 2:** The total volume of buildings to be constructed on the Site will be more than 100,000m^3. The potential dust emission magnitude during the construction phase is therefore 'large'. *Trackout stage* **Hybrid Planning Application 1:** Based on the traffic information provided by the Transport Consultant there will be over 50 outward HDV movements in any one working day in the peak construction year of 2023. They are likely to travel for more than 100m across a moderately dusty surface material. The potential dust emission magnitude during the trackout stage is therefore 'large'. **Hybrid Planning Application 2:** Construction traffic flows are unknown at this stage. It is possible that over 50 outward HDV movements in any one day may occur in the construction period. The potential dust emission magnitude during the trackout stage is therefore 'large'. Definition of Sensitivity of the Area The dominant wind direction at the Site is from the southwest quadrant. This means that receptors to the northeast are likely to be at greatest risk of dust and PM_{10} impacts. Fugitive emissions of dust and PM_{10} are only likely during dry conditions and are less likely to occur during or following precipitation when the ground surface remains in a damp state. The area surrounding the Site has a high density of buildings, including commercial premises and highly sensitive receptors including hospital wards and areas, numerous residential properties, and twelve education facilities including but not limited to nurseries, pre-schools, primary and secondary schools and a sixth form college. Consequently, there are more than 100 high sensitivity receptors within 20m of the boundary of the Site and 50m of construction traffic routes up to 500m from the Site egress. As a result, the area surrounding the Site has a **high** sensitivity to dust soiling effects on people and property due to activities carried out during construction phase. Background PM_{10} concentrations in the vicinity of the Site are low. Defra background map data for 2019 estimates the annual mean PM_{10} concentration at the Site to be 19.4µg/m^3. Taking this and the high density and close proximity of sensitivity receptors into account, the area surrounding the Site is considered to have a **high** sensitivity in relation to human health impacts. Ancient Woodland site are within 20m of the eastern Site boundary. The Epping Forest SAC/SSSI could also be affected by trackout from construction vehicles at the northern end of Whipps Cross Road (as illustrated in **Figure 5-1: Study Area for Construction Dust Impacts**). Accordingly, the surrounding area has a **high** sensitivity for ecological impacts. Definition of Risk of Impacts

The predicted dust emission magnitude has been combined with the sensitivity of the area to determine the risk of impacts during the construction phase, prior to mitigation. The risk of impacts for the Proposed Development in both Hybrid Planning Application 1 and Hybrid Planning Application 2 can be summarised as follows:

Potential Impact	Risk of Impact			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	High Risk	High Risk	High Risk	High Risk
Human health	High Risk	High Risk	High Risk	High Risk
Ecological	High Risk	High Risk	High Risk	High Risk

The risk category identified for each construction phase activity has been used to determine the level of mitigation required.

Additional Mitigation

Dust and pollution control measures will be necessary throughout the construction phase to minimise the impacts in terms of fugitive dust and PM_{10} emissions. The Principal Contractor will be required to implement measures to prevent and control emissions using Best Practicable Means and in accordance with Mayor of London: The Control of Dust and Emissions During Construction and Demolition - Supplementary Planning Guidance (**Ref. 5.15**). Further detail on dust mitigation is set out in the CEMP, submitted as a supporting planning document. Implementation of these mitigation measures will be the responsibility of the Principal Contractor.

Residual effects and monitoring

The residual effects of dust and PM_{10} generated by construction activities are likely to have a direct, temporary, short-term **minor adverse** effect on receptors in the local area (**not significant**) following the implementation of mitigation measures and good site practice.

Monitoring to ensure effective implementation of mitigation measures throughout the construction phase will be required. Given the large scale of the Proposed Development and the high sensitivity of the surrounding area, monitoring should include regular visual inspections and real-time monitoring of PM_{10} concentrations with an alert system in the event of action trigger levels being exceeded. Monitoring requirements should be secured through condition of planning consent from the LBWF.

Table 5-11 – Traffic emissions and human receptors: assessment of potential effects, additional mitigation, residual effects and monitoring during construction

Sensitive receptor

Human receptors including residential, school and hospital premises.

Potential effects

Changes in vehicle movements over the local road network during construction will have negligible impacts on air quality at all existing receptors with differences in annual mean concentrations of all pollutants of less than or equal to 0.3µg/m^3 everywhere for NO_2 and less than 0.1µg/m^3 for particulate matter (as PM_{10} and $PM_{2.5}$). Existing and future pollutant concentrations, without or with the Proposed Development, are within current legislated standards (**Table 5-9**).

The impacts for the modelled year (2023) are summarised below (full results are presented in **Appendix 5-6**). The summary of impacts is presented below for NO_2 only as an appropriate indicator of road traffic impacts on air quality; maximum total concentrations with the Proposed Development are provided for all pollutants. Using the IAQM descriptors (

Table 5-5), impacts on all assessed pollutants - NO_2, PM_{10}, $PM_{2.5}$ - are negligible.

The modelled annual mean $PM_{2.5}$ concentrations exceed the WHO guideline limit of 10µg/m^3 in all years. The maximum impact of the Proposed Development is, however, less than 1% of this guideline.

Location	Summary of Impacts	Maximum Conc. With Development Construction Works (2023)		
		NO_2	PM_{10}	$PM_{2.5}$
Whipps Cross Road, south of James Lane	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 46): Baseline 2019: 30.0 µg/m^3	23.3	18.4	12.1

	Without Dev. 2023: 23.2 µg/m^3 With Dev. 2023: 23.3 µg/m^3 Impact: 0.1 µg/m^3			
James Lane	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 2): Baseline 2019: 34.3 µg/m^3 Without Dev. 2023: 27.7 µg/m^3 With Dev. 2023: 28.0 µg/m^3 Impact: 0.3 µg/m^3	28.4	20.2	13.4
Whipps Cross Road, north of James Lane	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 22): Baseline 2019: 31.7 µg/m^3 Without Dev. 2023: 25.7 µg/m^3 With Dev. 2023: 25.9 µg/m^3 Impact: 0.2 µg/m^3	25.9	19.0	12.4
Lea Bridge Road	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 12): Baseline 2019: 28.9 µg/m^3 Without Dev. 2023: 23.9 µg/m^3 With Dev. 2023: 23.9 µg/m^3 Impact: 0.0 µg/m^3	25.4	19.3	12.9
Woodford New Road	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 18): Baseline 2019: 32.4 µg/m^3 Without Dev. 2023: 24.6 µg/m^3 With Dev. 2023: 24.6 µg/m^3 Impact: 0.0 µg/m^3	24.6	18.5	12.1
Forest Road / North Circular	No affected receptors for health impacts			
Whipps Cross Hospital Site (new and refurbished)	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 24): Baseline 2019: 30.0 µg/m^3 Without Dev. 2023: 24.8 µg/m^3 With Dev. 2023: 25.0 µg/m^3 Impact: 0.1 µg/m^3	25.0	19.3	12.8

Around the Whipps Cross Hospital Site boundary	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 44): Baseline 2019: 26.1 µg/m^3 Without Dev. 2023: 22.1 µg/m^3 With Dev. 2023: 22.1 µg/m^3 Impact: 0.0 µg/m^3	22.1	18.5	12.4

The sensitivity of all of the receptors is high, but the magnitude of change prior to mitigation, is negligible. Therefore, there is likely to be a direct, temporary, medium term, **negligible** effect **(not significant**) on all receptors.

Additional Mitigation	To minimise the potential local air quality impacts, construction vehicles are to be managed in accordance with a CEMP and Construction Logistics Plan, as referred to in **Chapter 2: Description of Proposed Development**. In addition, there would be a Construction Workforce Travel Plan, as referred to in **Chapter 14: Transport and Access**.
Residual effects and monitoring	The sensitivity of existing human receptors is high, but the magnitude of change to vehicle emissions without the need for secondary mitigation is negligible. Therefore, there is likely to be a **negligible** effect on receptors (**not significant**) without the need for secondary mitigation measures.

Table 5-12 – Traffic Emissions and Ecological Receptors: Assessment of Potential Effects, Additional Mitigation, Residual Effects and Monitoring During Construction

Sensitive receptor	Epping Forest SAC/SSSI and Ancient Woodland.
Potential effects	Changes in vehicle movements over the local road network during construction will have minor impacts on air quality within Epping Forest SAC/SSSI, but impacts decrease to negligible (<1% of any critical level or critical load) within 20m of the roadside. Similarly, over Ancient Woodland (AW) outside of the SAC/SSSI, impacts are minor adverse but decrease rapidly to negligible away from the roadside. The impacts for the modelled year (2023) are summarised below (full results are presented in **Appendix 5-7**).

Location	Pollutant Concentrations (Nitrogen Oxides and Ammonia)	Pollutant Deposition (Nutrient Nitrogen and Acid)
Whipps Cross Road, south of James Lane	**Nitrogen Oxides:** Concentrations **exceed the critical level** in the baseline and in 2023 without Development Maximum impact: 0.45µg/m^3 (1.5% of critical level) Impacts **exceed 1% at roadside only** **Ammonia:** Concentrations exceed the critical level in the baseline and 2023 without Development Maximum impact: 0.05µg/m^3 (5.1% of critical level) Impacts **exceed** 1% **20m into Site only**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** in the baseline and 2023 without Development Maximum impact: 0.42kgN/ha/yr (4.2% of critical load, woodland habitat) Impacts exceed **1% 20m into site for woodland habitats and 10m into site for heathland habitats** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** in the baseline and 2023 without Development Maximum impact: 0.03keq/ha/yr (1.7% of critical load, woodland habitat) Impacts exceed **1% at Site boundary only for all habitats**

James Lane	**Nitrogen Oxides:** Concentrations **exceed the critical level** in the baseline and in 2023 without Development Maximum impact: 1.2µg/m^3 (4.0% of critical level) Impacts **exceed 1% 20m into Site only** **Ammonia:** Concentrations exceed the critical level in the baseline and 2023 without Development Maximum impact: 0.02µg/m^3 (2.2% of critical level) Impacts **exceed** 1% **10m into Site only**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** in the baseline and 2023 without Development Maximum impact: 0.30kgN/ha/yr (3.0% of critical load, woodland habitat) Impacts exceed **1% 20m into Site** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** in the baseline and 2023 without Development Maximum impact: 0.02keq/ha/yr (1.3% of critical load, woodland habitat) Impacts exceed **1% at Site boundary only**
Whipps Cross Road, north of James Lane	**Nitrogen Oxides:** Concentrations **exceed the critical level** in the baseline and in 2023 without Development Maximum impact: 0.15µg/m^3 (0.5% of critical level) Impacts are **negligible** **Ammonia:** Concentrations exceed the critical level in the baseline and 2023 without Development Maximum impact: 0.02µg/m^3 (1.6% of critical level) Impacts **exceed** 1% **at Site boundary only**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** in the baseline and 2023 without Development Maximum impact: 0.13kgN/ha/yr (1.3% of critical load, woodland habitat) Impacts exceed **1% at Site boundary only** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** in the baseline and 2023 without Development Maximum impact: 0.01keq/ha/yr (0.6% of critical load, woodland habitat) Impacts are **negligible**
Lea Bridge Road	**Nitrogen Oxides:** Concentrations **exceed the critical level** in the baseline and in 2023 without Development Maximum impact: 0.02µg/m^3 (0.08% of critical level) Impacts are **negligible** **Ammonia:** Concentrations exceed the critical level in the baseline and 2023 without Development Maximum impact: 0.002µg/m^3 (0.2% of critical level) Impacts are **negligible**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** in the baseline and 2023 without Development Maximum impact: 0.02kgN/ha/yr (0.2% of critical load, woodland habitat) Impacts are **negligible** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** in the baseline and 2023 without Development Maximum impact: 0.002keq/ha/yr (0.1% of critical load, woodland habitat) Impacts are **negligible**
Woodford New Road	**Nitrogen Oxides:** Concentrations **exceed the critical level** in the baseline and in 2023 without Development Maximum impact: 0.001µg/m^3 (<0.01% of critical level) Impacts are **negligible** **Ammonia:**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** in the baseline and 2023 without Development Maximum impact: 0.003kgN/ha/yr (0.03% of critical load, woodland habitat) Impacts are **negligible** **Acid Nitrogen Deposition:**

	Concentrations exceed the critical level in the baseline and 2023 without Development Maximum impact: <0.001µg/m^3 (<0.01% of critical level) Impacts are **negligible**	Deposition **exceeds the critical load function** in the baseline and 2023 without Development Maximum impact: <0.001keq/ha/yr (0.01% of critical load, woodland habitat) Impacts are **negligible**
Forest Road	**Nitrogen Oxides:** Concentrations **exceed the critical level** in the baseline and in 2023 without Development Maximum impact: <0.001µg/m^3 (<0.001% of critical level) Impacts are **negligible** **Ammonia:** Concentrations exceed the critical level in the baseline and 2023 without Development Maximum impact: <0.002µg/m^3 (<0.2% of critical level) Impacts are **negligible**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** in the baseline and 2023 without Development Maximum impact: <0.001kgN/ha/yr (<0.01% of critical load, woodland habitat) Impacts are **negligible** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** in the baseline and 2023 without Development Maximum impact: <0.001keq/ha/yr (<0.01% of critical load, woodland habitat) Impacts are **negligible**
North Circular	**Nitrogen Oxides:** Concentrations **exceed the critical level** in the baseline and in 2023 without Development Maximum impact: 0.001µg/m^3 (<0.001% of critical level) Impacts are **negligible** **Ammonia:** Concentrations exceed the critical level in the baseline and 2023 without Development Maximum impact: <0.002µg/m^3 (<0.2% of critical level) Impacts are **negligible**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** in the baseline and 2023 without Development Maximum impact: <0.003kgN/ha/yr (<0.03% of critical load, woodland habitat) Impacts are **negligible** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** in the baseline and 2023 without Development Maximum impact: <0.001keq/ha/yr (<0.01% of critical load, woodland habitat) Impacts are **negligible**
Around the Whipps Cross Hospital Site boundary	No sites designated for nature conservation	

The sensitivity of all of the receptors is high, but the magnitude of change prior to mitigation is small alongside some roadsides, decreasing to negligible within a maximum of 20m into any nature conservation site. The impacts will be direct and temporary, and medium term.

Effects are likely to be negligible alongside Lea Bridge Road, Woodford New Road, Forest Road and the North Circular Road since the impacts are less than 1% of the relevant critical levels and critical loads everywhere within the nature conservation sites.

The significance of any ecological effects alongside Whipps Cross Road and James Lane are discussed and reported within **Chapter 8: Ecology and Nature Conservation**

Additional Mitigation	To minimise the potential local air quality impacts, construction vehicles are to be managed in accordance with a CEMP and Construction Logistics Plan, as referred to in **Chapter 2: Description of Proposed Development**. In addition, there would be a Construction Workforce Travel Plan, as referred to in **Chapter 14: Transport and Access**. The requirements for additional mitigation are discussed within **Chapter 8: Ecology and Nature Conservation**
Residual effects and monitoring	The significance of residual effects is discussed and reported within **the Chapter 8: Ecology and Nature Conservation**.

OPERATIONAL PHASE

Table 5-13 – Traffic and Generator Emissions and Human Receptors: Assessment of Potential Effects, Additional Mitigation, Residual Effects and Monitoring During Operation

Sensitive receptor	Human receptors including residential, school and hospital premises.
Potential effects	Changes in vehicle movements over the local road network during operation will have negligible impacts on air quality at all existing receptors with differences in annual mean concentrations of all pollutants of less than 0.3µg/m^3 everywhere for NO_2, less than 0.2µg/m^3 for PM_{10} and less than 0.1µg/m^3 for $PM_{2.5}$. Future users of the Proposed Development will not be exposed to unacceptable air quality, with concentrations falling within APEC Band A (**Table 5-6**). Existing and future pollutant concentrations, without or with the Proposed Development, are within current legislated standards (**Table 5-9**). The impacts for the modelled year (2038) are summarised below (full results are presented in **Appendix 5-8**). The summary of impacts is presented below for NO_2 only as an appropriate indicator of road traffic impacts on air quality; maximum total concentrations with the Proposed Development are provided for all pollutants. Using the IAQM descriptors (**Table** 5-5), impacts on all assessed pollutants - NO_2, PM_{10}, $PM_{2.5}$ - are negligible. The modelled annual mean $PM_{2.5}$ concentrations exceed the WHO guideline limit of 10µg/m^3 in all years. The maximum impact of the Proposed Development is, however, less than 1% of this guideline.

Location	Summary of Impacts	Maximum Conc. With Development Operation (2038)		
		NO_2	**PM_{10}**	**$PM_{2.5}$**
Whipps Cross Road, south of James Lane	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 46): Baseline 2019: 30.0 µg/m^3 Without Dev. 2038: 18.8 µg/m^3 With Dev. 2038: 18.8 µg/m^3 Impact: 0.0 µg/m^3	18.8	18.0	11.8
James Lane	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 2): Baseline 2019: 34.3 µg/m^3 Without Dev. 2038: 21.4 µg/m^3 With Dev. 2038: 21.7 µg/m^3 Impact: 0.2 µg/m^3	22.6	19.9	13.1
Whipps Cross Road, north of James Lane	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 22): Baseline 2019: 31.7 µg/m^3 Without Dev. 2038: 20.3 µg/m^3 With Dev. 2038: 20.4 µg/m^3 Impact: 0.1 µg/m^3	20.4	18.7	12.2
Lea Bridge Road	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 7): Baseline 2019: 31.5 µg/m^3 Without Dev. 2038: 20.9 µg/m^3 With Dev. 2038: 20.9 µg/m^3 Impact: 0.0 µg/m^3	20.9	19.0	12.6

Woodford New Road	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 18): Baseline 2019: 32.4 µg/m^3 Without Dev. 2038: 24.6 µg/m^3 With Dev. 2038: 24.6 µg/m^3 Impact: 0.0 µg/m^3	19.4	18.2	11.9
Forest Road / North Circular	No affected receptors for health impacts			
Whipps Cross Hospital Site (new and refurbished)	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 24): Baseline 2019: 30.0 µg/m^3 Without Dev. 2038: 20.5 µg/m^3 With Dev. 2038: 20.6 µg/m^3 Impact: 0.1 µg/m^3	20.60	18.9	12.6
Around the Whipps Cross Hospital Site boundary	**Negligible** impact at all receptors All concentrations **within air quality objectives** **Typical NO_2 impact** (Receptor 44): Baseline 2019: 26.1 µg/m^3 Without Dev. 2038: 18.9 µg/m^3 With Dev. 2038: 18.9 µg/m^3 Impact: 0.0 µg/m^3	18.9	18.1	12.1

The Proposed Development includes 5 x 3MW$_e$ diesel generators for the provision of standby power generation. These generators will not be in routine use. **Appendix 5-5** sets out an assessment of the statistical likelihood that the testing and likely worst case operational use of the generators will result in exceedances of the objective for hourly mean NO_2. The conclusion of the assessment is that this risk is negligible. Given the limited operating hours for the generators, they will have no perceptible impact on annual mean pollutant concentrations.

The sensitivity of all of the receptors is high, but the magnitude of change is negligible. Therefore, there is likely to be a direct, permanent, long-term **negligible** effect (**not significant**) on all receptors.

Additional Mitigation

Whilst the assessment demonstrates negligible effect the following measures as set out in **Chapter 14: Transport and Access** will help to ensure minimal impacts from traffic emissions:

- A Travel Plan for residential occupants and the workplace;
- A Delivery and Servicing Management Plan; and
- A Car and Cycle Parking Management Plan.

Additional measures that should be implemented include:

- Measures to limit the potential impact of emissions from operation of hospital standby diesel generators by employing state of the art solutions where reasonably practicable to do so;
- Avoiding the testing hospital backup generator when moderate to very high pollution levels are forecast;
- Implementation of travel plans that are relevant to the intended occupants/users of the Proposed Development;
- Implementation of plans to ensure low/zero emissions from servicing and maintenance activities associated with the Proposed Development; and
- Provision of electrical charging points for plug-in hybrid and electric vehicles.

Residual effects and monitoring

The sensitivity of existing human receptors is considered to be high, but the magnitude of change to operational phase vehicle and combustion plant emissions without the need for secondary mitigation is negligible. Therefore, there is likely to be a **negligible** effect on receptors (**not significant**) without the need for secondary mitigation measures.

Table 5-14 – Traffic and generator emissions and ecological receptors: assessment of potential effects, additional mitigation, residual effects and monitoring during operation

Sensitive receptor	Epping Forest SAC/SSSI and Ancient Woodland.		
Potential effects	Changes in vehicle movements over the local road network during operation will have minor impacts on air quality within Epping Forest SAC/SSSI, but impacts decrease to negligible (<1% of any critical level or critical load) within 10m of the roadside. Similarly, over Ancient Woodland (AW) outside of the SAC/SSSI, impacts are minor adverse but decrease rapidly to negligible away from (15m) the roadside. The impacts for the modelled year (2023) are summarised below (full results are presented in **Appendix 5-9**).		
	Location	**Pollutant Concentrations (Nitrogen Oxides and Ammonia)**	**Pollutant Deposition (Nutrient Nitrogen and Acid)**
	Whipps Cross Road, south of James Lane	**Nitrogen Oxides:** Concentrations **exceed the critical level** without Development, but only at roadside Maximum impact: 0.13µg/m^3 (0.4% of critical level) Impacts are **negligible** **Ammonia:** Concentrations **exceed the critical level** without Development Maximum impact: 0.02µg/m^3 (2.0% of critical level) Impacts **exceed** 1% **10m into Site only**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** without Development Maximum impact: 0.16kgN/ha/yr (1.6% of critical load, woodland habitat) Impacts exceed **1% 10m into Site for woodland habitats and at site boundary only for heathland habitats** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** without Development Maximum impact: 0.01keq/ha/yr (0.7% of critical load, woodland habitat) Impacts are **negligible**
	James Lane	**Nitrogen Oxides:** Concentrations **exceed the critical level** without Development, but only to 30m from roadside Maximum impact: 0.88µg/m^3 (2.9% of critical level) Impacts **exceed 1% 15m into Site only** **Ammonia:** Concentrations **exceed the critical level** without Development Maximum impact: 0.03µg/m^3 (2.7% of critical level) Impacts **exceed** 1% **10m into Site only**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** without Development Maximum impact: 0.10kgN/ha/yr (1.0% of critical load, woodland habitat) Impacts are **1% at Site boundary only** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** without Development Maximum impact: 0.01keq/ha/yr (0.6% of critical load, woodland habitat) Impacts are **negligible**
	Whipps Cross Road, north of James Lane	**Nitrogen Oxides:** Concentrations **exceed the critical level** without Development, but only to 20m from roadside Maximum impact: 0.08µg/m^3 (0.3% of critical level) Impacts are **negligible** **Ammonia:** Concentrations exceed the critical level without Development Maximum impact:	**Nutrient Nitrogen:** Deposition **exceeds the critical load** without Development Maximum impact: 0.16kgN/ha/yr (1.6% of critical load, woodland habitat, AW only) Impacts exceed **1% at Site boundary only** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** without Development Maximum impact: 0.012keq/ha/yr (0.7% of critical load, woodland habitat)

		0.01µg/m^3 (1.3% of critical level) Impacts **exceed** 1% **at Site boundary only**	Impacts are **negligible**
	Lea Bridge Road	**Nitrogen Oxides:** Concentrations **exceed the critical level** without Development, but only to 50m from roadside Maximum impact: 0.08µg/m^3 (0.3% of critical level) Impacts are **negligible** **Ammonia:** Concentrations exceed the critical level without Development Maximum impact: 0.014µg/m^3 (1.4% of critical level) Impacts **exceed 1% at Site boundary only**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** without Development Maximum impact: 0.12kgN/ha/yr (1.2% of critical load, woodland habitat) Impacts **exceed 1% at Site boundary only** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** without Development Maximum impact: 0.008keq/ha/yr (0.5% of critical load, woodland habitat) Impacts are **negligible**
	Woodford New Road	**Nitrogen Oxides:** Concentrations **exceed the critical level** without Development, but only to 100m from roadside Maximum impact: 0.08µg/m^3 (0.2% of critical level) Impacts are **negligible** **Ammonia:** Concentrations exceed the critical level without Development Maximum impact: 0.01µg/m^3 (1.2% of critical level) Impacts **exceed 1% at Site boundary only**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** without Development Maximum impact: 0.10kgN/ha/yr (1.0% of critical load, woodland habitat) Impact is **1% at Site boundary only** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** without Development Maximum impact: 0.007keq/ha/yr (0.4% of critical load, woodland habitat) Impacts are **negligible**
	Forest Road	**Nitrogen Oxides:** Concentrations **exceed the critical level** without Development, but only to 40m from roadside Maximum impact: 0.01µg/m^3 (<0.02% of critical level) Impacts are **negligible** **Ammonia:** Concentrations exceed the critical level in the baseline and 2023 without Development Maximum impact: <0.002µg/m^3 (<0.2% of critical level) Impacts are **negligible**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** in the baseline and 2023 without Development Maximum impact: 0.007kgN/ha/yr (<0.7% of critical load, woodland habitat) Impacts are **negligible** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** in the baseline and 2023 without Development Maximum impact: 0.001keq/ha/yr (0.03% of critical load, woodland habitat) Impacts are **negligible**

	North Circular	**Nitrogen Oxides:** Concentrations **exceed the critical level** without Development, but only to 110m from roadside Maximum impact: 0.01µg/m^3 (<0.04% of critical level) Impacts are **negligible** **Ammonia:** Concentrations exceed the critical level in the baseline and 2023 without Development Maximum impact: <0.002µg/m^3 (<0.2% of critical level) Impacts are **negligible**	**Nutrient Nitrogen:** Deposition **exceeds the critical load** in the baseline and 2023 without Development Maximum impact: 0.015kgN/ha/yr (<0.15% of critical load, woodland habitat) Impacts are **negligible** **Acid Nitrogen Deposition:** Deposition **exceeds the critical load function** in the baseline and 2023 without Development Maximum impact: 0.001keq/ha/yr (0.06% of critical load, woodland habitat) Impacts are **negligible**
	Around the Whipps Cross Hospital Site boundary	No sites designated for nature conservation	
	The proposed hospital standby diesel generators will have no perceptible impact on annual mean pollutant concentrations or deposition on any of the nature conservation sites. The sensitivity of all of the ecological receptors is high. Prior to mitigation, the magnitude of change with the Proposed Development is, at most, small alongside some roadsides, decreasing to negligible within a maximum of 15m into any nature conservation site. These impacts will be permanent but decreasing over time. Effects are likely to be **negligible** alongside Lea Bridge Road, Woodford New Road, Forest Road and the North Circular Road. Alongside these roads, impacts are less than 1% of the relevant critical levels and critical loads everywhere within the nature conservation sites, and only marginally exceeds 1% of the critical level for ammonia and the critical load for nutrient nitrogen deposition at the roadside boundary of the nature conservation sites alongside Lea Bridge Road and Woodford New Road. The significance of any ecological effects alongside Whipps Cross Road and James Lane are discussed and reported within **Chapter 8: Ecology and Nature Conservation**		
Additional Mitigation	The requirements for additional mitigation are discussed within **Chapter 8: Ecology and Nature Conservation**		
Residual effects and monitoring	The significance of residual effects is discussed and reported within **the Chapter 8: Ecology and Nature Conservation**.		

Air Quality Neutral Assessment

5.6.1. **Table 5-15** and **Table 5-16** present the findings of air quality neutral assessments for Hybrid Planning Application 1 and Hybrid Planning Application 2 respectively. In both cases, the Proposed Development exceeds air quality neutral requirements, and includes, *inter alia* air quality positive elements within the design including zero emission heating, cooling and electrical power sources, and provision electric vehicle charge points. No additional mitigation is required.

Table 5-15 – Hybrid Planning Application 1: Air Quality Neutral Assessment

Element	Emissions or vehicle trips	Benchmarked emissions threshold, or TRAVL trip rate	Difference	Air quality neutral?
Building emissions	NO_x: 2,582.5 kg/year PM_{10}: 507.5 kg/year (for calculation details see **Appendix 5-5**)	NO_x: 5,823 kg/year PM_{10}: 507 kg/year	NO_x: **-3,240** kg/year PM_{10}: **-395.5** kg/year	**Yes**
Transport emissions	C2: 15.8 trips/m^2/year D1: 32 trips/m^2/year	C2: 19.5 trips/m^2/year D1: 46.1 trips/m^2/year	C2: **-3.7** trips/m^2/year D1: **-14.1** trips/m^2/year	**Yes**

Table 5-16 – Hybrid Planning Application 2: Air Quality Neutral Assessment

Element	Emissions or vehicle trips	Benchmarked emissions threshold, or TRAVL trip rate	Difference	Air quality neutral?
Building emissions	Not applicable (on-site zero emissions sources for heating, cooling and electrical power)	Not applicable	Not applicable	Not applicable
Transport emissions	NO_x: 1,009.1 kg/year PM_{10}: 173.2 kg/year	NO_x: 2,329.5 kg/year PM_{10}: 400.5 kg/year	NO_x: **-1,320.4** kg/year PM_{10}: **-227.3** kg/year	**Yes**

5.7. OPPORTUNITIES FOR ENVIRONMENTAL ENHANCEMENT

5.7.1. Potential opportunities for enhancing the environment in terms of local air quality include planting to provide 'green screens' separating roadways and buildings/cycle/pedestrian routes.

5.8. DIFFICULTIES AND UNCERTAINTIES

5.8.1. The assessment of construction phase impacts relies upon the information that is available before the appointment of a Principal Contractor. Assumptions are therefore necessary concerning demolition and construction activities and vehicle movements. Acknowledging the inherent uncertainty in such an assessment, the approach used therefore assumes a degree of caution to ensure a reasonably robust assessment.

5.8.2. The dispersion model software used in this assessment simulates complex real-world processes in necessarily simplified terms and as such there will always be some uncertainty in the predictions. This is minimised as far as possible by the software developer regularly upgrading and testing (validating) model algorithms to improve predictive ability. Additionally, dispersion modelling relies on input data that are generated by actual measurement or modelling with some degree of inherent uncertainty.

5.8.3. For the modelling with ADMS-Roads, to minimise the degree of uncertainty as far as possible, base year model predictions have been verified against roadside monitoring data, with adjustment to compensate for systematic under-estimation of pollutant concentrations. This process can never eliminate uncertainty entirely from subsequent adjusted model predictions but does ensure that the assessment undertaken is as robust as possible.

5.8.4. The current set of Defra vehicle emissions factors (**Ref. 5.16**) used in this assessment do not forecast emissions beyond 2030 and do not account for the potential impact of the London ULEZ expansion (from 25 October 2021), out to the North Circular road. The impacts that are reported in this chapter for 2023 and 2038 therefore don't account for any improvements in local air quality that would occur with the imminent ULEZ expansion and after 2030. In this respect, the air quality assessment is conservative.

5.8.5. The assessment of NH_3 emissions from vehicles is the subject of ongoing research. As a result, this assessment has adopted a conservative approach and has used the CREAM emissions tool. Vehicle emission factors within CREAM exceed - by a considerable margin - equivalent factors in the UK's National Atmospheric Emissions Inventory (**Ref. 5.41**).

5.8.6. NH_3 is not released by the combustion of fuel but arises as a by-product of the emissions reduction systems required to meet standards for emissions of NO_x. Traffic-related emissions are dominated by petrol and hybrid vehicles and, to a lesser extent, heavy goods vehicles.

5.8.7. The CREAM tool is based on published remote sensing data and fuel consumption data (**Ref 5.40**). However, whilst monitored average NH_3 emissions from petrol vehicles have decreased over time, CREAM does not make allowance for this improvement. Rather it assumes that future petrol and hybrid cars will have the same emissions as the average vehicles in these classes in 2015. The rationale for this is that there is some evidence that emissions increase with vehicle age. However, assuming no improvement over time from these vehicles is, on the basis of available data, conservative. As such, the assessment of impacts from NH_3, and its contribution to nitrogen and acid deposition, is also likely to be conservative and tending to overestimate impacts.

5.8.8. Background deposition and NH_3 concentrations were obtained from the JNCC's APIS (**Ref. 5.12**). APIS does not provide future projections of background concentration and deposition. To assume no improvement over time is overly conservative. As noted in the methodology (see **Appendix 5-4**), the Joint Nature Conservation Council produced a report (**Ref. 5.1**) setting out multiple scenarios for future emissions of nitrogen compounds. The projection of concentrations and deposition levels has been based on the JNCC's 'Business as Usual' scenario. This is the most conservative scenario, and it takes no account of potential actions that will be required if the UK is to meet its statutory emissions targets for NH_3. The approach taken for this assessment is therefore conservative and results in a slight increasing trend in background NH_3 concentrations. This adds to the conservatism of the overall assessment of impacts on ecological receptors.

5.9. SUMMARY

5.9.1. **Table 5-17** provides a summary of the findings of the assessment in relation to human receptors during all phases of the Proposed Development, and for ecological receptors in relation to construction works. The corresponding summary for air quality impacts on ecological receptors in relation to changes to emissions from traffic during construction and operation is set out in **Chapter 8: Ecology and Nature Conservation** provides a summary of the findings of the assessment.

Table 5-17 – Summary of Air Quality Effects

Receptor	Potential Effects	Additional Mitigation	Residual Effects	Monitoring
Construction Phase				
Human receptors Ecological receptors (dust impacts only)	Potential impacts arise from dust and particulate emissions from construction works (demolition, earthworks, construction, and track out of dirt from Site onto road network) and increased exposure to pollution at the roadside due to construction traffic emissions. Without mitigation there are high risks of adverse dust soiling and PM_{10} affecting people, property and people and property, and sensitive habitats and plant communities at ecological site. The potential effects at human receptors due traffic emissions are **negligible** (**not significant**).	Mitigation, based on best practice dust reduction measures and a traffic management plan, is included within the proposals. To minimise the potential local air quality impacts, construction vehicles are to be managed in accordance with a CEMP and Construction Logistics Plan, as referred to in **Chapter 2: Description of Proposed Development**. In addition, there would be a Construction Workforce Travel Plan, as referred to in **Chapter 14: Transport and Access**.	Dust and particulate emissions (human and ecological receptors): **Minor adverse (not significant)** **T / D / MT** Traffic emissions (human receptors): **Negligible (not significant)** **T / D / MT**	Monitoring of PM_{10} will be required throughout the construction phase. This will be the responsibility of the appointed contractor and secured via planning condition.
Operational Phase				
Human receptors	Potential impacts arise from increased exposure to pollution at the roadside due to development-related traffic, and from short-term exposure to emissions from Hospital standby diesel generator testing. The potential effects at human receptors are **negligible** (**not significant**).	No additional measures are necessary Whilst the assessment demonstrates negligible effect the following measures as set out in **Chapter 14: Transport and Access** will help to ensure minimal impacts from traffic emissions: ▪ A Travel Plan for residential occupants and the workplace; ▪ A Delivery and Servicing Management Plan; and ▪ A Car and Cycle Parking Management Plan. ▪ Additional measures that should be implemented include: ▪ Measures to limit the potential impact of emissions from operation of hospital standby diesel generators by employing state of the art solutions where reasonably practicable to do so; ▪ Avoiding the testing hospital backup generator when moderate to very high pollution levels are forecast; ▪ Implementation of travel plans that are relevant to the intended occupants/users of the Proposed Development; ▪ Implementation of plans to ensure low/zero emissions from servicing and maintenance activities associated with the Proposed Development; and	**Negligible (not significant)** **P / D / LT**	No monitoring is necessary for the operational phase

Receptor	Potential Effects	Additional Mitigation	Residual Effects	Monitoring
		▪ Provision of electrical charging points for plug-in hybrid and electric vehicles.		

Key to table:

P / T = Permanent or Temporary, D / I = Direct or Indirect, ST / MT / LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

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Legend

- Hybrid Planning Application 1: Site
- Hybrid Planning Application 2: Site
- Hybrid Planning Application 1: Study Area for Construction Dust Impacts
- Hybrid Planning Application 2: Study Area for Construction Dust Impacts
- Potential Extent of Trackout Dust Impacts on Public Highway

Revision Details	By / Check	Date	Suffix

Drawing Status
FINAL

Job Title
BARTS HEALTH NHS TRUST
WHIPPS CROSS HOSPITAL
WHIPPS CROSS ROAD,
LEYTONSTONE, LONDON

Drawing Title
STUDY AREA FOR CONSTRUCTION DUST IMPACTS

Scale at A3

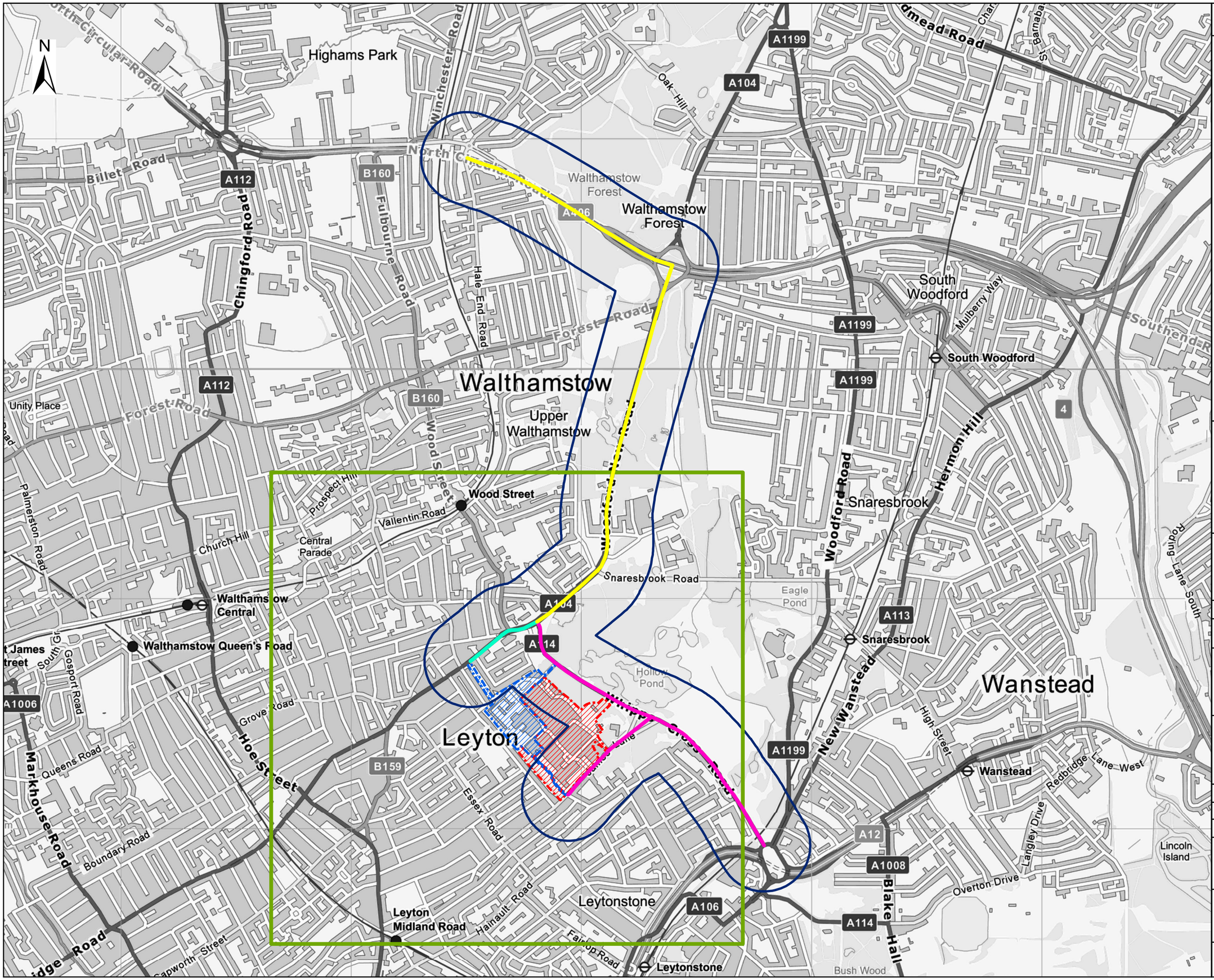
Drawn ukact002

Stage 1 check	Stage 2 check	Originated	Date
UKACT002	-	-	28/04/2021

0 100 200
Metres

wsp

Drawing Number
FIGURE 5-1



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED

Legend

- Hybrid Planning Application 1: Site
- Hybrid Planning Application 2: Site
- Study Area for Local Air Quality Impacts: Traffic Emissions
- Study Area for Local Air Quality Impacts: Hospital Standby Generator Emissions
- Change >50 AADT, 2023 (peak construction) only
- Change >50 AADT, 2038 only
- Change >50 AADT, 2023 and 2038

Revision Details	By / Check	Date	Suffix

Drawing Status: FINAL

Job Title: BARTS HEALTH NHS TRUST WHIPPS CROSS HOSPITAL WHIPPS CROSS ROAD, LEYTONSTONE, LONDON

Drawing Title: STUDY AREA FOR LOCAL AIR QUALITY IMPACTS

Scale at A3

Drawn: ukact002

Stage 1 check	Stage 2 check	Originated	Date
UKACT002	-	-	28/04/2021

0 0.25 0.5
Kilometers

wsp

Drawing Number: FIGURE 5-2