14. Air Quality and Dust

14.1 Introduction

14.1.1 This Chapter, which has been prepared by Waterman, provides further information with regards to the potential impacts to air quality, including dust, arising from the Scheme with Phase 1B (North) in place (and having regard also to the detailed design previously approved in relation to Phase 1A (North)). The Chapter is provided pursuant to the s73 ES and other EIA Documentation (as defined in **Chapter 4: Approach to the ES Further Information Report**) in light of the further detailed design information now available in respect of Phase 1B (North), and confirms whether the findings of the s73 ES and other EIA Documentation with respect to the likely significant effects, mitigation and residual impacts in relation to air quality and dust, remain valid.

14.1.2 A review of relevant policy, legislation and guidance published since preparation of the s73 ES and other EIA Documentation has been carried out. A review of the detailed design for Phase 1B (North), as defined in **Chapter 2: Description of Phase 1B (North) RMA**, has then been undertaken, to identify elements of the Phase 1B (North) RMA of relevance to the air quality assessment.

14.1.3 The approach to the further information is set out, along with a summary of recent consultation undertaken in relation to the Phase 1B (North) RMA. A review of the baseline information presented in the s73 ES and other EIA Documentation has been undertaken to confirm where this remains valid, and updated data is presented where relevant. Any new or different potential air quality impacts arising as a result of the Phase 1B (North) RMA from those identified in the s73 ES and other EIA Documentation are described. Likewise, any new or different mitigation measures from those identified in the s73 ES and other EIA Documentation are presented where considered necessary, and residual impacts following the application of mitigation are described.

14.1.4 This Chapter is supported by appendices containing details of the air quality monitoring survey carried out by Waterman for the years 2015 and 2016; the methodology used in the air quality assessment; the air quality modelling results; and the bus station design. These are as follows:

- **Appendix 14.1: Air Quality Monitoring Survey**;
- **Appendix 14.2: Air Quality Modelling Study**;
- **Appendix 14.3: Air Quality Modelling Results**; and
- **Appendix 14.4: Air Quality Design Report**.

14.2 Legislation, Planning Policy and Guidance

14.2.1 There have been no significant changes to air quality related legislation since the s73 ES and other EIA Documentation were prepared which would have a material effect on the approach to, or findings of, the assessment. As such, no new legislation is presented beyond that included in the s73 ES and other EIA Documentation.

14.2.2 There have been no significant changes to policy since the s73 ES and other EIA Documentation was prepared which have a material effect on the approach to or finding of the assessment. A review of material published or amended since the previous assessment is set out below for reference.

National Planning Policy

Improving Air Quality in the UK: Tackling Nitrogen Dioxide in our Towns and Cities - UK Overview Document

14.2.3 Defra adopted the 'Improving Air Quality in the UK: Tackling Nitrogen Dioxide in our Towns and Cities UK Overview Document' in January 2016[i], which sets out the plan to improve air quality in the UK by reducing NO_2 emissions in towns and cities as part of the UK's commitment for cleaner air. The air quality improvement plan sets out targeted local, regional and national measures in order to meet the UK's legal obligations to achieve the NO_2 limit values set out in the EU Framework Directive 2008/50/EC. There are 18 specific measures for the London Borough of Barnet (LBB); measures relevant to the Development include:

- Measure 4: Improve traffic flow in town centres by improved coordination of traffic lights;
- Measure 5: Improve traffic flow in general;
- Measure 10: Promote public transport;
- Measure 11: Promote design that reduces the need for travel;
- Measure 13: Encourage cleaner energy sources for buildings;
- Measure 14: Encourage more efficient energy generation and use;
- Measure 15: Promote good design and location of new development;
- Measure 17: Control air pollution from industrial / commercial and residential sources; and
- Measure 18: Monitor air quality.

14.2.4 The above measures have been considered and taken account within the design and operation of the Development. Further details are provided in the Mitigation Section of this Chapter.

14.2.5 A recent High Court ruling (November, 2016) in relation to the ClientEarth case[ii] regarding the UK's continued breach of legal air quality limits, has resulted in the Government being ordered to revise the air quality improvement plan to meet compliance for NO_2 in the UK. On the 7th December 2016, the UK Government confirmed that a revised air quality improvement plan would be in consultation by 24th April 2017 and a final plan adopted by 31st July 2017. To date this revised air quality improvement plan is not available and as such has not been considered further within this Chapter.

Regional Planning Policy

A City For All Londoners, 2016

14.2.6 The Mayor of London's 'A City For All Londoners'[iii] document outlines the challenges and opportunities across priority policy areas in London, as well as the changes that City Hall wants to deliver over the next four years to improve air quality. The Mayor is committed to reducing and improving air quality through the design of 'Healthy Streets'. Such measures detailed include:

- Introducing an emissions surcharge (or 'Toxicity Charge') in 2017 for high-polluting older vehicles in central London;
- Introducing a Central-London Ultra-Low Emission Zone (ULEZ) in 2019 and potentially enlarging the area it covers, up to the North and South Circular Roads for all vehicles and London wide for the most polluting heavy vehicles. The new ULEZ would incorporate the J1/M1;

- Replace diesel buses with green buses (hybrid or zero emission); this includes a retrofit scheme of 3,000 buses outside central London by 2020;
- All buses in central London to be 'Euro 6' hybrid by 2019;
- All new buildings in London to be air quality positive to include reducing emissions and associated exposure;
- Planting trees on a busy road to provide a buffer between pedestrians and traffic, as well as absorbing pollutants to improve air quality; and
- Increase the use of cycling and walking.

14.2.7 The above measures have been considered and taken account within the design and operation of the Development. Further details are provided in the Mitigation Section of this Chapter.

Mayor of London's Supplementary Planning Guides: Sustainable Design and Construction, 2014

14.2.8 The Sustainable Design and Construction Supplementary Planning Guidance[iv] (SPG) provides guidance to support the implementation of the London Plan. Although referenced briefly in the Phase 1A (North) FIR, additional detail on this SPG is provided below following consultation with LBB, who requested the report be written in accordance with this guidance (a copy of the LBB consultation response is presented in **Appendix 14.2: Air Quality Modelling Study**).

14.2.9 Section 4.3 of the SPG focuses on air pollution and the effects from the construction and operation of new developments to ensure that they are 'air quality neutral'. Emission benchmarks are provided within the SPG for:

- Emissions from buildings; and
- Transport emissions.

14.2.10 Section 4.3.17 and Appendix 5 of the SPG note that two sets of Building Emission Benchmarks (BEBs) have been defined for a series of land-use classes, one for NO_x (nitrogen oxides) and one for PM_{10}. Section 4.3.18 and Appendix 6 of the SPG note that the design of a development should encourage and facilitate walking, cycling and the use of public transport, thereby minimising the generation of air pollutants (these measures are consistent with those discussed within the mitigation section of this Chapter).

14.2.11 An Air Quality Neutral Assessment has not been undertaken for this reserved matters application as the make and model of the boilers and Combined Heat and Power units to be used in the energy centre have not been identified and are indicative at this stage. In addition, an assessment of transport emissions cannot be completed at this stage as the trip generation considered in this assessment relates to the entire redevelopment (including the southern land parcels which are in outline and subject to further detail as part of the respective Reserved Matters Application) and not Phase 1B in isolation. It is considered that an appropriately worded planning condition is provided by LBB associated with the granting of planning permission requesting that an Air Quality Neutral Assessment is completed prior to the operation of the Development, to ensure that the Development is Air Quality Neutral and that appropriate mitigation measures have been provided.

Guidance

14.2.12 Based on the methodology for this air quality assessment as agreed with LBB (see **Appendix 14.2: Air Quality Modelling Study**), there have been no significant changes to relevant guidance since the s73 ES and other EIA Documentation were prepared which have a material effect on the approach to or findings of the assessment. A review of material published or amended since the previous assessment is set out below for reference.

Environmental Protection UK & Institute of Air Quality Management Guidance; Land-Use Planning & Development Control: Planning for Air Quality, 2017

14.2.13 The Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) Guidance[v] provides a framework for air quality considerations within local development control processes, promoting a consistent approach to the treatment of air quality issues.

14.2.14 The guidance explains how development proposals can adopt good design principles to reduce emissions and contribute to better air quality. The guidance also provides a method for screening the need for an air quality assessment and a consistent approach for describing the impacts at individual receptors.

14.2.15 The EPUK and IAQM Guidance, advises that:

"… In arriving at a decision about a specific proposed development, the local planning authority is required to achieve a balance between economic, social and environmental considerations. For this reason, appropriate consideration of issues such as air quality, noise and visual amenity is necessary. In terms of air quality, particular attention should be paid to:

- *Compliance with national air quality objectives and of EU Limit Values;*
- *Whether the development will materially affect any air quality action plan or strategy;*
- *The overall degradation (or improvement) in local air quality; or*
- *Whether the development will introduce new public exposure into an area of existing poor air quality….".*

14.2.16 Whilst the EPUK and IAQM Guidance provides updated significance criteria that can be used to determine the impacts of a development, in order to allow a direct comparison of the impact of the Development against those previously identified for the s73 ES and other EIA Documentation, the EPUK Guidance[vi] significance criteria have been used. This approach was agreed with the EHO at LBB (see **Appendix 14.2: Air Quality Modelling Study)**.

Local Air Quality Management Policy Guidance (PG16), 2016

14.2.17 The Local Air Quality Management Policy Guidance LAQM (PG16)[vii] provides additional guidance on the links between transport and air quality. LAQM (PG16) describes how road transport contributes to local air pollution and how transport measures may bring improvements in air quality. Key transport-related Government initiatives are set out, including regulatory measures and standards to reduce vehicle emissions and improve fuels, tax-based measures and the development of an integrated transport strategy.

14.2.18 LAQM (PG16) also provides guidance on the links between air quality and the land use planning system. The guidance advises that air quality considerations should be integrated within the planning process at the earliest stage, and is intended to aid local authorities in developing action plans to deal with specific air quality issues and create strategies to improve air quality. LAQM (PG16) summarises the means in which the land use planning system can help deliver compliance with the air quality objectives.

Low Emission Neighbourhoods, 2016

14.2.19 The Mayor of London along with Transport for London (TfL) have produced a Low Emission Neighbourhood (LEN) Plan[viii] for the five most polluted neighbourhoods (across eight boroughs) in London. These areas include:

- Westminster - Marylebone LEN;

- Hackney, Islington and Tower Hamlets - City Fringe LEN;
- City of London - Barbican LEN;
- Greenwich - Town Centre and Trafalgar Road LEN; and
- Redbridge and Newham - Ilford Garden Junction LEN.

14.2.20 A LEN is an area-based scheme that includes a package of measures focused on reducing emissions (and promoting sustainable living more generally). The main objectives of the LEN include:

- Reduced transport emissions, leading to improved air quality and climate change mitigation, and reduced negative impacts on health;
- Increased human physical activity and health, through encouragement of more walking and cycling;
- Reduced road traffic causalities through overall reduction in vehicle kilometres and alterations to traffic management; and
- More efficient use of limited road space, urban regeneration and improved local economy.

14.2.21 Whilst LBB and London Borough of Brent (LB Brent) are not identified as an LEN, air quality mitigation detailed in this Chapter (see subheading 'Mitigation') have, however, been considered in accordance with the London LEN Guidance.

Barnet Air Quality Action Plan, 2016

14.2.22 Following the declaration of the borough-wide AQMA in 2001, LBB published an initial Air Quality Action Plan (AQAP) in January 2003 and issued an updated AQAP in 2016, setting out actions for reducing air pollution under the following six broad topics:

- Emissions from developments and buildings;
- Public health and raising awareness of causes of pollution;
- Delivery servicing and freight;
- Borough fleet actions;
- Localised solutions; and
- Cleaner transport.

14.2.23 The AQAP recognises that there are a large number of air quality policy areas that are outside of the Council's influence (such as Euro standards, national vehicle taxation policy, taxis and buses) which are likely to result in significant improvements in air quality. The AQAP states that LBB will continue to work with and scope to lobby regional and central government on policies and issues beyond LBB's influence.

14.2.24 As part of the AQAP LBB wishes for all vehicles to meet the Euro 6 standard by 2020/2023. However, as above, it is recognised that part of this aspiration is outside of the Council's influence and requires Government incentive (such as a scrappage scheme).

14.2.25 The measures detailed in the AQAP have been considered and taken account within the design and operation of the Development. Further details are provided in the Mitigation Section of this Chapter.

14.3 Relevant Phase 1B (North) RMA Details

14.3.1 Details of the Phase 1B (North) RMA of relevance to air quality are identified as follows:

- **Phase 1B (North) (Infrastructure):** replacement Brent Cross Bus Station.
- **Phase 1B (North) (Open Spaces / Public Realm / Threshold Spaces):**
  - Those new areas of Public Realm and Open Space to be provided as part of Phase 1B (North). These include Brent Cross Main Square, High Street North and Threshold Spaces including - Fenwick Place, Tempelhof Circus and Layfield Place.
  - The Eastern Brent Riverside Park and Western Brent Riverside Park to be provided adjacent to the realigned River Brent together with the River Brent Nature Park 4, and a riverside walkway adjacent to the realigned River Brent.
  - Sturgess Park to be retained and enhanced including new formal play facilities, seating areas, gardens, informal sports provision and nature areas.
- **Phase 1B (North) (Development Plots):** those development plots to the south, west and east of the existing Brent Cross Shopping Centre, around High Street North and Brent Cross Main Square and containing a mix of uses including retail, leisure, food and beverage, hotel, and community floorspace, in addition to an energy centre, residential development on Plot 113 and multi-storey car parks

14.3.2 In addition to the above scheme details, as discussed in the Introduction to this Chapter, the ICP and CIA have been updated to reflect changes to the Phase 1 North construction programme.

14.4 Assessment Methodology

14.4.1 The methodology used for this air quality assessment remains as that used for the Phase 1A (North) RMA, which, following consultation with LBB (see **Appendix 14.2: Air Quality Modelling Study**) is considered appropriate and valid. The air quality assessment does not remodel the 2012 baseline or Scenario 1 (2031 End State 'Do Nothing' scenario) as no changes have been made to the traffic flows in these scenarios and the data remains as that considered in the s73 ES and other EIA Documentation. Scenario 2 (2031 End State 'Do Something' scenario) has been remodelled to take account of the locations of future air quality sensitive exposure within Phase 1B (North), and to include a transport sensitivity analysis associated with an increase in the amount of retail floor space proposed within the New Town Centre, as detailed in **Chapter 2.** As a result of the detailed design information now available for Phase 1B (North), the air quality assessment:

- Assesses the future ambient air quality concentrations at locations of future sensitive exposure within Phase 1B (North). This includes areas of residential use (such as Plot 113 where detailed design is now provided), public open space and the proposed hotel; and
- Assesses the potential air quality impact associated with the emissions from the replacement bus station, the bus station ventilation ducts and the energy centre introduced as part of Phase 1B (North).

Baseline Conditions

Nitrogen Dioxide (NO_2)

14.4.2 As part of the preparation of the Phase 1A (North) FIR, a site-specific NO_2 monitoring survey to supplement the NO_2 monitoring data available from the local authorities' air quality network was carried out. Suitable diffusion tube monitoring locations were selected based on proposed works

and sensitive receptor locations, and were agreed with the Environmental Health Officer (EHO) at LBB (see **Figure 14.1**). Monitoring commenced end of August 2014 and is on-going (to date). Whilst the baseline data used in this assessment remains as per the s73 ES and other EIA Documentation, the latest full year of monitoring data (for the years 2015 and 2016) have been considered in order to determine if the baseline conditions remain appropriate.

14.4.3 In addition to the site specific NO_2 monitoring, updated automatic monitoring data was also obtained from LBB and LB Brent air quality data online.

14.4.4 Further details are provided in Section 14.6: Baseline Conditions.

Particulate Matter (PM_{10} and $PM_{2.5}$)

14.4.5 Whilst the baseline data used in this assessment remains as per the s73 ES and other EIA Documentation, the latest particulates monitoring data from LBB and LB Brent have been considered in order to determine if the baseline conditions remain appropriate. To date, no site specific particulate monitoring has been undertaken.

14.4.6 Further details are provided in Section 14.6: Baseline Conditions.

Demolition and Construction Assessment

14.4.7 The Indicative Construction Programme (ICP) and Construction Impact Assessment Addendum (CIA) have been updated to reflect changes to the Phase 1 North construction programme, details of which are provided within **Chapter 2** and **Appendix 2.1: Construction Impact Assessment (CIA) Addendum Technical Note**. These changes to the programme have been considered in order to determine if there are any changes to the potential air quality impacts from those detailed in the s73 ES and other EIA Documentation.

Demolition and Construction Dust Emissions

14.4.8 A qualitative review has been undertaken to determine the potential impact of the updated ICP and CIA on demolition and construction dust emissions from the previous conclusions set out in the s73 ES and other EIA Documentation. The qualitative review is based on professional judgement using the Mayor of London's Construction Guidance[ix].

Demolition and Construction Vehicle Emissions

14.4.9 A qualitative review has been undertaken to determine the potential impact of the updated ICP and CIA on demolition and construction vehicle emissions from the previous conclusions set out in the s73 ES and other EIA Documentation. The qualitative review is based on the criteria detailed in the Design Manual for Road and Bridges[x].

Demolition and Construction Plant Emissions

14.4.10 Since the preparation of the s73 ES and EIA Documentation, all construction plant (described as non-road mobile machinery (NRMM)) are required to meet the emission standards as set out in the London Plan. Details of the NRMM used during demolition and construction would be uploaded and registered to the NRMM website prior to use, and details on the plant, emission standards and emission control measures would be made available to LBB once these details are known and prior to the plant being used during the demolition and construction phase. Based on this control measure, it is considered that an assessment of demolition and construction plant emissions is not required and this has not been considered further.

Operational Development Assessment

14.4.11 Full details of the methodology followed to assess the impact of the Phase 1B (North) RMA on air quality once completed are provided in **Appendix 14.2: Air Quality Modelling Study**, including presentation of input data, assumptions, and model verification. The methodology for the air quality assessment is consistent with that of the s73 ES and other EIA Documentation (specifically the Phase 1A (North) FIR). This section provides a brief summary of this methodology.

Air Quality Dispersion Models

14.4.12 The potential impacts of road traffic emissions for the Development, i.e. the Scheme with Phase 1A (North) and Phase 1B (North) in place, have been modelled using the atmospheric dispersion model ADMS-Roads™. This methodology remains consistent with the Phase 1A (North) FIR and approved for the s73 ES and other EIA Documentation, and is considered appropriate and valid.

14.4.13 The project transport consultants' (AECOM) transport model (BXC DDM) was used, and the traffic data from this model was used for the assessment of the road infrastructure associated with the entire Scheme (as detailed in the Phase 1A (North) FIR).

14.4.14 The air quality assessment includes modelling of the following three scenarios:

- Baseline: 2012;
- Scenario 1: 2031 End State 'Do Minimum' scenario (i.e. Without Development); and
- Scenario 2: 2031 End State 'Do Something' (i.e. With Development) scenario.

14.4.15 The air quality assessment does not remodel the 2012 Baseline or Scenario 1 (2031 End State 'Do Nothing' scenario) as no changes have been made to the traffic flows in these scenarios and the data remains as that considered in the s73 ES and other EIA Documentation. Scenario 2 (2031 End State 'Do Something' scenario) has been remodelled to take account of the locations of future air quality sensitive exposure within Phase 1B (North) and to include a transport sensitivity analysis of the proposed increase in the amount of retail floorspace associated with Brent Cross East (BXE) over and above the threshold approved by the 2014 Permission, for which further details have been provided in **Chapter 2: Description of Phase 1B (North) RMA**.

14.4.16 The potential impacts of emissions from the replacement bus station within Phase 1B (North) have been considered and assessed in ADMS-Roads. Data relating to the number of bus trips and idling times have been provided by the project transport consultants AECOM. A baseline year of 2016 has been modelled with the existing bus station conditions to be consistent with the latest year of available monitoring data at the bus station. These data have been used to undertake a specific model verification, in accordance with LAQM.TG(09)[xi]. The replacement bus station has been modelled in Scenario 2 (2031 End State 'Do Something' scenario).

14.4.17 The emissions from the energy centre located in Plot 101 and the bus station ventilation ducts, in Phase 1B (North), have been considered and assessed using the atmospheric dispersion model, ADMS 5. Details on the proposed plant and stack characteristics for the energy centre and the bus station ventilation ducts have been provided by Hilson Moran and are presented in **Appendix 14.2: Air Quality Modelling Study.**

NO_2 Sensitivity Analysis

14.4.18 Analyses of historical monitoring data by Defra[xii] have identified a disparity between actual measured NO_x and NO_2 concentrations and the expected decline (improvement) associated with emission forecasts, which form the basis of the air quality modelling. The reason is thought to be

related to the on-road performance of certain vehicles compared to calculations based on Euro emission standards, which inform emission forecasts.

14.4.19 A note 'Projecting NO_2 Concentrations'[xiii] published by Defra in 2012 provides a number of alternative approaches that can be followed in air quality assessments, in relation to the modelling of future NO_2 concentrations, considering that future NO_x / NO_2 road-traffic emissions and background concentrations may not reduce as previously expected. This includes the use of revised background pollution maps, alternative projection factors and revised vehicle emission factors. It is important to note that the Defra note does not form part of statutory guidance and no prescriptive method is recommended for use in an air quality assessment.

14.4.20 As per the s73 ES and other EIA Documentation (specifically as detailed in the air quality assessment for the Phase 1A (North) FIR) this air quality assessment has been based on current guidance from Defra, i.e. using existing forecast emission rates and background concentrations to the completion year of 2031, which assume a progressive reduction compared to the baseline year 2012. A sensitivity analysis has also been undertaken, assuming no reductions in NO_x and NO_2 levels between 2012 and 2031. The sensitivity approach presented in this air quality assessment was used in the Phase 1A (North) FIR and was deemed acceptable as it provides a clear method to account for the uncertainty in future NO_x and NO_2 concentrations in air quality assessments.

14.4.21 It is important to note that the sensitivity test is likely to be overly conservative. This is especially the case for this assessment, given the long period of time between the baseline scenario (2012) and future scenarios (2031). Even if NO_x and NO_2 do not reduce as currently expected by the latest tools and guidance, it is very unlikely that NO_2 background and NOx vehicle emissions will be the same in 2031 as they are now when taking account of the recent High Court Ruling and the need to improve NO_2 concentrations in the shortest timescale possible. In particular, for the Brent Cross area, the Mayor of London is implementing measures to improve air quality in the shortest timescale possible, such measures are discussed in section 14.2 and include replacing and retrofitting the bus fleet; employing a toxicity charge; and establishing an ULEZ for the North and South Circular. The results of the sensitivity analysis are based on the latest tools available and are conservative, however, the results should be treated with caution in terms of their reality in 2031.

14.4.22 The results of this sensitivity analysis, which represents a conservative assessment scenario, are presented in **Appendix 14.3: Air Quality Modelling Results**.

Background Pollutant Concentrations

14.4.23 Background pollutant concentrations have been added to the modelled contribution of road traffic, bus station (including the bus station ventilation ducts) and energy centre emissions, to estimate the overall pollutant concentration. Given that the traffic data and assessment years remain as assessed in the Phase 1A (North) FIR, the background pollutant concentrations have not been updated and remain the same as those presented in the s73 ES and other EIA Documentation. Details of the background concentrations used in the air quality assessment are provided in **Appendix 14.2: Air Quality Modelling Study**.

Model Verification

14.4.24 Model verification is the process of comparing monitored and modelled pollutant concentrations and, if necessary, adjusting the modelled results to reflect actual measured concentrations, in order to improve the accuracy of the modelling results. The ADMS-Road model for the Phase 1A (North) Infrastructure within the overall Scheme was previously verified by comparing the predicted annual mean NO_2 concentrations for the baseline year of 2012, with the results of the diffusion

tube (NO_2) monitoring study; details of which are presented in **Appendix 14.1: Air Quality Monitoring Survey**. Roadside modelled concentrations were then adjusted accordingly. As above, given that the traffic data and assessment remains as considered previously, the verification and adjustment process for the road traffic emissions has not been updated. Details of the model verification are provided in **Appendix 14.2: Air Quality Modelling Study**.

14.4.25 To be consistent with the methodology detailed in the s73 ES and other EIA Documentation, a separate model verification has been undertaken using LAQM.TG(09) for the modelled existing and proposed bus station, based on the results from the site-specific diffusion tubes located outside of the existing Brent Cross bus station. Details of the monitoring data are presented in **Appendix 14.1: Air Quality Monitoring Survey** and details of the model verification are provided in **Appendix 14.2: Air Quality Modelling Study**.

Potentially Sensitive Receptors

14.4.26 Air pollutant concentrations have been modelled at existing sensitive receptors (façade of existing residential properties and other sensitive land use such as schools) along the affected road network (see **Figure 14.2**), to determine the change in air quality (increase or decrease in air pollutant concentrations) following completion of Phase 1B (North). These receptors are consistent with those detailed in the s73 ES and other EIA Documentation, including the Phase 1A (North) FIR. Proposed residential properties, as detailed in the RMAs (as Plots 53 and 54 for Phase 1A (North) and Plot 113 for Phase 1B (North)) along with other proposed sensitive uses (such as the proposed hotel and areas of public open space) have also been considered in order to determine those concentrations future users are likely to be exposed to.

14.4.27 In addition to the above, in order to quantify the impact of the energy centre a 3km by 3km grid, centred on the energy centre (National Grid Reference 523098, 187680) has been modelled and the results displayed in **Figure 14.3**.

Significance Criteria

14.4.28 As discussed above, the significance criteria remain the same as that considered in the s73 ES and other EIA Documentation.

Limitations and Constraints

14.4.29 The air quality assessment in relation to the Phase 1B (North) RMA has been undertaken following the same methodology and modelled inputs as detailed in the s73 ES and other EIA Documentation (in particular as detailed in Chapter 14 of the Phase 1A (North) FIR) and is based on an urban redevelopment as per the Town and Country Planning Act (1990). Whilst other air quality methodologies may exist, given the previous methodology for the s73 ES and other EIA Documentation was deemed acceptable, it is considered that the same assessment approach is appropriate. The approach to the air quality assessment has been discussed and agreed with LBB (see **Appendix 14.2: Air Quality Modelling Study**).

14.4.30 Amendments to the highway infrastructure (including the M1) have been considered in the Phase 1A (North) FIR. No further changes to the roadside infrastructure are proposed as part of the Phase 1B (North) RMA and no updated modelling of the road infrastructure has been undertaken. However, Scenario 2 (2031 End State 'Do Something' scenario) has been remodelled to take account of the locations of future air quality sensitive exposure within the Phase 1B (North) RMA and to capture an increase in the amount of retail floorspace associated with the Brent Cross Shopping Centre as detailed in Phase 1B (North).

14.4.31 An assessment of the End State of 2031 was accepted for the s73 ES and other EIA Documentation, and as such no interim year assessment or assessment of phasing years has been considered.

14.4.32 The assessment of the operational phase is based on dispersion modelling, which includes a number of assumptions and limitations associated to input data (road traffic flows, vehicle emission factors, meteorological conditions, air pollution monitoring and background pollution data, model verification). These are reported in **Appendix 14.2: Air Quality Modelling Study**.

14.4.33 Compliance with the EU Limit Values is considered to be the UK Government's responsibility given that national measures (such as vehicle scrappage schemes, increased diesel fuel prices, implementation of the ULEZ) would be required in order to meet compliance. As such, the effect of the Development has been assessed against the UK Air Quality Strategy (AQS) objectives rather than the EU Limit values. In order to demonstrate that the Development has a positive influence on air quality, a summary of measures which are likely to lead to a benefit to air quality have been outlined. The review of mitigation measures has been undertaken considering mitigation measures detailed in relevant guidance.

14.4.34 As above, measures to be introduced as part of the Development which are likely to result in an improvement to air quality are presented later in this Chapter. Whilst these measures are likely to result in an improvement to air quality the quantitative amount of these improvements (such as in $\mu g/m^3$) cannot be identified because this information is not available within air quality technical guidance due to an absence of real-word research data and the impacts local conditions may have on the success of such measures. As such, only professional judgement can be made on the success of these measures.

14.5 Consultation

14.5.1 Details on the consultation with the EHO at LBB are presented in **Appendix 14.2: Air Quality Modelling Study**).

14.5.2 Comments received on air quality from LBB, TfL and Capita as part of the Scoping Opinion (**Appendix 4.2**) are presented in **Table 4.1** together with responses. Comments are addressed within the Chapter, where appropriate.

14.6 Baseline Conditions

Summary of Local Authority Review and Assessment of Air Quality

London Borough of Barnet

14.6.1 There have been no changes to air quality from those reported and detailed in the s73 ES and other EIA Documentation.

London Borough of Brent

14.6.2 There have been no changes to air quality from those reported and detailed in the s73 ES and other EIA Documentation.

Air Quality Monitoring

14.6.3 Both LBB and LB Brent operate a network of air quality monitoring stations across their boroughs, including both automatic monitors measuring NO_2 and particulate matter, as well as NO_2 diffusion

tubes. Moreover, Waterman has carried out a NO_2 monitoring survey from the end of August 2014 to date (on-going).

14.6.4 A summary of the most recent monitoring results for NO_2 and particulate matter, further to the results presented in the s73 ES and other EIA Documentation, is presented below. Results of the Waterman survey for the most recent years (2015 and 2016), which is based on a range of diffusion tubes installed around the Site and along the affected road network, are also presented below. The location of the NO_2 diffusion tube monitors installed in 2014 is provided in **Figure 14.1.**

London Borough of Barnet

14.6.5 The closest automatic monitor to the Site is the Chalgrove Primary School site, about 2km north east of the Site. The site is an urban background monitoring station measuring both NO_2 and PM_{10}. The latest results from this monitoring station are provided in **Table 14.1**.

Table 14.1 – Monitoring Results at the Chalgrove Primary School Automatic Monitor

Pollutant	Averaging Period	AQS Objective	Year			
			2012	2013	2014	2015
NO_2	Annual Mean (µg/m^3)	40µg/m^3	32	32	27	23
	Hourly (No. of hours)	200µg/m^3 not to be exceeded more than 18 times a year	15	5	9	0
PM_{10}	Annual Mean (µg/m^3)	40µg/m^3	19	19	20	18
	No. of Days	50µg/m^3 not to be exceeded more than 35 times per year	0	0	0	3

Note: Data obtained from the London Borough of Barnet Air Quality Annual Status Report for 2015

14.6.6 As shown in **Table 14.1** all AQS objectives for NO_2 and PM_{10} have been met at the Chalgrove School monitoring site. This is consistent with the monitoring data for Chalgrove School as reported in the s73 ES and other EIA Documentation. However, between 2013 and 2015, for annual mean NO_2 there has been a year on year decline in monitored concentrations (from 32µg/m^3 to 23µg/m^3).

14.6.7 It is noted that the Chalgrove School monitor is at an urban background location. These are chosen on the basis that they are away from major sources of pollution and are regarded as broadly representative of town/city-wide background concentrations.

14.6.8 LBB also operates two NO_2 diffusion tube monitoring sites close to the Site. **Table 14.2** presents the most recent monitoring data for these monitoring sites.

Table 14.2 - LB Barnet Diffusion Tube Annual Mean NO_2 Concentrations (µg/m^3)

Site ID	Site Location	Classification	Approximate Distance to Centre of Site	AQS Objective	2012	2013	2014	2015
PBN19	Rear of 7-12 Dyson Court, Tilling Road	Roadside	0.4km south	40µg/m^3	**51.2**	**55.5**	**54.8**	**52.3**
PBN6	347 Hendon Way	Roadside	0.2km north		**49.2**	**50.5**	**50.7**	**41.7**

Note: Data obtained from the London Borough of Barnet Air Quality Annual Status Report for 2015

In bold, exceedence of the AQS objectives

14.6.9 The results in **Table 14.2** show the annual mean objective (40µg/m^3) has been exceeded at both monitoring locations for the most recent years. This is consistent with the monitoring data for these diffusion tubes as reported in the s73 ES and other EIA Documentation. It is noted that both sites are affected by heavily trafficked roads, PBN19 by the A406, and PBN6 by the A41.

London Borough of Brent

14.6.10 The closest automatic monitor is located at Brent Park Ikea, Drury Way, about 3.5km south west from the Site. The site is a roadside monitoring station measuring NO_2, PM_{10} and $PM_{2.5}$. The latest available results are provided in **Table 14.3**.

Table 14.3 - Monitoring Results at the Brent Park Ikea – Drury Way Automatic Monitor

Pollutant	Averaging Period	AQS Objective	Year			
			2012	2013	2014	2015
NO_2	Annual Mean (µg/m^3)	40µg/m^3	**76**	No data	**79.7**	No data
	Hourly (No. of hours)	200µg/m^3 not to be exceeded more than 18 times a year	**33**		10	
PM_{10}	Annual Mean (µg/m^3)	40µg/m^3	32	34	29	29
	Daily (No. of Days)	50µg/m^3 not to be exceeded more than 35 times per year	33	**38**	26	23

Notes: In bold, exceedence of the AQS objectives

NO_2 data for 2013 and 2015 not reported due to low data capture

14.6.11 The results in **Table 14.3** show the annual mean NO_2 objective (40µg/m^3) has been exceeded in 2012 and 2014, as well as the 1-hour mean objective in 2012. The 24-hour mean objective for PM_{10} has also been exceeded at the Brent Park Ikea site in 2013, and was close to be exceeded in 2012. The site is affected by heavy traffic on the A406 North Circular Road.

14.6.12 These latest results are consistent with those presented in the s73 ES and other EIA Documentation.

Waterman Monitoring Survey (2015 and 2016 results)

14.6.13 Waterman has carried out a Site-specific monitoring survey at 18 locations around the Site and along the main roads nearby. The survey commenced on the 22nd August 2014 and is ongoing. Full details of the survey, including monthly results, and estimated annual averages, are provided in **Appendix 14.1: Air Quality Monitoring Survey**. The location of all diffusion tubes is also shown in **Figure 14.1**.

14.6.14 A summary of results for the full calendar years of 2015 and 2016 is presented in **Table 14.4** below.

Table 14.4 - Waterman Diffusion Tube Survey - NO_2 Concentrations (µg/m^3)

Location	2015		2016	
	Annual Average	Bias Adjusted Annual Average[(a)]	Annual Average	Bias and Annualised Adjusted Average[(b)]
1. Ethridge Road	**69.2**	**60.2**	**73.0**	**51.9**
2. Layfield Road	39.6	34.4	**45.5**	32.3
3. Claremont Road	**53.3**	**46.4**	**59.0**	**41.9**

Location	2015		2016	
	Annual Average	Bias Adjusted Annual Average[a]	Annual Average	Bias and Annualised Adjusted Average[b]
4. Wallcote Avenue	33.5	29.1	37.3	26.5
5. Clitterhouse Road	**40.9**	35.6	**51.8**	38.9[c]
6. Purbeck Drive	37.0	32.2	**46.9**	33.3
7. Brent Terrace	37.5	32.6	**43.2**	32.4[c]
8. Handley Grove	37.8	32.9	Monitoring Stopped[e]	
9. Claremont Road	**71.6**	**62.3**	**77.6**	**55.1**
10. 274 Cricklewood Lane	**82.6**	**71.8**	**87.6**	**62.2**
11. The Vale	**65.7**	**57.1**	**76.7**	**54.4**
12. Brentfield Gardens	**75.3**	**65.5**	**81.7**	**58.0**
13. A41 Hendon Way	**80.3**	**69.9**	**90.4**	**67.8[c]**
14. Edgware Road	**48.1**	**41.9**	**57.9**	**41.1**
15. Quantock Gardens/ Claremont Road	No Data[d]		**57.8**	**42.0[d]**
16. Bus Station 1	No Data[d]		**73.9**	**53.6[d]**
17. Bus Station 2	No Data[d]		**76.8**	**55.7[d]**
18. Bus Station 3	No Data [d]		**77.3**	**56.0[d]**

Notes (a) Multiply previous column by 0.87

(b) Multiply previous column by 0.71

(c) Monitoring stopped on 6th July 2016. Data has been annualised by 1.056

(d) Monitoring started on 1st June 2016. Data has been annualised by 1.021

(e) Monitoring stopped due to continual monthly vandalism

In bold, exceedence of the NO_2 AQS objective of 40µg/m3

14.6.15 Overall, based on the survey, estimated annual averages exceed the NO_2 annual mean objective at the majority of the locations (8 out of 14 in 2015 and 12 out of 17 in 2016). These latest results are consistent with those presented in the s73 ES and other EIA Documentation (which showed 9 out of 14 sites exceeding the NO_2 annual mean objective in 2014).

14.7 Assessment and Mitigation

Demolition and Construction Assessment

Demolition and Construction Dust Emissions

14.7.1 The interim ICP update reprogrammes some of the elements of work within Phase 1 North. However, it remains the case that most the potential adverse air quality impacts will be experienced in the first year when Phase 1 (including Phases 1A (North), 1B (North), 1A (South), 1B (South) and 1C (South)) and Phase 2 have commenced construction, as these phases contain a large proportion of the critical infrastructure required for the delivery of the Development.

14.7.2 Furthermore, whilst the interim ICP update reprogrammes some of the elements of the works, the overall demolition and construction activities remain the same as those considered within the s73 ES and other EIA Documentation. Consequently, by adhering to the mitigation measures set out in

the s73 ES, including the control measures to be implemented in: The Code of Construction Practice (CoCP) for High Risk construction sites (as detailed in the Mayor of London's Guidance); the Construction Environmental Management Plan (CEMP); and a Construction Traffic Management Plan (CTMP), which are to be submitted under Conditions 8.1, 8.3 and 12.2 respectively, it is considered that dust emissions would remain as reported in the s73 ES and other EIA Documentation, as **insignificant**. In addition, dust monitoring and a Dust Management Plan would be used throughout the demolition and construction works to ensure that the mitigation measures are adequate and to ensure existing and future air quality sensitive receptors are protected during the demolition and construction works.

14.7.3 Based on the above, taking account of the interim ICP update, the impact from dust emissions generated by the demolition works and the construction activities as reported in the s73 ES and other EIA Documentation remains valid.

Demolition and Construction Vehicle Emissions

14.7.4 The interim ICP update includes revised traffic histograms which are presented in the CIA Addendum Technical Note (see **Appendix 2.1**). This shows the potential for a 23% increase in peak construction traffic movements compared with the construction traffic figures previously reported for all phases, based on the premise that the same construction activities will now take place within a contracted timescale. Condition 1.9 of the 2014 Permission requires the submission of a CCC Feasibility Study for each phase or sub phase of the Development and this Study has been approved by LBB. The construction traffic impacts of the CCC are not considered in detail within this Phase 1B (North) FIR as the final option has not yet been confirmed. In terms of construction traffic however, the CIA Addendum Technical Note presents a worst-case scenario as it does not assume that a CCC is in place.

14.7.5 The s73 ES concludes that the impacts on air quality will vary depending on the magnitude and location of construction activities. Whilst for the early years it is considered emissions from construction vehicles will be insignificant based on the existing number of Heavy Goods Vehicles (HGVs) on the network and current air quality conditions, the combined impacts from the construction and operational impacts have been qualitatively considered. In the combined scenario, the s73 ES predicts there would be a maximum of 82 construction vehicles per hour (62 Light Goods Vehicles (LGVs) and 20 HGVs). This change is below the DMRB methodology criteria (as an Annual Average Daily Traffic flow of less than 1000 LGVs and 200 HGVs) and as such the impacts on air quality are considered insignificant.

14.7.6 Taking account of the detailed information presented in the s73 ES, the potential 23% increase in peak construction traffic results in an additional 14 LGVs and 5 HGVs per hour, and therefore an overall increase of 76 LGVs per hour and 25 HGVs per hour. This change is below the DMRB methodology criteria of when there is likely to be an air quality impact for the number of LGVs, but is above the criteria for HGVs. However, with the implementation of the CoCP, CEMP and the CTMP referred to above, and considering that all construction vehicles would need to meet the emission standards for the London Low Emission Zone, any adverse impacts should be reduced to a minimum. Therefore, it is considered the impacts as reported in the s73 ES remain as **insignificant**. As such, the impact from construction traffic as reported in the s73 ES and other EIA Documentation remains valid.

Demolition and Construction Plant Emissions

14.7.7 As discussed in the Assessment Methodology section above, all NRMM are required to meet the emission standards as set out in the London Plan. Based on this control measure, it is considered an assessment of demolition and construction plant emissions is not required, and the impacts would remain as reported in the s73 ES and other EIA Documentation as **insignificant**.

Operational Assessment

Overview

14.7.8 As discussed under the methodology section above, the transport model (BXC DDM) includes the most recent baseline traffic survey counts and represents the detailed design highways network as per the s73 ES and other EIA Documentation. The air quality assessment does not remodel the 2012 baseline or Scenario 1 (2031 End State 'Do Nothing' scenario) as no changes have been made to the traffic flows in these scenarios and the data remains as that considered in the s73 ES and other EIA Documentation. Scenario 2 (2031 End State 'Do Something' scenario) has been remodelled to take account of the locations of future air quality sensitive exposure within Phase 1B (North) and to include a transport sensitivity analysis associated with the proposed increase in retail floorspace described earlier in this chapter.

14.7.9 To show the impacts of the detailed design of Phase 1B (North), the individual contribution from the transport emissions, replacement bus station, the bus ventilation ducts and the energy centre (as described above) are shown in **Appendix 14.3: Air Quality Modelling Results** prior to combining together to determine the overall impacts and effects of the Development. The traffic emissions have been presented separately, in order to demonstrate that there are no significant changes to the results associated with the increase in retail floorspace from those identified previously.

14.7.10 The following sections provide a summary of the results; the modelled results at each modelled receptor are presented in **Appendix 14.3: Air Quality Modelling Results**.

Nitrogen Dioxide (NO_2)

14.7.11 **Table 14.5** provides a summary of the significance of impacts related to the NO_2 annual mean at all modelled site-wide sensitive receptors.

14.7.12 The results in **Table 14.5** are similar to those presented for the Phase 1A (North) FIR. The changes in the predicted impacts are related to the increase in the retail floorspace for BXE rather than associated with the emissions from the replacement bus station, the bus ventilation ducts and the energy centre.

14.7.13 As shown in **Table 14.5**, for the vast majority of sensitive receptors (99 receptors), the significance of impacts would be **Negligible** (rather than the previous 103 receptors reported in the Phase 1A (North FIR)). Adverse impacts are however predicted for a number of receptors due to forecast changes in traffic flows, including a **Substantial Adverse** impact at two receptors (previously one receptor in the Phase 1A (North FIR)), a **Moderate Adverse** impact at six receptors (previously four receptors in the Phase 1A (North FIR)), and a **Slight Adverse** impact at a further 17 receptors (previously 18 receptors in the Phase 1A (North FIR)). However, **Slight Beneficial** impacts are also predicted at four receptors (previously three receptors in the Phase 1A (North FIR)). Given that the same range of impacts are predicted, the results in the s73 ES and other EIA Documentation (specifically for the Phase 1A (North) FIR) remain valid.

Table 14.5 – Summary of Impact Significance for NO_2 Annual Mean at Sensitive Receptors

Significance of Impact (NO_2 Annual Mean)	No. Receptors
Substantial Adverse	2
Moderate Adverse	6
Slight Adverse	17
Negligible	99
Slight Beneficial	4
Moderate Beneficial	1
Substantial Beneficial	0
Total	**129**

14.7.14 Detailed modelled results focusing on receptors predicted to experience either an adverse or beneficial impact (i.e. excluding all receptors for which a negligible impact is predicted) are provided in **Table 14.6**. The receptor locations are shown in **Figure 14.2**, and results at all receptors provided in **Appendix 14.2: Air Quality Modelling Study**.

Table 14.6 – NO_2 Annual Mean Concentrations – Significance of Impacts

Receptor ID	NO_2 Annual Mean Concentrations ($\mu g/m^3$)				Magnitude	Significance	Location
	Baseline 2012	Do Minimum 2031	Do Something 2031	Change			
16	**61.1**	35.6	**40.5**	4.9	Large	Substantial Adverse	Claremont Road / Somerton Road Junction
59	**82.9**	**43.5**	**49.3**	5.8	Large	Substantial Adverse	A5 Cricklewood Broadway / Cricklewood Lane Junction
1	**53.6**	34.2	38.7	4.6	Large	Moderate Adverse	A407 Cricklewood Lane
3	**53.9**	31.8	36.6	4.8	Large	Moderate Adverse	A5 Cricklewood Broadway / Chichele Road Junction
6	**86.7**	**45.8**	**47.9**	2.1	Medium	Moderate Adverse	A41 (Finchley Road)
33	**69.4**	36.9	39.2	2.3	Medium	Moderate Adverse	Highfield Avenue
60	**67.8**	36.5	**40.4**	4.1	Large	Moderate Adverse	A407 Cricklewood Lane / Lichfield Road Junction
63	**53.5**	34.6	38.8	4.2	Large	Moderate Adverse	Claremont Road / The Vale Junction
2	**51.2**	28.6	31.8	3.2	Medium	Slight Adverse	A407 Cricklewood Lane
4	**56.7**	31.2	33.8	2.6	Medium	Slight Adverse	A407 Cricklewood Lane
32	**48.9**	27.7	30.5	2.8	Medium	Slight Adverse	A41 (Hendon Way)

Receptor ID	NO_2 Annual Mean Concentrations (µg/m^3)				Magnitude	Significance	Location
	Baseline 2012	Do Minimum 2031	Do Something 2031	Change			
52	**54.3**	29.3	32.4	3.1	Medium	Slight Adverse	A41 (Hendon Way)
58	**63.1**	34.8	36.4	1.6	Small	Slight Adverse	A5 Cricklewood Broadway / Oaklands Road Junction
73	**68.8**	33.2	35.2	2.1	Medium	Slight Adverse	A406 North Circular Road
86	**74.6**	**41.2**	41.6	0.5	Small	Slight Adverse	A4088 Dudden Hill Lane / Dollis Hill Lane Junction
93	**77.0**	41.9	43.1	1.3	Small	Slight Adverse	A41 (Finchley Road)
95	**49.6**	28.1	31.7	3.6	Medium	Slight Adverse	Highfield Avenue
111	**52.2**	29.5	31.7	2.2	Medium	Slight Adverse	A41 (Finchley Road)
115	**50.2**	24.3	28.9	4.6	Large	Slight Adverse	Fairfield Avenue
116	**58.7**	24.6	33.8	9.2	Large	Slight Adverse	Brent Park Road
118	**47.9**	29.4	31.7	2.3	Medium	Slight Adverse	A41 (Great North Way)
120	**58.1**	32.8	33.7	0.9	Small	Slight Adverse	A41 (Watford Way) / A41 (Great North Way)
122	**61.6**	36.5	37.6	1.0	Small	Slight Adverse	Colindeep Lane
128	**54.4**	27.7	30.1	2.4	Medium	Slight Adverse	A41 (Hendon Way)
129	**47.9**	30.1	32.2	2.1	Medium	Slight Adverse	Humber Road / Green Road Junction
54	**59.7**	34.6	32.5	-2.1	Medium	Slight Beneficial	A5 Edgware Road / Oxgate Gardens Junction
89	**71.5**	37.4	36.3	-1.1	Small	Slight Beneficial	A406 North Circular Road
91	**71.3**	39.1	38.4	-0.7	Small	Slight Beneficial	A406 North Circular Road
121	**72.1**	**40.5**	40.0	-0.5	Small	Slight Beneficial	A5 Edgware Road / Longley Way Junction

In bold, exceedence of the NO_2 annual mean AQS objective of 40µg/m^3

*incorrect significance criteria previously applied but has now been updated from an imperceptible magnitude to a small magnitude

14.7.15 As outlined above and shown in **Appendix 14.3: Air Quality Modelling Results**, with Phase 1B (North) in place the predicted impacts as a result of the Development as shown in **Table 14.6** are within the range of results as presented in the s73 ES and other EIA Documentation (specifically the Phase 1A (North) FIR). The main contribution at the modelled receptors is from traffic emissions from surrounding infrastructure (which was previously considered in the Phase 1A

(North) FIR) rather than from additional emissions arising from the operation of Phase 1B (North) (i.e. from the replacement bus station, the bus station ventilation ducts and the energy centre).

14.7.16 As shown in Table A14.3.6 of **Appendix 14.3: Air Quality Modelling Results**, the maximum annual mean NOx contribution (prior to conversion to NO_2) from the relocated bus station, the bus station ventilation ducts, and the energy centre at all modelled receptors, is 4.11µg/m^3 of NO_x at Receptor 35 (2.93µg/m^3 of NOx from the relocated bus station; 0.02µg/m^3 of NOx from the bus station ventilation ducts; and 1.16µg/m^3 from the energy centre). This receptor is located on Tiling Road and is the closest receptor modelled to the relocated bus station and the energy centre. Consequently, when the emissions are converted to NO_2 and combined with the road traffic emissions, the overall change at Receptor 35 is 1.3µg/m^3 of NO_2 and the impact **Negligible**.

14.7.17 As discussed in **Appendix 14.2: Air Quality Modelling Study**, the 1-hour mean objective for NO_2 is unlikely to be exceeded at a roadside location where the annual mean NO_2 concentration is less than 60µg/m^3. As shown in Table A14.3.9 in **Appendix 14.3**, the annual mean NO_2 concentrations are all predicted to be below 60µg/m^3 with the Development. Therefore, the 1-hour mean objective is likely to be met at all sensitive receptors considered. Accordingly, it is considered that the Development would have a **Negligible** impact on hourly NO_2 concentrations. This is consistent with the findings of the s73 ES and other EIA Documentation.

Particulate Matter (PM_{10} and $PM_{2.5}$)

14.7.18 Table A14.3.11 in **Appendix 14.3**: **Air Quality Modelling Results** shows that PM_{10} annual mean would be well below the AQS objective of 40µg/m^3 (both in the 'Do Minimum' and 'Do Something' scenarios) with the maximum concentration predicted to be 27.5ugm^3. The maximum increase in PM_{10} annual mean would be 1.5µg/m^3 at receptor 59, at the junction of Cricklewood Broadway and Cricklewood Lane. As above, the main contribution at the modelled receptors is from traffic emissions rather than from emissions arising from the operation of Phase 1B (North) (i.e. from the replacement bus station, the bus station ventilation ducts and the energy centre). Consequently, the results in the s73 ES and other EIA Documentation (specifically for the Phase 1A (North) FIR) remain valid.

14.7.19 Similarly, Table A14.3.12 in **Appendix 14.3: Air Quality Modelling Results** shows that the number of exceedances of the PM_{10} daily mean (less than 19 exceedances predicted at any receptor) would be well below the objective (35 exceedances per year allowed) in both scenarios.

14.7.20 **Table 14.7** and **Table 14.8** provide a summary of the significance of impacts related to the PM_{10} annual mean and 24-hour mean respectively at all modelled sensitive receptors. Results show that the significance of impacts would be **Negligible** at all modelled receptors. The significance of results in **Table 14.7 and 14.8** are the same as those presented previously (specifically for the Phase 1A (North) FIR). Consequently, the results in the s73 ES and other EIA Documentation (specifically the Phase 1A (North) FIR) remain valid.

Table 14.7 - Summary of Impact Significance for PM_{10} Annual Mean at Existing Sensitive Receptors

Significance of Impact	No. Receptors
Substantial Adverse	0
Moderate Adverse	0
Slight Adverse	0
Negligible	129
Slight Beneficial	0
Moderate Beneficial	0
Substantial Beneficial	0
Total	**129**

Table 14.8 - Summary of Impact Significance for PM_{10} 24-Hour Mean at Existing Sensitive Receptors

Significance of Impact	No. Receptors
Substantial Adverse	0
Moderate Adverse	0
Slight Adverse	0
Negligible	129
Slight Beneficial	0
Moderate Beneficial	0
Substantial Beneficial	0
Total	**129**

14.7.21 As shown in Table A14.3.7 of **Appendix 14.3: Air Quality Modelling Results**, the maximum annual mean PM_{10} contribution from the relocated bus station, the bus station ventilation ducts, and the energy centre at all modelled receptors, is 0.25µg/m^3 of PM_{10} at Receptor 35 (from the replacement bus station only). As above, this receptor is located on Tiling Road and is the closest receptor modelled to the relocated bus station. Consequently, the overall change at Receptor 35 is **Negligible**.

14.7.22 Table A14.3.13 in **Appendix 14.3: Air Quality Modelling Results** shows that $PM_{2.5}$ annual mean in 2031 would be well below the AQS objective of 25µg/m^3 (both in the 'Do Minimum' and 'Do Something' scenarios), with the maximum concentration predicted to be 17.7ugm^3. The maximum increase in $PM_{2.5}$ annual mean would be 0.8µg/m^3 at receptor 59, at the junction of Cricklewood Broadway and Cricklewood Lane. As above, the main contribution at the modelled receptors is from traffic emissions rather than from emissions arising from the operation of Phase 1B (North) (i.e. from the replacement bus station, the bus station ventilation ducts and the energy centre).

14.7.23 Given these results, and as for PM_{10}, the significance of impacts would be **Negligible** for $PM_{2.5}$ at all receptors. Consequently, the results in the s73 ES and other EIA Documentation (specifically the Phase 1A (North) FIR) remain valid.

Conditions within the Development

14.7.24 **Appendix 14.3: Air Quality Modelling Results** shows the modelled NO_2, PM_{10} and $PM_{2.5}$ concentrations at selected future receptors representative of the detailed design locations for the Development. These include:

- Receptors 130 to 132: Residential units included at Plot 53 from the ground floor to the first floor included as part of Phase 1A (North);

- Receptor 133 to 135: Residential units included at Plot 54 from the ground floor to the first floor included as part of Phase 1A (North);
- Receptor 136 to 139: Residential units included at Plot 113, Block 1 from the ground floor to the third floor included as part of Phase 1B (North);
- Receptor 140 to 143: Residential units included at Plot 113, Block 2 from the ground floor to the third floor included as Phase 1B (North);
- Receptor 144 to 147: Residential units included at Plot 113, Block 3 from the ground floor to the third floor included as part of Phase 1B (North);
- Receptor 148 to 151: Residential units included at Plot 113, Block 4 from the ground floor to the third floor included as part of Phase 1B (North);
- Receptors 152 to 164: The location of the replacement bus stands as part of Phase 1B (North);
- Receptors 165 to 170: The location of area of open space as included as part of Phase 1A (North) and Phase 1B (North); and
- Receptor 171: The location of the hotel as part of Phase 1B (North).

14.7.25 In accordance with LAQM.TG(16) only the short-term objectives apply at the hotel, bus station and areas of open space.

14.7.26 As shown in **Appendix 14.3: Air Quality Modelling Results**, modelled concentrations for all pollutants are below the relevant AQS objectives at all selected sensitive receptors considered. As a result, the impact of introducing new sensitive uses (residential, open space and hotel) is considered **negligible**. Consequently, the results in the s73 ES and other EIA Documentation (specifically the Phase 1A (North) FIR) remain valid.

Summary

14.7.27 The air quality impacts from the Development identified in this assessment are consistent with the range previously reported in the existing EIA Documentation. The air quality modelling of road traffic from the Development as a whole has taken account of the improvements in technology and tighter emissions controls through the future pollutant emission rates. Although the modelling results showed that, for NO_2, there would be a **Substantial Adverse** impact on NO_2 at the junction of the A5 Cricklewood Broadway and Cricklewood Lane and Claremont Road, and **Moderate Adverse** impacts on NO_2 locally along stretches of Cricklewood Lane, Claremont Road, A41 and Highfield Avenue south of the Development, the impact at the vast majority of sensitive receptors (representative of existing properties) is **Negligible**. Furthermore, **Slight Beneficial** impacts are also predicted at a number of receptors. The impact on particulate matter (both PM_{10} and $PM_{2.5}$) is also **Negligible**, without any mitigation measures in place.

14.7.28 Additional modelled results at future proposed sensitive uses show that concentrations would be within the relevant AQS objectives, and therefore, the impact on new future uses is considered **Negligible**.

NO_2 Sensitivity Analysis Results

14.7.29 The results of the sensitivity analysis, with Phase 1B (North) in place, are presented in Table A14.3.10 in **Appendix 14.3 Air Quality Modelling Results**. As discussed previously, this sensitivity test is based on the assumptions that NO_x and NO_2 emissions from road traffic, and NO_x and NO_2 background concentrations, will not reduce at all by 2031 (compared to the baseline 2012) as per the latest projection by Defra. It is important to note that this scenario is pessimistic as reductions in NO_x and NO_2 are more likely to occur over such an extended period of time

(between 2012 and 2031). Therefore, modelled NO_2 results from this sensitivity test, which are much higher than those reported above, are likely to be overly conservative and professional judgement should be used with regards to the interpretation of these results.

14.7.30 Based on these assumptions, all receptors would be above the objective of 40µg/m^3 in 2031, both in the 'Do Minimum' and 'Do Something' scenario. Predicted annual mean NO_2 concentrations in 2031 would also be over 60µg/m^3 at a significant number of receptors (over 40) both in the 'Do Minimum' and 'Do Something' scenarios, which means that it is likely that the 1-hour mean objective would be exceeded at these locations. It is, however, noted that the Development would not lead to any new exceedances, as all receptors would exceed the objectives in the 'Do Minimum' scenario as well.

14.7.31 **Table 14.9** provides a summary of the significance of impacts related to the NO_2 annual mean at all modelled sensitive receptors.

14.7.32 The results in **Table 14.9** are similar to those presented previously (specifically for the Phase 1A (North) FIR). The changes in the predicted impacts are related to the increase in the retail floorspace for BXE, rather than associated with the emissions from the replacement bus station, the bus ventilation ducts and the energy centre.

14.7.33 As shown in **Table 14.9**, based on the conservative assumption that there is no improvement in NO_x and NO_2, more sensitive receptors would be subject to adverse impacts, including a **Substantial Adverse** impact at 21 receptors (rather than the previous 6 receptors in the Phase 1A (North FIR)), a **Moderate Adverse** impact at 47 (rather than the previous 27 receptors in the Phase 1A (North FIR)), and a **Slight Adverse** impact at 33 receptors (rather than the previous 54 receptors in the Phase 1A (North FIR)). However, there would also be receptors subject to beneficial impact, including a **Slight Beneficial** impact at eight receptors (rather than the previous 12 receptors in the Phase 1A (North FIR)), a **Moderate Beneficial** impact at six receptors (rather than the previous seven receptors in the Phase 1A (North FIR)), and a **Substantial Beneficial** impact predicted at two receptors. Only a minority of sensitive receptors would experience a **Negligible** impact (12 receptors compared with 11 receptors in the Phase 1A (North FIR)). This is because these conservative assumptions amplify the change in NO_2 concentrations predicted between the 'Do Minimum' and 'Do Something' scenarios. Given that the same range of impacts are predicted, the results in the s73 ES and other EIA Documentation (specifically for the Phase 1A (North) FIR) remain valid.

Table 14.9 - Summary of Impact Significance for NO_2 Annual Mean at Existing Sensitive Receptors (Sensitivity Test)

Significance of Impact	No. Receptors
Substantial Adverse	21
Moderate Adverse	47
Slight Adverse	33
Negligible	12
Slight Beneficial	8
Moderate Beneficial	6
Substantial Beneficial	2
Total	**129**

14.7.34 As above, the main contribution at the modelled receptors is from traffic emissions rather than from emissions arising from the operation of the Development (i.e. from the replacement bus station, the bus station ventilation ducts and the energy centre).

14.7.35 As shown in Table A14.3.6 of **Appendix 14.3: Air Quality Modelling Results**, the maximum annual mean NOx contribution (prior to conversion to NO_2) from the relocated bus station, the bus station ventilation ducts, and the energy centre at all modelled receptors, is 4.11µg/m^3 of NO_x at Receptor 35 (2.93µg/m^3 of NOx from the relocated bus station; 0.02µg/m^3 of NOx from the bus station ventilation ducts; and 1.16µg/m^3 from the energy centre). This receptor is located on Tiling Road and is the closest receptor modelled to the relocated bus station and the energy centre. Consequently, when the emissions are converted to NO_2 and combined with the road traffic emissions, the overall change at Receptor 35 for the sensitivity is 0.5µg/m^3 of NO_2 and the impact **slight adverse**.

Conditions within the Development

14.7.36 As shown in Table A14.3.10 of **Appendix 14.3: Air Quality Modelling Results**, modelled concentrations in the NO_2 sensitivity analysis are above the relevant AQS objectives at all selected sensitive receptors considered. However, it is noted that, again, this sensitivity test is likely to be overly conservative, and modelled results are very likely to significantly overestimate NO_2 concentrations over such an extended period of time to 2031 given that, overall, changes in vehicle technologies, improvements in vehicle emissions and increased energy efficiency should lead to lower road-traffic NO_x emissions and background concentrations by 2031 when compared to 2012. The sensitivity test should therefore be regarded as an absolute worst-case scenario, which highlights changes in NO_2 levels associated with an overall increase in traffic flows on the local road network, combined with no improvement at all in vehicle emissions and background concentrations.

Mitigation

14.7.37 **Table 14.10** presents the measures inherent to the Development (i.e. included within the impact assessment above) and additional mitigation measures to be included during the construction and operational phases of Phase 1A (North) and Phase 1B (North) (i.e. not considered in the impact assessment above) which are likely to have a benefit to air quality. Reference is also made to the two open spaces which are proposed to be re-phased to Phase 1B (South), but which are to be funded by the Applicant.

14.7.38 The measures are in accordance with relevant policy and guidance, such as the Mayor of London's 'A City for All Londoners', the Mayor of London's LEN, LBB's AQAP and Defra's Guidance on Improving NO_2 in the UK (see Legislation, Planning Policy and Guidance subheading for further information).

Table 14.10 – Air Quality Mitigation Measures Introduced as Phase 1A (North) RMAs and Phase 1B North (RMA)

Phase	Mitigation Measures
Demolition and Construction Phase	• Environmental management controls developed and set out in the Construction Environmental Management Plan for each Phase or Sub-Phase. • Environmental management controls developed and set out in the Site Wide Code of Construction Practice. • All construction plant would adhere to the emissions standards for NO_2 and PM_{10} set out for NRMM in the London Plan. • Avoidance, or limited use, of traffic routes in proximity to sensitive routes (i.e. residential roads etc.). All construction traffic logistics would be agreed with LBB. • Avoidance, or limited use, of roads during peak hours, where practicable.

Phase	Mitigation Measures
	• Provision of a Construction Worker Travel Plan and a Construction Transport Management Plan. • Dust monitoring and dust controls to be agreed with LB Barnet and undertaken 6 months prior to and throughout the demolition and construction phase.
Inherent – Measures included in the design of Phase 1A (North)	• Improvements to Claremont Park and Clitterhouse Playing Fields (now proposed to be re-phased to Phase 1B (South)) to include extensive green planting and the provision of leisure facilities. • No car parking provided for Claremont Park (now proposed to be re-phased to Phase 1B (South)). Provision of 20 cycle parking stands. All ramps and barriers will be removed and the park will be graded to ensure access for all users is achievable. Improvements aimed to promote walking, cycling and the use of public transport. • Provision of 60 cycle parking stands; new paths and cycle routes; and 21 car parking spaces at Clitterhouse Playing Fields (now proposed to be re-phased to Phase 1B (South)). Improvements aimed to promote walking, cycling and the use of public transport. • New Central Brent Riverside Park, including River Brent Nature Park, to include extensive green planting. No car parking provided for Central Brent Riverside Park. Provision of 8 cycle parking stands, along with new paths and cycle routes to promote walking, cycling and the use of public transport. • Creation of new energy and thermal efficient housing at Plots 53 and 54. • A total of 73 cycle spaces and 47 car parking spaces to be provided for users of Plots 53 and 54. • Creation of a Public Transport Strategy, which sets out the provision and strategy for the generation of alternative modes of travel. • Gateway Junction improvements / alterations to improve traffic flow and capacity at: - M1/A406 and A5/A406 (Staples Corner); - A41/A406 Junction; - A5/A407 Cricklewood Lane; and - A406 Brent Cross Access/Egress Junction. • Road and junction improvements / alterations to improve traffic flow and capacity at: - A406 North Circular Road; - A41 Southbound On-Slip; - Tempelhof Avenue and Link Road; - Diversion of Prince Charles Drive; - Tilling Road West Realignment; and - Modifications to BXSC Perimeter Road. • Provision of new bridge structures to include: - Living Bridge; - Replacement Tempelhof Bridge A406; - M1 pedestrian and cycle bridge; and - River Brent Bridges. • Site-wide Pedestrian and Cycle Strategy to include: - Around the Brent Cross Shopping Centre connecting with surrounding networks at Shirehall Lane roundabout, Sturgess Avenue, Layfield Road, Tempelhof Bridge and Living Bridge; - Pedestrian and cycle link alongside the River Brent between A41 and the Western roundabout; - Pedestrian only link alongside River Brent Corridor from west of Western roundabout to M1 underpass; - Shared footway/ cycleway along Brentfield Gardens towards Brent Cross London Underground station tying into a modified pedestrian/ cycle network beneath the A406/A41 junction; - Shared footway/ cycleway along Tempelhoff Link Road and the widened Tempelhof Bridge; - Links onto Brent Terrace North and Brent Terrace South; and

Phase	Mitigation Measures
	- Pedestrian and cycle links on northern and southern side of Staples Corner/M1/A406 junction.
Additional measures to be included in the operation of the Phase 1A (North)	• Provision of a Framework Travel Plan. • Provision of a Servicing and Delivery Strategy.
Additional future measures that could be included	• To consider and discuss with TfL, LB Barnet, GLA and HE: - air quality information boards on the M1/J1; and - geofencing from the M1/J1 to the shopping centre to switch hybrid vehicles via GPS to electric mode.
Inherent – Measures included in the design of the Phase 1B (North)	• Interim detailed dispersion modelling completed (using ADMS) and results used to ensure that the Energy Centre flue is designed and located for adequate dispersion of flue gases to avoid adverse impacts at existing receptor locations and receptors within the Development (see **Appendix 14.3: Air Quality Modelling Study**). • Energy centre to be gas-fired, use low NOx technology and to meet the London Plan Emission Standards; • Relocated bus station considered improvements to air quality within its design. The Air Quality Bus Station Design Report is available in **Appendix 14.4** and includes: - Colt impulse fans mounted to the soffit to provide air movement from the front of the bus station to the rear extract points. Air drawn in from height, away from the tailpipe emissions; - Continual mechanical extract via two risers at the rear of the bus station with the provision of natural ventilation; - Extract plant be mounted at the roof level of the South Car Park and connect via internal risers located within the South Car Park to two extract plenums; - The fan and mechanical extractions to include normal air change rate 6 Air Changes per Hour (AC/hr) and Smoke Clearance rate 10 AC/hr to ensure there is constant movement of air; - Use of the proposed Energy Centre for the northern part of the Site, for the provision of heat and power to the information kiosk, staff rooms and public facilities; - Provision of low emission vehicle refuelling infrastructure, including electric charging points, to accommodate advances in bus type and to reduce the reliance of diesel vehicles; - All seating (excluding seating at the bus stops) to be located away from the kerbside and away from direct tailpipe emissions; and - Planting located in the footbridge to the Brent Cross shopping centre (the 'Living Bridge') and outside of the Bus Station (notably in the Brent Riverside Park proposals) to include plants that absorb and capture air pollutants (to be reviewed at detailed landscape design stage). • Enhanced public transport facilities, including the possibility for new bus routes and bus frequency; • New public realm and open space with extensive green planting to include: - Fenwick Place (approximately 0.05ha) - Tempelhof Circus (approximately 0.03ha) - Layfield Place (approximately 0.05ha) - Living Bridge Approach North (located at the northern end of the Living Bridge) • New parks with extensive green planting to include: - Eastern Brent Riverside Park (approximately 0.55ha) - Western Brent Riverside Park (approximately 1.37ha) - River Brent Nature Park (approximately 0.27ha) - Sturgess Park (approximately 0.7ha) - High Street North to be a covered pedestrianised area (see "K31" on **Figure 2.1**), reducing the potential exposure to traffic emissions; • Creation of new energy and thermal efficient housing on Plot 113;

Phase	Mitigation Measures
	• Creation of new community, leisure and retail facilities reducing the need to travel to similar facilities; • Provision of 760 active charging points and 760 passive charging points in the Brent Cross Shopping Centre; • Car Park Management to promote sustainable modes of transport and reduce parking demand; and • Pedestrian and bicycle strategy to promote the use of sustainable modes of travel. In particular, to include a bicycle hub in Plot 101, provision of 16 walking routes and provision of 17 cycle routes.
Additional measures to be included in the operation of the Phase 1B (North)	• Provision of a Framework Travel Plan. • Provision of a Servicing and Delivery Strategy (see **Appendix 7.4: Servicing and Delivery Strategy)**.
Additional future measures that could be included	• Further detailed design and operation of Brent Cross Shopping Centre to consider the following (in discussion with TfL, LB Barnet, GLA and future tenants): - variable parking rates based on the emissions of vehicles; - use of Euro 6 vehicles only at the shopping centre by 2020/2023; - area wide coordination of servicing and freight movement to minimise servicing/freight traffic; - electric hub of servicing (use of electric vehicles for last leg of journey); - restricted loading bays (only for low or zero emission commercial vehicles); - latest electric charging infrastructure – such as wireless charging plates or rapid chargers; - geofencing from the M1/J1 to the shopping centre to switch hybrid vehicles via GPS to electric mode; - restricted road access based on the emissions of vehicles; and - parking restrictions on roads found to have high level of ambient air quality following completion and operation of the Development.

Residual Impacts

Nitrogen Dioxide (NO_2)

14.7.39 Whilst the success of the mitigation measures cannot be quantified, as a worst-case assumption based on professional judgement, it is considered that the residual impacts at the properties where a **Substantial Adverse** impact is predicted without mitigation would likely reduce to **Moderate Adverse**, considering that only a small reduction in NO_x emissions would be required.

14.7.40 Similarly, at properties along Cricklewood Lane, A41 Finchley Road, at Cricklewood Broadway / Chichele Road, Claremont Road / Somerton Road and Cricklewood Lane / Lichfield Lane junctions, where a **Moderate Adverse** impact is predicted without mitigation, it is considered the residual impacts would likely reduce to **Slight Adverse**.

14.7.41 Finally, the impacts at all other receptors where a **Slight Adverse** impact is predicted would likely reduce to **Negligible**.

14.7.42 The residual impacts are the same as those presented previously (specifically for the Phase 1A (North) FIR). Consequently, the results in the s73 ES and other EIA Documentation (specifically the Phase 1A (North) FIR) remain valid.

Particulate Matter (PM_{10} and $PM_{2.5}$)

14.7.43 Residual impacts on particulate matter (PM_{10} and $PM_{2.5}$) would be **Negligible** at all modelled receptors, as predicted impacts are Negligible even without any mitigation in place.

14.7.44 The residual impacts are the same as those presented previously (specifically for the Phase 1A (North) FIR). Consequently, the results in the s73 ES and other EIA Documentation (specifically for the Phase 1A (North) FIR) remain valid.

14.7.45 A summary of the residual impacts associated with air quality and dust is included within **Chapter 22: Summary of Residuals Impacts and Mitigation**.

References

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[iii] Mayor of London (2016) A City for all Londoners, London

[iv] Greater London Authority (2014), 'Sustainable Design and Construction - Supplementary Planning Guidance', Greater London Authority, London.

[v] Environmental Protection UK & Institute of Air Quality Management (2017), 'Land-Use Planning & Development Control: Planning for Air Quality', EPUK & IAQM, London

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[vii] Defra (2009), 'Local Air Quality Management Policy Guidance (PG16)', Defra, London.

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x Highways England (2009) Design Manual for Road and Bridges, Volume 11, Part 1

xi Department for Environment Food and Rural Affairs, 2016, Local Air Quality Management Technical Guidance (TG16) Part IV of the Environment Act 1995, Environment (Northern Ireland) Order 2002 Part II

xii http://laqm.defra.gov.uk/faqs/faqs.html

xiii Department for the Environment, Food and Rural Affairs, 2012, 'Local Air Quality Management: Note on Projecting NO_2 Concentrations'