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Cycling Future Route 3

Air Quality Assessment

Transport for London

January 2020

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Document history

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1. Introduction

This air quality assessment has been prepared on behalf of Transport for London (TfL) for Cycling Future Route 3, herein referred to as the 'Proposed Scheme'.

The Proposed Scheme is a combination of segregated track, quietway-style intervention on local roads and cyclists being separated in time and space from other road users. The Proposed Scheme aims to contribute to increasing the proportion of journeys made by sustainable modes of transport and increase levels of cycling in London, through improving cycling conditions (including the perception of safety and comfort), providing new connection for cyclists and introducing cycling networks in closer proximity to a larger proportion of the London population.

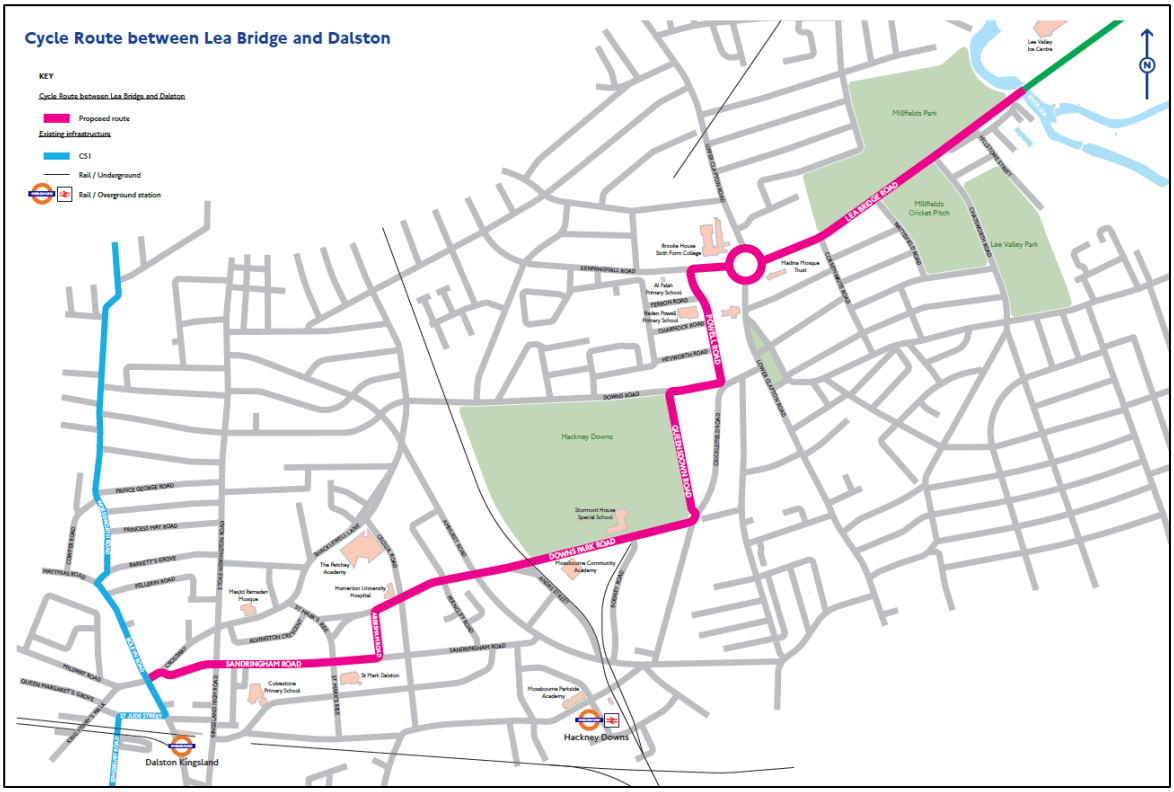
The Proposed Scheme may lead to a redistribution of some traffic movements and speeds on the local road network due to changes in road alignment and introduction of new or revised junction layouts.

The objective of this assessment is to quantify the impacts of changes in traffic movements and speeds as a result of the Proposed Scheme on pollutant concentrations at sensitive receptors within the study area.

1.1. Study Area

The Proposed Scheme runs between Dalston and Lea Bridge, around the A104 corridor within the administrative boundaries of London Borough of Hackney (LBH), however, the air quality study areas extends to the administrative areas of London Borough of Waltham Forest (LBWF), due to traffic changes extending beyond the area immediately around the Proposed Scheme. The extent of the Proposed Scheme is shown below in Figure 1

Figure 1 - Extent of The Proposed Scheme



1.2. Assessment Scope

This air quality assessment includes:

- A summary of the relevant local air pollutants (NO_2, PM_{10} and $PM_{2.5}$) and the regulatory and policy context;
- A summary of baseline conditions and measured ambient concentrations in the study area and a comparison with the relevant air quality criteria;
- A quantitative assessment of the potential air quality effects during the operational phase;
- Recommendations for mitigation of potentially significant effects; and
- Conclusions.

The scope of the assessment does not include assessment of emissions generated during the construction phase of the Proposed Scheme.

1.3. Assessment Methodology

An initial screening assessment has been undertaken with reference to the methodology given in Highways England's Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 1 LA105 Air Quality[1] (referred to as DMRB LA105). Although this guidance is specifically for the Strategic Road Network (SRN) it provides a means to determine a suitable study area for the current proposal, in particular roads that are likely to be affected by changes in air quality (the affected road network (ARN)).

Detailed modelling has been undertaken for the ARN in accordance with the approaches described in the Department for Environment, Food and Rural Affairs (Defra) Local Air Quality Management Technical Guidance (LAQM.TG(16))[2] and London Local Air Quality Management Technical Guidance (LLAQM.TG(16)[3], including the most recent revisions to LAQM tools and data resources published by Defra[4]. The impact of the Proposed Scheme on concentrations of local air pollutants has been modelled using the ADMS-Roads 4.1 dispersion model and resulting impacts described and assessed with reference to guidance published by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) entitled "Land use planning and development control guidance for air quality"[5] (EPUK/IAQM Planning Guidance).

[1] Highways England, 'Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 (LA105, Air Quality)', November 2019. Available at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20105%20Air%20quality-web.pdf

[2] Defra, 'Local Air Quality Management Technical Guidance (LAQM.TG(16))', Feb 2018. Available at: https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf

[3] GLA, London Local Air Quality Management Technical Guidance 2019 (LLAQM.TG(19)), 2019. Available at: https://www.london.gov.uk/sites/default/files/llaqm_technical_guidance_2019.pdf

[4] http://laqm.defra.gov.uk/whatsnew.html

[5] Environmental Protection UK and Institute of Air Quality Management, 'Land-Use Planning & Development Control: Planning For Air Quality', January 2017.

3. Legislation, Policy and Guidance

3.1. Air Pollutants

In most urban areas in the UK, the main local source of air pollutants is road traffic. Emissions from vehicle exhausts contain a complex mixture of pollutants including oxides of nitrogen (a mixture of nitrogen dioxide and nitric oxide – dominated by the latter), particulate matter (PM), carbon monoxide, and hydrocarbons (including benzene and 1,3-butadiene). The quantities of each pollutant emitted depend upon the vehicle type, quantity and type of fuel used, engine size, speed of the vehicle and abatement equipment fitted. In recent years, the local air pollutants of greatest concern have been nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$).

These pollutants are introduced briefly below.

3.1.1. Nitrogen Dioxide

Nitrogen dioxide (NO_2) is generally produced by the oxidation of nitric oxide (NO) in ambient air (i.e. it is not formed directly and as such is known as a secondary pollutant). The pollutants NO and NO_2 are collectively termed oxides of nitrogen (NOx). One third of UK NOx emissions are from road transport[6] while a quarter are from other forms of transport. The majority of NOx emitted from vehicles is in the form of NO, which oxidises rapidly in the presence of ozone (O_3) to form NO_2. In high concentrations NO_2 can affect the respiratory system, whereas NO does not have any observable effect on human health at the range of concentrations found in ambient air. High concentrations of NOx can have an adverse effect on vegetation, including leaf or needle damage and reduced growth. Deposition of pollutants derived from NOx emissions contribute to acidification and/or eutrophication of sensitive habitats.

3.1.2. Particulate Matter

Particulate matter in vehicle exhaust gases consists of carbon nuclei onto which a wide range of compounds are absorbed. These particles have an effective aerodynamic diameter of less than 10 micrometres (µm). Particles in this size range are referred to as PM_{10}. Diesel engines produce the majority of particulate emissions from the vehicle fleet. Approximately 12 percent of PM_{10} emissions in the UK are derived from road transport[7]. Particulate matter is associated with a range of symptoms of ill health including effects on the respiratory and cardiovascular systems, on asthma and on mortality. There is evidence that exposure to a finer fraction of particles ($PM_{2.5}$, which typically make up around two thirds of PM_{10} emissions and concentrations) has a significant contributory role in human all-cause mortality and in particular in cardiopulmonary mortality[8].

3.2. Air Quality Legislation

3.2.1. UK Legislation

There are two types of air quality regulations that apply in England:

- Regulations implementing mandatory European Union Directive limit values: The Air Quality Standards Regulations 2010 (Statutory Instrument (SI) 2010 No. 1001)[9] and The Air Quality Standards (Amendment) Regulations 2016 (SI 2016 No. 1184)[10]; and
- Regulations implementing national air quality objectives: Air Quality (England) Regulations 2000 (SI 2000 No. 928) and Air Quality (England) (Amendment) Regulations 2002 (SI 2002 No. 3043)[11],[12].

[6] http://naei.beis.gov.uk/overview/pollutants?pollutant_id=6 (accessed September 2019)
[7] http://naei.beis.gov.uk/overview/pollutants?pollutant_id=24 (accessed September 2019)
[8] Air Quality Expert Group (AQEG) Fine Particulate Matter ($PM_{2.5}$) in the UK (2012), https://uk-air.defra.gov.uk/assets/documents/reports/cat11/1212141150_AQEG_Fine_Particulate_Matter_in_the_UK.pdf (accessed September 2019)
[9] The Air Quality Standards Regulations 2010: http://www.legislation.gov.uk/uksi/2010/1001/contents/made
[10] The Air Quality Standards (Amendment) Regulations 2016: https://www.legislation.gov.uk/uksi/2016/1184/contents/made
[11] The Air Quality (England) Regulations 2000: http://www.legislation.gov.uk/uksi/2000/928/contents/made
[12] The Air Quality (England) (Amendment) Regulations 2002: http://www.legislation.gov.uk/uksi/2002/3043/contents/made

3.2.2. EU Limit Values

In April 2008, the European Commission adopted the Directive on ambient air quality and cleaner air for Europe (2008/50/EC). This Directive merged the previous Air Quality Framework Directive and the first three daughter directives and introduced new objectives for $PM_{2.5}$. UK regulations (SI 2010 No. 1001) implement the EU Directive. The relevant EU limit values in the context of this assessment for the protection of human health are presented in Table 1.

3.2.3. National Air Quality Strategy

The 2007 Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland[13] (UK AQS) sets out the national air quality standards and objectives for a number of local air pollutants. The standards are set by expert organisations with regard to scientific and medical evidence on the effects of the particular pollutant on health, and define the level of pollution below which health effects are expected to be minimum or low risk even for the most sensitive members of the population. The objectives are targets for air pollution levels to be achieved by a specified timescale, which take account of the costs and benefits of achieving the standard, either without exception or, for certain short term averaging period standards, with a permitted number of exceedances. Local authorities have a responsibility (under Part IV of the Environment Act 1995, see below) to review and assess local pollution levels against these objectives. These criteria are defined in Regulations SI 2000 No. 928 and SI 2002 No. 3043.

It should be noted that the UK AQS objectives only apply in locations likely to have 'relevant exposure' i.e. where members of the public are exposed for periods equal to or exceeding the averaging periods set for the standards. For this assessment, locations of relevant exposure include building façades of residential premises, schools, public buildings and medical facilities; places of work (other than certain community facilities) are excluded.

In January 2019, the UK Government published a Clean Air Strategy[14], which sets out actions to improve air quality by reducing pollution from a wide range of sources. Within the strategy, the Government sets an ambitious target to reduce the population exposed to concentrations of $PM_{2.5}$ above 10 µg/m^3 by 2025.

The relevant statutory air quality criteria for the protection of human health are outlined in Table 1.

Table 1 - Statutory Air Quality Criteria

Pollutant	Objective
NO_2	Hourly mean concentration should not exceed 200 µg/m^3 more than 18 times a year Annual mean concentration should not exceed 40 µg/m^3
PM_{10}	24-hour mean concentration should not exceed 50 µg/m^3 more than 35 times a year Annual mean concentration should not exceed 40 µg/m^3
$PM_{2.5}$	UK (Except Scotland) annual mean concentration should not exceed 25 µg/m^3† Exposure reduction^ (UK urban areas): target of 15% reduction in concentrations at urban background between 2010 and 2020*

† UK AQS objective is 25 µg/m^3 to be met by 2020. EU limit value is 25 µg/m^3 to be met by 2015, with a requirement in urban areas to bring exposure down to below 20 µg/m^3 by 2020.

^ EU limit value exposure reduction target of 20% reduction between 2010 and 2020.

* 25 µg/m^3 is a cap to be seen in conjunction with 15% reduction.

3.2.4. Local Air Quality Management

Under Part IV of the Environment Act 1995 all local authorities are responsible for Local Air Quality Management (LAQM), the mechanism by which the Government's AQS objectives are to be achieved. As part of this LAQM role, local authorities are required to periodically review air quality

[13] Department for Environment, Food and Rural Affairs (Defra), 2007. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. http://archive.Defra.gov.uk/environment/quality/air/airquality/strategy/documents/air-qualitystrategy-vol1.pdf

[14] Defra 2019, Clean Air Strategy. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf

in their area and to assess present and likely future air quality against the objectives defined in Regulations. Where a local authority anticipates an objective is expected to be breached within their area, they must designate an Air Quality Management Area (AQMA) and develop an action plan to improve pollution levels and work towards achieving the AQS objectives. Under the current LAQM regime, a local authority is responsible for regular review and assessment of local air quality, reports on which are published following public consultation and review by Defra.

Statutory responsibility for achieving EU limit values rests with the Secretary of State and local authorities have no responsibility for achieving the national air quality criteria, although they should contribute to this through local action plans designed to reduce pollution levels in AQMAs.

3.3. Air Quality Planning Policy

3.3.1. National Planning Policy

3.3.1.1. National Planning Policy Framework

The Government's planning guidance of general relevance to air quality is found within the National Planning Policy Framework (NPPF)[15]. It assists local authorities to incorporate air quality considerations into planning decisions and attempts to protect the environment and to promote sustainable growth.

Paragraph 103 refers to sustainable transport:

"*The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making*."

Paragraph 181 considers impacts on local air quality:

"Planning policies and 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, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. 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."

3.3.1.2. Planning Practice Guidance

Planning Practice Guidance (PPG)[16] is intended to support the NPPF and provide further detail to its policies. PPG indicates at paragraph 006 that information relating to air quality could be important to decision makers, and when there are concerns about air quality, the local planning authority may want to know about:

- *"the 'baseline' local air quality;*
- *whether the Proposed Development could significantly change air quality during the construction and operational phases; and/or*
- *whether there is likely to be a significant increase in the number of people exposed to a problem with air quality, such as when new residential properties are proposed in an area known to experience poor air quality."*

PPG also advocates, at paragraph 006, early engagement with the local planning and environmental health departments to establish the scope of any assessment. Guidance is also

[15] Ministry of Housing, Communities & Local Government, National Planning Policy Framework (NPPF), July 2018, from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728643/Revised_NPPF_2018.pdf

[16] National Planning Portal, available at http://planningguidance.planningportal.gov.uk/blog/guidance/air-quality/

given on the level of detail required in an air quality assessment, and measures which could be employed to mitigate adverse effects.

3.3.2. Regional Planning Policy

3.3.2.1. The Draft New London Plan

The Draft New London Plan[17], which will be published in February/March 2020 and supersede the current London Plan[18], is the overall strategic plan for London, which sets out a fully integrated economic, environmental, transport and social framework for the development of the capital over the next 20-25 years and forms part of the development plan for Greater London. The new plan has been expanded and now aims to improve air quality through an 'Air Quality Positive' approach and linked policies such as Healthy Streets and Air Quality Focus Areas. London boroughs' local plans need to be in general conformity with the London Plan, and its policies guide decisions on planning applications by councils and the Mayor.

Improvement of air quality is one of the key policy objectives of the London Plan, as confirmed by Policy SI1 'Improving air quality', which states:

A. Development Plans, through relevant strategic, site-specific and area based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.

B. To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:

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.*
2. *In order to meet the requirements in Part 1, as a minimum:*
   - *a) development proposals must be at least Air Quality Neutral*
   - *b) development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures*
   - *c) major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1*
   - *d) development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.*

C. Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this a statement should be submitted demonstrating:

- *a) how proposals have considered ways to maximise benefits to local air quality, and*
- *b) what measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.*

D. In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.

E. Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions

[17] The Draft London Plan, available at https://www.london.gov.uk/sites/default/files/intend_to_publish_-_clean.pdf

[18] The London Plan 2016, available at https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan/london-plan-2016-pdf

cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development.

3.3.2.2. Mayor's Transport Strategy

The Mayor's Transport Strategy[19] sits within the overall London Plan with Policy 6 committing to reducing vehicle emissions to improve air quality and support compliance with UK and EU legal limits as soon as possible. Measures to achieve are stated to include retrofitting vehicles with equipment to reduce emissions, promoting electrification, road charging, the imposition of parking charges/levies, responsible procurement, the making of traffic restrictions/ regulations and local actions.

Policy 7 seeks to make London's transport network zero emission by 2050, contributing towards the creation of a zero carbon city and delivering improvements to air quality. The policy also includes the introduction of a tighter health-based target of 10µg/m^3 for $PM_{2.5}$ to be achieved by 2030.

3.3.2.3. London Environment Strategy

The London Environment Strategy (LES)[20] sets out an ambitious vision for improving London's environment for the benefit of all Londoners and includes a number of policies considered relevant to the proposed Development including:

- Policy 4.2.1 - Reduce emissions from London's road transport network by phasing out fossil fuelled vehicles, prioritising action on diesel, and enabling Londoners to switch to more sustainable forms of transport;
- Policy 4.2.3 - Reduce emissions from non-transport sources, including by phasing out fossil fuels;
- Policy 4.3.3 - Phase out the use of fossil fuels to heat, cool and maintain London's buildings, homes and urban spaces, and reduce the impact of building emissions on air quality; and
- Policy 4.3.4 - Work to reduce exposure to indoor air pollutants in the home, schools, workplace and other enclosed spaces.

Under Policy 4.3.3, it is proposed that the London Plan includes policies so that all new large scale developments in London are 'Air Quality Positive', and maintain Air Quality Neutral requirements for all other developments (Proposal 4.3.3.a). As described above, all major developments are required to be Air Quality Neutral, however the LES suggests that larger developments have the potential to go further and boost local air quality by effective design and integration into the surrounding area. For instance, by the provision of low or zero emission heating and energy, green infrastructure, or improvements to public transport, walking and cycling infrastructure, 'Air Quality Positive' developments will make sure that emissions and exposure to pollution are reduced. As of yet however, guidance has not been published on the most effective approach to take to ensure a development is Air Quality Positive.

3.3.2.4. Supplementary Planning Guidance

The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance (SPG)[21] sets out how impacts on air quality can be minimised during the construction phase of development and advises on necessary mitigation measures. An assessment of construction phase effects in accordance this SPG has however not been undertaken for CFR3 as this is outside the scope of this assessment.

[19] Greater London Authority (2018), Mayor's Transport Strategy, March 2018. Available at: https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf

[20] Greater London Authority (2018), London Environment Strategy, May 2018. Available at: https://www.london.gov.uk/sites/default/files/london_environment_strategy.pdf.

[21] Greater London Authority (2014), The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance, July 2014. Available at: https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/control-dust-and.

The Sustainable Design and Construction Supplementary Planning Guidance[22] describes how the principles detailed in the London Plan are to be incorporated into the design and construction of development. It provides guidance on the following key areas:

- assessment requirements;
- construction and demolition;
- design and occupation; and
- air quality neutral policy for buildings and transport; and emissions standards for combustion plants.

The Air Quality Neutral Planning Support Update: GLA[23] was published in April 2014 to accompany the Sustainable Design and Construction SPG. It provides methodology to undertake an Air Quality Neutral assessment, as well as emission benchmarks for buildings and transport, against which the predicted values for the Proposed Scheme will be compared.

3.3.3. Local Planning Policy

The Proposed Scheme lies within the administrative boundaries of London Borough of Hackney (LBH). Although the study area extends in to London Borough of Waltham Forest, only the local planning policy and actions related to air quality issues for LBH are presented in this report.

3.3.3.1. Core Strategy

The core strategy is the primary and strategic document in the local development framework (LDF). It sets out a long term spatial vision and strategic objectives for future development in the area. In relation to air quality and new development, Policy 6 Transport and Land Use of the document states that:

The Council will encourage patterns and forms of development that reduce the need to travel, particularly by car, and will ensure that development results in the highest standard of design quality, environment and facilities for pedestrians and cyclists.

The Council will aim to improve the quality of an area and the way it functions in transport terms by:

- *Meeting access standards, and in turn the mobility requirements of all users, including people with sensory or mobility difficulties*
- *Maximising accessibility for pedestrians, cyclists and public transport users*
- *Mitigating any potentially negative impacts of the development on the transport network*
- *Promoting public transport improvements, including rail*
- *Safeguarding sites for Crossrail 2 alignment and construction access*
- *Managing travel demand by car, Seeking reductions of through traffic*
- *Reduced or preferably no on site parking in areas of good accessibility*
- *Reallocating road space to sustainable modes of travel where appropriate.*

3.3.3.2. Air Quality Action Plan (2015-2019)

This plan sets out actions to improve air quality in the borough corresponding to the AQMA that was declared for exceeding NO_2 and PM_{10} AQS objectives. Road based transport is responsible for a large proportion of NO_2 and PM_{10} emissions in the borough and is the largest single contributor in areas where AQS objectives are exceeded. Cycling and walking related actions including cycle to work schemes and the development of cycle and walking infrastructure, has been considered as one of cost-effective transport related actions that have been developed within Hackney and across London.

[22] Sustainable Design and Construction Supplementary Planning Guidance, April 2014. Available at:https://www.london.gov.uk/sites/default/files/gla_migrate_files_destination/Sustainable%20Design%20%26%20Construction%20SPG.pdf

[23] Air Quality Neutral Planning Support Update: GLA, April 2014. Available at: https://www.london.gov.uk/sites/default/files/gla_migrate_files_destination/Sustainable%20Design%20%26%20Construction%20SPG.pdf

3.4. Non-Statutory Guidance

3.4.1. LAQM Technical Guidance

Guidance concerning local air quality management is given in Defra's technical guidance LAQM.TG(16)[24] and London LLAQM.TG(19)[3]. Defra's guidance provides relevant methods concerning treatment and interpretation of modelling and monitoring data for local authorities in relation to the LAQM regime but is frequently applied when undertaking assessments for planning applications.

3.4.2. Design Manual for Roads and Bridges

Specific guidance for assessment of the impacts of motorway and all-purpose trunk roads on air quality is given in DMRB LA105[1]. This guidance covers the assessment of impacts of Highways England road schemes on local and regional air quality

3.4.3. Development Control

Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)'s 'Land-use Planning and Development Control: Planning for Air Quality' (2017)[5] guidance (EPUK/IAQM Planning Guidance) sets out to ensure that air quality is adequately considered in the land-use planning and development control processes. It comprises an initial screening stage to determine the need for an air quality assessment. If further assessment is required, a number of more stringent criteria are provided to help establish the need for further work, which may be either qualitative or quantitative, simple or detailed, depending on the impact of the development on, for instance, traffic flow. It also provides a framework for describing the magnitude of changes in local air pollutant concentrations at individual receptors (the impact) and gives advice on how overall significance may be assessed using professional judgement (the effect).

[24] https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf

4. Assessment Methodology

4.1. Baseline

Information on existing baseline air quality conditions within the study area was obtained from the following sources:

- LBH[25], and LBWF[26]'s air quality review and assessment reports;
- Boundaries of Air Quality Management Areas (AQMAs)[27];
- Air quality background concentrations and Pollution Climate Mapping (PCM) modelling data from Defra's UK Air Quality Information Resource (UK-AIR)[28];
- London Atmospheric Emissions Inventory (LAEI) 2013 Air Quality Focus Areas[29] and
- Designated ecological site information from Magic[30].

4.2. Operational Phase

4.2.1. Study area

In order to determine the air quality assessment study area, traffic data for the future year scenarios, as provided by TfL and processed by Atkins Transportation, have been compared against the DMRB LA105[1] traffic change criteria in order to establish an affected road network (ARN). The ARN provides an indication of the key road links which may be affected by the operation of the Proposed Scheme such that there may be a significant impact on air quality. According to DMRB LA105, a road link is included in the ARN where the changes in traffic and/or road alignment meet any of the following criteria[31]:

- annual average daily traffic (AADT) >=1,000; or
- heavy duty vehicle (HDV) AADT >=200; or
- a change in carriageway alignment by >=5

The extent of the ARN for the Proposed Scheme is illustrated in Figure 4.The air quality study area has thus been defined as the area comprising all ARN links which have relevant sensitive receptors within 200 metres either side of the centreline of the road carriageways.

4.2.2. Assessment Scenarios

Traffic data were provided for the following scenarios:

- Opening year 2021 without the Proposed Scheme (DM); and
- Opening year 2021 with the Proposed Scheme (DS)).

Pollutant concentrations have been modelled at selected sensitive receptors for each of the scenario described above in order to determine the impact of the Proposed Scheme on local air quality.

[25] The London Borough of Hackney Air Quality Annual Status Report for 2018, available at https://hackney.gov.uk/air-what-we-are-doing

[26] Waltham Forest Air Quality Annual Status Report for 2017, available at https://walthamforest.gov.uk/sites/default/files/London_Borough_Waltham_Forest%27s_Air_Quality_Annual_Status_Report_for_2017.pdf

[27] Defra Air Quality Management Areas available at: http://uk-air.Defra.gov.uk/aqma/maps.

[28] https://uk-air.defra.gov.uk/

[29] https://data.london.gov.uk/dataset/laei-2013-london-focus-areas

[30] http://www.natureonthemap.naturalengland.org.uk/

[31] a change in speed band is also included in the DMRB LA105 criteria, however this has not been applied as the use of speed bands is specific to Highways England assessments.

4.2.3. Traffic Conditions

Traffic conditions vary throughout the course of a day and between weekdays and weekends. In the absence of 24 hour traffic count data for the weekend, a 24-hour diurnal profiles was produced based on the available weekday count data and has been applied in the model for both weekday and weekend days. Further details of the modelled diurnal emission profile used are provided in Appendix A.

4.2.4. Emission Factors

Vehicle exhaust emissions of NO_x, PM_{10} and $PM_{2.5}$ for each road link in each modelled scenario were calculated using Defra's Emissions Factors Toolkit (EFT, version 9.0, May 2019) for the opening year 2021 without and with the Proposed Scheme. The emission calculations assumed a road type of "London – Inner" and "London–Outer" for the modelled roads based the definitions in the EFT Userguide[32].

4.2.5. Background Concentrations

The output from the ADMS dispersion model provides the contribution from road traffic emissions to annual mean concentrations of NOx, PM_{10} and $PM_{2.5}$ at discrete receptor points. These incremental concentrations are combined with estimates of background concentrations, to account for other sources of air pollution, to derive total annual mean concentrations. Background concentrations have been derived from Defra's background maps and are presented in Table 8. In order to avoid double counting, sector removal was undertaken for both "Trunk A Road in" and "Primary A Road in".

Background concentrations derived from Defra's background maps (for a 2017 reference year) have been compared with monitored data at background site in the study area, to ensure the mapped estimates are appropriate. The comparison is provided in Appendix C and shows that mapped concentrations within the air quality study area are within 30% of measured concentrations and are therefore considered appropriate to use unadjusted in the assessment.

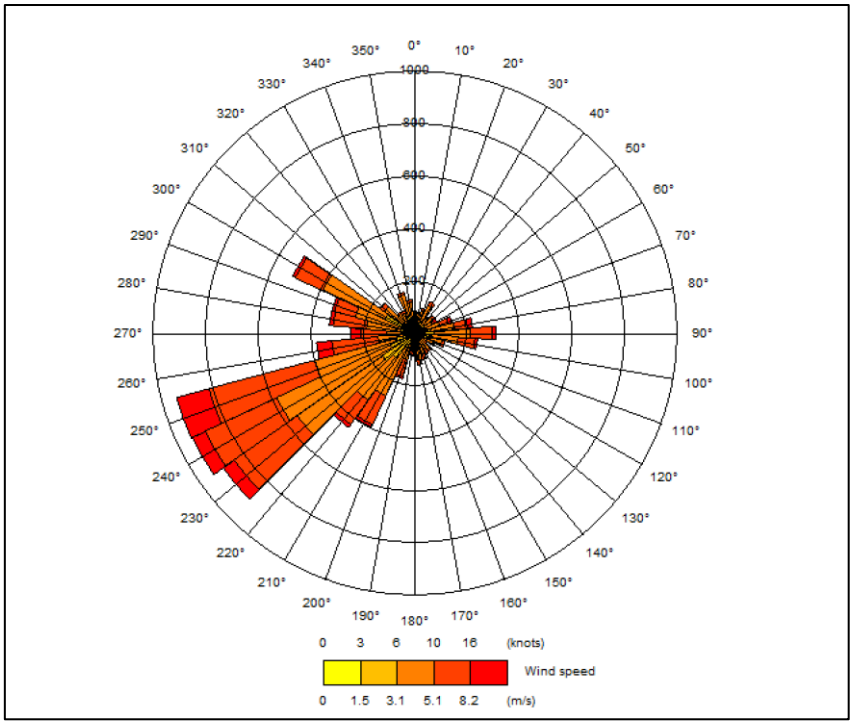
4.2.6. Meteorological Data

Hourly sequential meteorological data for the nearest suitable meteorological station, in this case London City Airport, were used in the air quality model for the year 2017. The meteorological station is approximately 9 kilometres southeast of the Proposed Scheme and is representative of conditions in the study area given the absence of major topographical features between the two locations. The basic data include: date, hour, direction that the wind is blowing from, wind speed, how many eighths ('oktas') of the sky are covered by cloud, and surface air temperature.

A windrose for London City Airport 2017 is presented in Figure 2, which indicates that the prevailing wind is from the southwest with a secondary prevailing wind from the north west.

[32] https://laqm.defra.gov.uk/documents/EFTv9-user-guide-v1.0.pdf

Figure 2 - Windrose for London City Airport, 2017



4.2.7. Receptors

Concentrations were modelled at 69 locations representative of existing human health receptors (e.g. residential properties and nine receptors representative of schools or school grounds). These receptors were placed at the façades of buildings/school yards closest to the modelled road network to estimate the highest pollutant concentration and the largest change in pollutant concentrations as a result of the Proposed Scheme. The height of the receptors was set at 1.5 metres above ground level to represent breathing height. The modelled receptors are shown in Figure 4 and reported in Appendix B, Table 10.

There are no designated ecological sites requiring assessment that have been identified within the study area (i.e.200 metres either side of the modelled road network). Therefore, no ecological receptors have been included in the assessment.

4.2.8. Model Inputs and Assumptions

The air dispersion model scenarios have been based on the following key inputs and assumptions:

- Ordnance Survey maps used to define the modelled road geometry and receptor locations;
- Road widths were manually determined from aerial photography;
- Traffic data in 24 hour AADT format for the opening year (2021) without and with the Proposed Scheme as prepared by Atkins Transportation;
- Diurnal profiles have been applied in the model to represent changes in traffic conditions and hence vehicle emissions in each hour of the year. The average diurnal profile (as shown in Appendix, Figure 3) were calculated for an average weekday (Monday to Friday) based on traffic count data provided by TfL.
- Surface roughness defined as 1.5 metres for the both the modelled area and the meteorological station (representative of large urban areas)[33];

[33] Surface roughness length is a measure of the vertical height of obstacles to wind flow at the earth's surface.

- Model default values used for surface albedo and Priestly-Taylor parameter. The Monin-Obukhov length for both the modelled area and the meteorological station have been set at 100 metres to represent large conurbations[34].

4.2.9. Model Uncertainty

Any air dispersion modelling exercise has inherent areas of uncertainty, including:

- input data (traffic data, emissions data);
- simplifications in model algorithms and empirical relationships that are used to simulate complex physical and chemical processes in the atmosphere;
- background concentrations; and
- meteorological data.

Uncertainty associated with vehicle emissions data has been minimised by using a recent version of the ADMS-Roads modelling software (version 4.1) and Defra emission factors (EFT v9.0). The model has been adjusted in line with recent assessments within London, using measured data for model verification (see below for approach).

Uncertainty associated with model algorithms and empirical relationships have been minimised by using algorithms and relationships within a dispersion model (ADMS-Roads) that has been independently validated and judged as fit for purpose.

Hourly sequential meteorological data have been used to estimate future concentrations provided by an approved supplier and which has been subject to robust quality checks. The key limiting assumption is that conditions in the future will be the same as in the past; however, in reality no two years are the same. To address some of this uncertainty, the meteorological data used in the model was for the same year as the air quality monitoring data used in the base year verification.

Given the above, the approach taken to this assessment is considered to be robust and is in line with good practice.

4.2.10. Model Verification

Model verification is the process of determining the local area performance of the base year model in comparison with measured data. The verification step involves comparison of modelled pollutant concentrations at suitable monitoring sites with monitored values that are representative of the base model period.

Where there is a disparity between modelled and measured concentrations, and where further improvements to input data are not possible, then if required, an appropriate adjustment factor can be determined to correct for systematic bias. This adjustment is applied to the base year and future year model outputs.

The tender documents did not indicate the need for a baseline scenario for air quality. In the absence of a modelled baseline scenario, an adjustment factor of 2.0 was applied to the modelled road-NOx contribution based on Atkins' experience of the adjustment factors derived in accordance with Defra's Technical Guidance LAQM.TG(16) for studies undertaken in London.

The assumed model adjustment factor for NOx was also applied to modelled PM_{10} and $PM_{2.5}$ concentrations. This approach is suggested within Defra's Technical Guidance LAQM.TG(16), which states that "*in the absence of any PM_{10} data for verification, it may be appropriate to apply the road-NO_X adjustment to the modelled road-PM_{10}*". This approach is considered likely to provide a conservative estimate of the contribution of modelled roads to ambient PM_{10} concentrations.

4.2.11. Comparison with Air Quality Criteria

Nitrogen Dioxide

To derive total NO_2 concentrations from modelled road NOx concentrations, and allow comparison with the air quality criteria, the method described in Defra's Technical Guidance LAQM.TG(16) has

[34] Model default surface albedo = 0.23 (not snow covered); model default Priestly-Taylor parameter = 1 (moist grassland); model default minimum Monin-Obukhov length = 100 calculated by model based on surface roughness; the Monin-Obukhov length is a parameter that limits occasions of very stable conditions with minimal thermal turbulence.

been used. Total annual mean NO_2 concentrations have been calculated from modelled road NOx and background NO_2 concentrations, using the latest version of the 'NOx to NO_2 conversion spreadsheet' (version 7.1) available from the Defra UK-AIR website[35].

In addition to the modelled road NOx and background NO_2 data, Defra's NOx to NO_2 conversion spreadsheet requires a local authority area to be specified to determine regional oxidant concentrations, and a traffic mix to determine the proportion of primary NO_2. The local authorities selected in the conversion tool were "Hackney London Borough" and "Waltham Forest London Borough", based on the location of the relevant receptors; the traffic mix selected was "All London traffic" for all modelled roads.

Since only annual mean concentrations have been calculated using the air dispersion model, commentary on potential exceedances of the hourly mean NO_2 standard have been made through reference to Defra's Technical Guidance LAQM.TG(16). The guidance suggests that if annual mean concentrations of NO_2 do not exceed 60 µg/m^3 then it is unlikely that hourly mean concentrations would exceed the relevant objective, which allows for 18 exceedances of the hourly standard in a calendar year.

Particulate Matter

To determine total annual mean concentrations of PM_{10} and $PM_{2.5}$ at human health receptors, the modelled road contribution has been added to the background concentration to give the total concentration for comparison with the annual mean assessment criterion.

Annual mean PM_{10} concentrations are used to derive the number of exceedances of the 24-hour mean PM_{10} criterion, of which 35 are allowed in a calendar year. The method described in LAQM.TG(16) was applied. This method is based on the relationship between the number of 24-hour exceedances of 50 µg/m^3 and the annual mean concentration derived from UK Automatic Network Sites. This is described in Equation 1.

Equation 1 – Calculation of PM_{10} 24-Hour Mean Exceedances

Number of exceedances of 24-hour mean of 50 µg/m^3 = $-18.5 + 0.00145 * a^3 + (206/a)$

Where 'a' = total annual mean PM_{10} concentration.

4.2.12. Assessment of Significance

A matrix for describing the impact of a change in concentration at individual receptors is set out in the EPUK/IAQM Planning Guidance[5], reproduced in Table 2. These descriptors are used in the assessment of changes to annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ with the Proposed Scheme, and range from negligible to slight, moderate or substantial.

The impact description depends upon:

- the larger value of the total concentration without the Proposed Scheme or with the Proposed Scheme, as a percentage of the relevant Air Quality Assessment Level (AQAL i.e. AQS objective); and
- the change in concentration, classified according to the percentage change relative to the AQAL of interest. The change is calculated based on concentrations rounded to one decimal place. The percentage change is then rounded up or down to the nearest whole number before application of the impact descriptor.

Table 2 - EPUK/IAQM Planning Guidance Air Quality Impact Descriptors for Individual Receptors

Long Term Average Concentration at Receptor	Percentage Change in Concentration Relative to AQAL			
	1	**2 – 5**	**6 – 10**	**>10**
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 – 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 – 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

The overall determination of significance of effect requires the professional judgement of a suitably qualified air quality professional. This judgement must take into account such factors as:

- the existing and future air quality in the absence of the scheme or development;
- the extent of current and future population exposure to the impacts (i.e. extrapolating the findings from the individual modelled receptors); and
- the influence and validity of any assumptions adopted when modelling the impacts.

5. Baseline Conditions

5.1. Local Air Quality Management

The whole of LBH has been declared as AQMA due to exceedances of both the hourly mean and annual mean NO_2 AQS objectives and the daily mean PM_{10} AQS objective. The whole of LBWF has also been declared as AQMA due to exceedances of both hourly and annual mean NO_2 AQS objective and the daily mean PM_{10} AQS objective. Details of the AQMAs within the air quality study area are provided in Table 3.

Table 3 - Descriptions of AQMAs within the Air Quality Study Area

Local Authority	Name	Air Quality Criteria Exceeded	Description
Hackney	Hackney AQMA	NO_2 annual mean, NO_2 hourly mean and PM_{10} 24-hour mean	An area encompassing the whole borough.
Waltham Forest	Waltham Forest AQMA	NO_2 annual mean and PM_{10} 24-hour mean	An area encompassing the entire borough.

5.2. LAEI Air Quality Focus Area

There are 187 Air Quality Focus Areas (AQFA)[29] in London. These are locations were identified as having potential exceedances of the annual mean NO_2 AQS objective in combination with the potential for high human exposure. The AQFA were defined to address concerns raised by boroughs within the LAQM review process and forecasted air pollution trends. There are three AQFAs within the study area, including the areas of A104 Lea Bridge Road/A107 Lower Clapton Road/Kenninghall Road, Wick Homerton High Street/Wick Road/Cassland Road/Victoria Park, and Leyton Lea Bridge Road from Orient Way to Avondale Road as shown in Figure 4.

5.3. Air Quality Monitoring

Air quality monitoring is a key component of local air quality management. Measurements of pollutant concentrations include analytical instruments that measure continuously, and passive sampling devices such as diffusion tubes which give longer period results (typically monthly, to calculate an annual mean concentration).

5.3.1. Continuous Monitoring Data

LBH operate continuous monitoring at one site (HK6), which is approximately 3.6km to the southwest of the study area. This monitor has not been considered further in this assessment due to the distance to the study area. There is one continuous monitoring site (CMS), operated by LBWF, (WL5), located just outside the study area. The CMS is located approximately 240m to the southeast of the ARN, as shown in Figure 4. Table 4 below provides the annual mean NO_2 concentrations measured at the CMS. The results show that NO_2 concentrations did not exceeded the annual mean AQS objective between 2013 and 2017. 2018 data was not available at the time of this report.

Table 5 below provides the number of exceedances of the hourly mean standard of 200 µg/m^3, of which 18 are permitted, for comparison with the hourly mean AQS objective. The results show that were no exceedances of the hourly AQS objective in any year at the site in the period 2013 to 2017.

Table 4 - Annual Mean NO_2 CMS results, µg/m^3, 2013 - 2017

Site ID	Site Name	X	Y	Annual Mean NO_2 concentrations				
				2013	2014	2015	2016	2017
WL5	Ruckholt Close, Leyton	537804	186025	28	36	31	35	33

Table 5 - Number of 1-Hour mean NO_2 concentrations > 200 µg/m³, 2013 - 2017

Site ID	Site Name	X	Y	Hourly mean NO_2 concentrations > 200 µg/m³				
				2013	2014	2015	2016	2017
WL5	Ruckholt Close, Leyton	537804	186025	0	7	0	0	4

Table 6 below provides the ratified annual mean PM_{10} concentrations measured at WL5 CMS. PM_{10} concentrations were below both the annual mean and daily mean AQS objectives from 2013 to 2017.

Table 6 - Monitoring results PM_{10} (µg/m³), 2013 - 2017

Site ID	Site Name	X	Y	Criteria	2013	2014	2015	2016	2017
WL5	Ruckholt Close, Leyton	537804	186025	Annual	21	20	18	19	18
				No. 24-Hour Means >50 µg/m³	8	9	3 (90th percentile is 28)	6	6

5.3.2. Passive Monitoring Data

Annual mean NO_2 concentrations are also measured by the local authorities using diffusion tubes. There are nine diffusion tube sites located within the study area operated by either LBWF or LBH. The data for these sites in presented in Table 7and their locations are shown in Figure 4.

The diffusion tube monitoring data indicates that annual mean NO_2 concentrations decreased between 2016 and 2018 at all sites. Measured data are below the AQS annual mean objective for all years presented.

Table 7 - Annual Mean NO_2 Concentrations (µg/m³)

Local Authority	Site ID	Site Type	X	Y	2014	2015	2016	2017	2018
Hackney	4	R	534960	185880	32	38	39	38	33
Hackney	5	R	536184	185073	29	32	38	34	32
Hackney	13	R	534823	186219	31	34	36	36	35
Hackney	18	B	534441	186257	28	29	32	31	29
Hackney	97	R	534126	186224	-	-	-	37	30
Hackney	99	R	534267	186060	-	-	-	36	33
Hackney	147	R	534381	186185	-	-	-	33	-
Waltham Forest	9	R	536457	187238	-	-	38.6	37.8	N/A
Waltham Forest	10	R	535928	186914	-	-	30.6	29.2	N/A

R- Roadside site, B – background site
N/A, no data available as 2017 ASR is the latest report
-No data available
Values are taken directly from LBH's ASR 2018 and LWF's 2017

5.4. Defra Mapped Concentrations

Estimates of current and future year background pollutant concentrations in the UK are available on the Defra UK-AIR website. The background estimates, which are a combination of measured and modelled data, are available for each one kilometre grid square throughout the UK for a base year

of 2017 and future year estimates up to 2030. These background estimates include contributions from all source sectors, e.g. road transport, industry and domestic and commercial heating systems.

Estimated annual mean background concentrations for the one kilometre grid squares covering the study area for opening year (2021) are presented below in Table 8 for the pollutants NO_2, PM_{10} and $PM_{2.5}$. The mapped concentrations of key pollutants indicate that background concentrations at the Proposed Scheme site are expected to be well below relevant AQS objectives.

Table 8 – 2021 Defra Mapped Background Concentrations (µg/m^3)

Grid Square	Defra Mapped Concentration			Revised Concentration Post Sector Removal		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
534500,185500	24.2	18.3	12.2	23.2	18.3	12.2
534500,186500	23.4	17.8	12.0	22.7	17.8	12.0
535500,185500	24.4	18.2	12.3	23.5	18.2	12.3
535500,186500	22.7	17.5	11.7	21.7	17.5	11.7
536500,184500	28.7	18.7	12.4	23.1	18.7	12.4
536500,185500	24.1	17.6	11.8	22.7	17.6	11.8
536500,186500	21.5	16.5	11.3	21.4	16.5	11.3
536500,187500	23.5	18.0	12.1	22.4	18.0	12.1

5.5. Pollution Climate Mapping (PCM)

Defra's PCM model provides estimates of roadside concentrations of annual mean NO_2 and PM_{10}, which are used in reporting to the EU regarding compliance with EU limit values. The model provides projected roadside concentrations of pollutants, for the years 2019-2030 inclusive, based on a 2017 base year.

The PCM model links within the study area include the A107 Lower Clapton Road, A104 Lea Bridge Road and A102 Homerton High Street. Defra PCM links are shown in Figure 4. Roadside annual mean NO_2 concentrations are projected to be above the EU limit value in 2017, varying between 43.5 µg/m^3 and 53.2 µg/m^3. However, in the opening year (2021) the Defra PCM link roadside concentrations at those locations are expected to be between 30 and 40 µg/m^3 and therefore below the NO_2 EU limit value.

5.6. Summary of Baseline Conditions

The entire area of LBH and LBWF are declared as AQMA, due to exceedances of the annual mean NO_2 AQS objective, hourly average NO_2 AQS objective and daily mean PM_{10} AQS objective. There are also three AQFAs within the study area.

Defra mapped background concentrations for 2021, are however well below the relevant AQS objectives for all pollutants. The Defra PCM model estimates indicate that roadside concentrations of annual mean NO_2 are below the EU limit value in the Proposed Scheme opening year (2021).

Measured concentrations at local authority monitoring site locations indicate that the annual mean NO_2 concentrations are currently below the relevant AQS objective at all roadside locations within the study area and have decreased since 2016.

6. Potential Impacts

6.1. Nitrogen Dioxide

Total annual mean NO_2 concentrations and expected changes in concentrations of NO_2 at the modelled receptors in 2021 are presented in Appendix, Table 12. The impact of the Proposed Scheme on link flows and annual mean NO_2 at modelled receptors are shown in Figure 5.

Concentrations are below the annual mean AQS objective of 40 µg/m^3 at all the receptors, both without and with the Proposed Scheme. The magnitude of change with the Proposed Scheme at all the receptors is negligible.

The majority of the receptors (59 out of 69 receptors) are expected to have a decrease in annual mean concentrations with the Proposed Scheme. The maximum decrease in annual mean NO_2 concentration is 0.7 µg/m^3, at R67 located adjacent to Chatsworth Road where the Proposed Scheme results in a decrease in traffic flows of approximately 2628 AADT.

The maximum modelled annual mean NO_2 concentration with the Proposed Scheme is 31.2 µg/m^3 at R22, located at Lockbridge Court, 37 Lea Bridge Road. R22 is also expected to have the largest increase in annual mean NO_2 concentration of 0.5 µg/m^3, which is considered to be a negligible increase. The Proposed Scheme results in a maximum increase in traffic flows of approximately 1500 AADT, south of Lower Clapton Road near the roundabout junction with Lea Bridge Road/Kenninghall Road.

As the modelled annual mean NO_2 concentrations do not exceed 60 µg/m^3 there is no risk that hourly mean NO_2 concentrations would exceed the 1-hour mean AQS objective.

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

The total annual mean PM_{10} concentrations, number of exceedances of the daily mean standard (in brackets) and changes in concentrations of PM_{10} for the modelled receptors are presented in Appendix, Table 13.

Total annual mean concentrations are below the AQS objective of 40 µg/m^3 at all modelled receptors, both with or without the Proposed Scheme. The estimated number of exceedances of the daily mean standard, presented in brackets in Appendix, Table 13, are within the AQS objective of 35 permitted exceedances. The Proposed Scheme results in negligible changes in annual mean PM_{10} concentrations at all receptor locations.

Total annual mean concentrations of $PM_{2.5}$ are modelled to be below the AQS objective of 25 µg/m^3 at all modelled receptors with or without the Proposed Scheme. All changes in $PM_{2.5}$ concentrations are negligible. The total annual mean $PM_{2.5}$ concentrations and changes in concentrations of $PM_{2.5}$ for the modelled specific receptors are presented Appendix, Table 14.

6.3. Assessment of Significance

The results of the local air quality assessment described in Section 6.1 to 6.2 indicate that concentrations of NO_2, PM_{10} and $PM_{2.5}$ are unlikely to exceed AQS objectives at all the receptors with or without the Proposed Scheme in the opening year of 2021. The magnitude of modelled changes in annual mean NO_2 concentrations at all the modelled receptors are considered to be negligible, with a decrease in annual mean concentrations at the majority of the receptors. The impact of change in PM_{10} or $PM_{2.5}$ concentrations modelled at all receptors is also negligible. It is therefore considered that the effect of the Proposed Scheme on local air quality in the study area is not significant.

8. Mitigation

8.1.1. Traffic Emissions

The air quality assessment indicates that the traffic changes due to the Proposed Scheme would not result in any new exceedances of AQS objectives or worsening of existing exceedances. No air quality mitigation for the Proposed Scheme is therefore required.

10. Conclusions

This air quality assessment included a review of existing air quality conditions and quantitative assessment using a dispersion model of the impacts and potential for significant effects the Proposed Scheme.

A review of existing air quality conditions indicated that:

- The Proposed Scheme runs through two borough-wide AQMAs declared due to exceedances of the annual mean NO_2 and daily mean PM_{10} AQS objectives, and annual and hourly mean NO_2 and annual and daily mean PM_{10} AQS objectives respectively;
- There are three AQFAs within the study area;
- The diffusion tube monitoring data indicates that annual mean NO_2 concentrations are below the AQS objective in 2018 at all LBH's and LBWF's monitoring locations;
- Annual and daily mean PM_{10} concentrations in the study area are well within the relevant AQS objectives;
- Defra mapped background concentrations for 2021, are well below the relevant AQS objectives for all pollutants.
- Roadside annual mean NO_2 concentrations for PCM links within the study area are projected to be above the EU limit value in 2017, varying between 43.5 and 53.2 µg/m^3. However, in the opening year (2021) roadside concentrations at those locations are expected to be between 30 and 40 µg/m^3, therefore the NO_2 EU limit is met.

A local air quality assessment for the operation of the Proposed Scheme was carried out using detailed dispersion modelling. Changes in annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at sensitive receptor locations in the vicinity of roads likely to be affected by changes in road traffic were calculated. These changes represent the impact of traffic changes during the operational phase in the year 2021.

Concentrations of NO_2, PM_{10} and $PM_{2.5}$ are unlikely to exceed AQS objectives at all the receptors without and with the Proposed Scheme in 2021. There is no risk that hourly mean concentrations would exceed the hourly mean AQS objective at any location. The change in annual mean NO_2 at all the receptors modelled is negligible with the decrease in annual mean concentrations expected at majority of receptors. Changes in annual mean PM_{10} or $PM_{2.5}$ concentrations at all modelled receptors are negligible.

Overall the on NO_2, PM_{10} and $PM_{2.5}$ concentrations as a result of the Proposed Scheme are not expected to be significant.

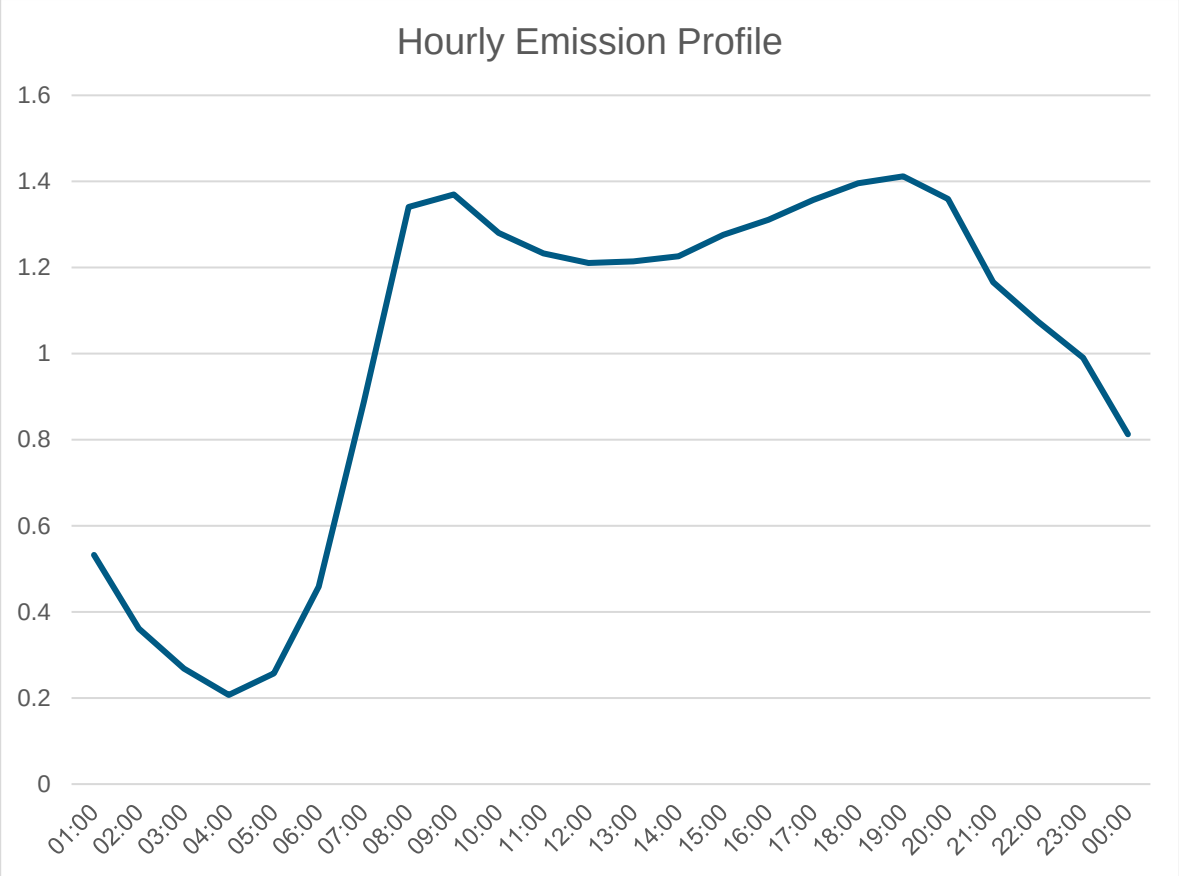
Appendices

Appendix A. Traffic Data

Table 9 - Diurnal Traffic Profile Used in the Air Quality Dispersion Model

Hour	Weekday	Saturday	Sunday
1	0.53	0.53	0.53
2	0.36	0.36	0.36
3	0.27	0.27	0.27
4	0.21	0.21	0.21
5	0.26	0.26	0.26
6	0.46	0.46	0.46
7	0.89	0.89	0.89
8	1.34	1.34	1.34
9	1.37	1.37	1.37
10	1.28	1.28	1.28
11	1.23	1.23	1.23
12	1.21	1.21	1.21
13	1.21	1.21	1.21
14	1.23	1.23	1.23
15	1.28	1.28	1.28
16	1.31	1.31	1.31
17	1.36	1.36	1.36
18	1.40	1.40	1.40
19	1.41	1.41	1.41
20	1.36	1.36	1.36
21	1.17	1.17	1.17
22	1.07	1.07	1.07
23	0.99	0.99	0.99
24	0.81	0.81	0.81

Figure 3 - Modelled Diurnal Traffic Profiles



Appendix B. Modelled Receptors

Table 10 - Sensitive Receptors included in the Air Quality Dispersion Model

Receptor	X	Y	Z
R1	534898	186100	1.5
R2	534891	186061	1.5
R3	534460	186186	1.5
R4	534237	186248	1.5
R5	535580	186657	1.5
R6	534333	186170	1.5
R7	536019	185161	4.5
R8	536006	185156	4.5
R9	534951	186190	1.5
R10	534294	186212	1.5
R11	535713	185505	4.5
R12	535694	185500	4.5
R13	535701	185483	4.5
R14	535720	185489	4.5
R15	534823	186217	1.5
R16	534786	186194	1.5
R17	534787	186157	1.5
R18	534721	186159	1.5
R19	534669	186184	1.5
R20	534617	186173	1.5
R21	534589	186183	1.5
R22	534964	186225	1.5
R23	534219	186286	1.5
R24	534215	186248	1.5
R25	535606	185823	1.5
R26	535576	185911	1.5
R27	535529	185986	1.5
R28	535364	186454	1.5
R29	535668	185496	1.5
R30	535677	185476	1.5
R31	535731	185513	1.5
R32	535748	185497	1.5
R33	535716	185570	1.5
R34	535779	185286	1.5

Receptor	X	Y	Z
R35	535759	185378	1.5
R36	536024	185142	1.5
R37	535994	185184	1.5
R38	536153	185090	1.5
R39	535863	185110	1.5
R40	535922	185125	1.5
R41	536218	184949	1.5
R42	535849	185177	1.5
R43	536015	185186	1.5
R44	536168	185118	1.5
R45	536221	184876	1.5
R46	536402	187179	1.5
R47	536389	187170	1.5
R48	534840	185909	1.5
R49	534665	186154	1.5
R50	534664	186159	1.5
R51	534426	186187	1.5
R52	534464	186204	1.5
R53	534388	186190	1.5
R54	534201	186094	1.5
R55	534206	186097	1.5
R56	534177	186156	1.5
R57	534283	186115	1.5
R58	534300	186174	1.5
R59	534253	186217	1.5
R60	535600	185782	1.5
R61	535572	185821	1.5
R62	535996	186112	1.5
R63	536000	186137	1.5
R64	536185	185053	1.5
R65	534843	186033	1.5
R66	535507	186026	1.5
R67	535536	186025	1.5
R68	535522	186005	4.5
R69	535531	186038	4.5

Appendix C. Background Comparison

Estimated annual mean background NO_2 concentrations for 2018 were obtained from the background mapping provided on the Defra UK-AIR website and compared with 2018 monitoring data from background monitoring sites located in the air quality study area. Table 11 presents the results of this comparison, which indicates that both mapped and measured background NO_2 concentrations for 2018 were well within the level of the annual mean AQS objective and that measured concentrations were within 30% of the mapped concentrations at all sites. As such, it was considered appropriate to use unadjusted mapped background NO_2 concentrations in the local air quality assessment.

Table 11 - Comparison of Annual Mean NO_2 Pollutant Concentrations ($\mu g/m^3$) for Defra Background Mapping and Urban Background Monitoring Sites

Local Authority	Site ID	Monitor Type	X,Y	1 km Grid Square X,Y	2018 Defra Background	2018 Monitored Background	%Difference (grid square NO_2 – monitored NO_2) / monitored NO_2*100)
Hackney	18	DT	534441, 186257	534500, 186500	29	27.8	-4.3%

Appendix D. Air Quality Constraints and Results

Figure 4 - Air Quality Constraints Map

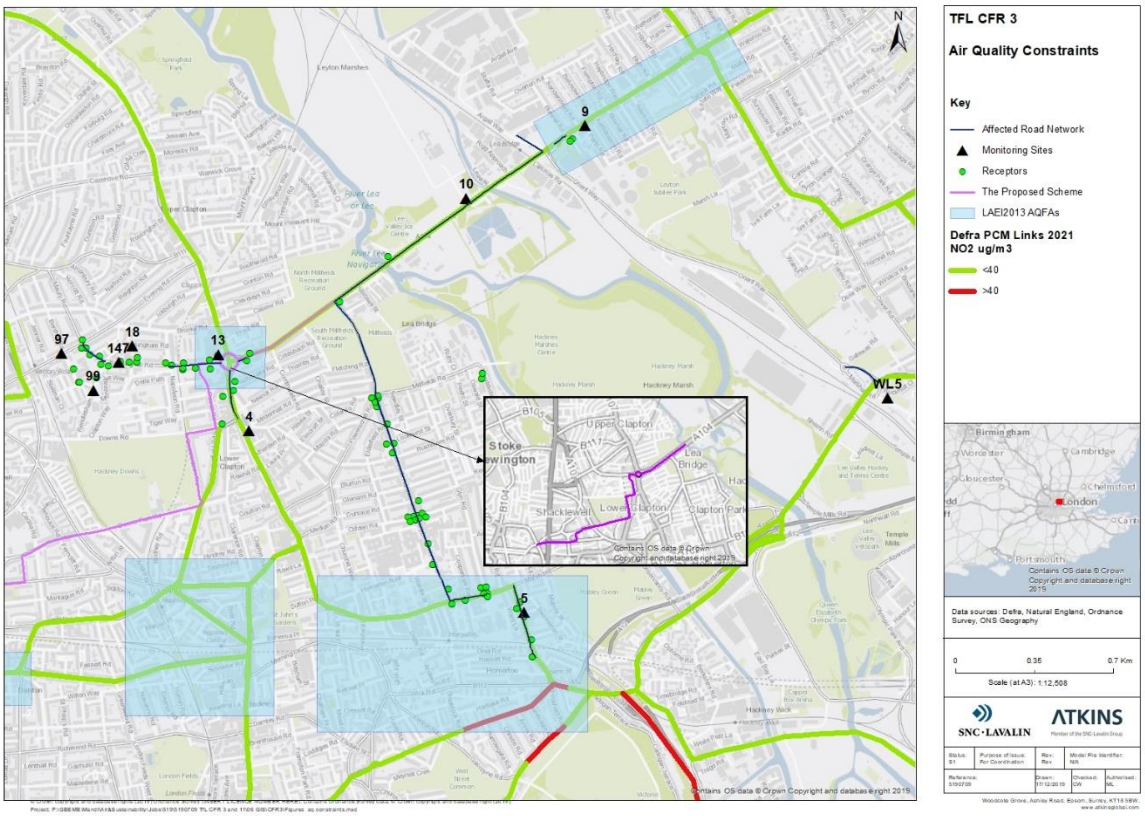


Figure 5 - Modelled Receptors and Impacts

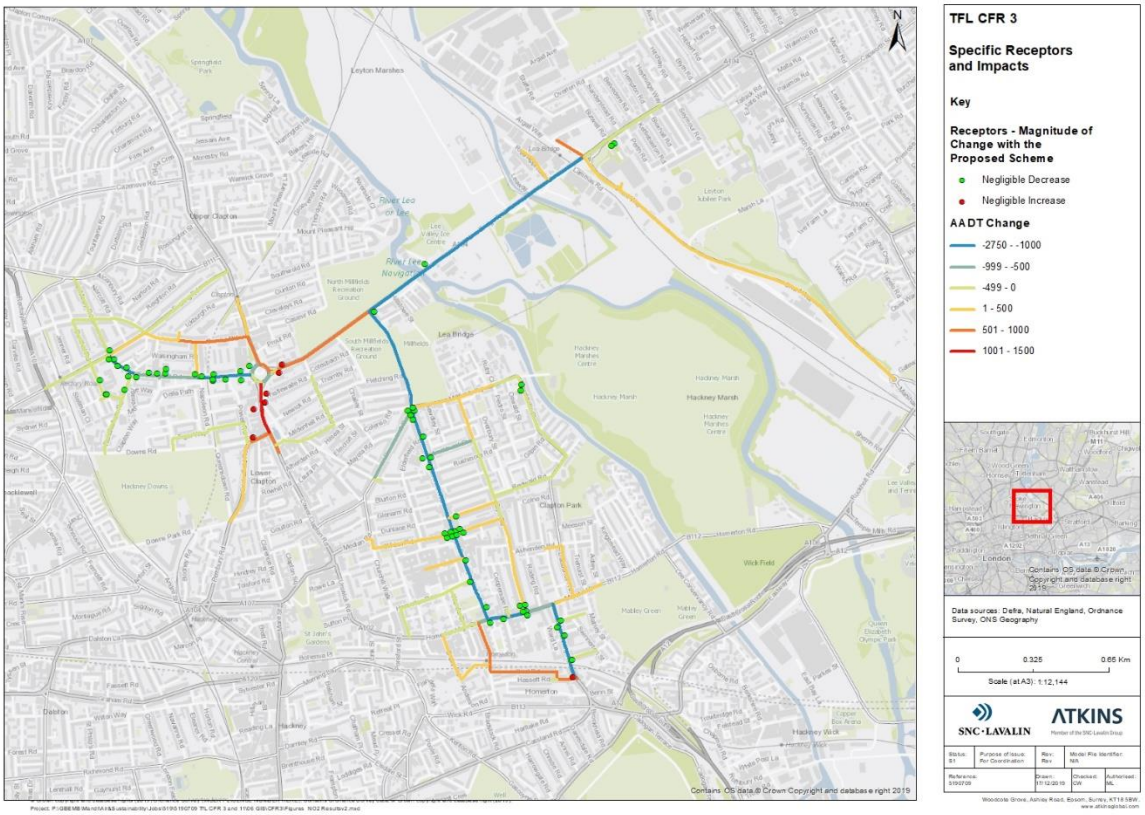


Table 12 - Annual Mean NO_2 Concentrations (µg/m^3) and Impact

Receptor ID	2021 Without Proposed Scheme	2021 With Proposed Scheme	Change	Impact of Change
R1	26.9	26.2	-0.7	Negligible
R2	27.7	26.1	-1.6	Negligible
R3	26.1	25.9	-0.2	Negligible
R4	25.7	25.2	-0.5	Negligible
R5	26.1	26.0	-0.1	Negligible
R6	25.8	25.7	-0.1	Negligible
R7	27.6	27.5	-0.1	Negligible
R8	27.8	27.6	-0.2	Negligible
R9	30.1	30.5	0.4	Negligible
R10	25.2	24.8	-0.4	Negligible
R11	26.1	25.8	-0.3	Negligible
R12	25.8	25.6	-0.2	Negligible
R13	25.9	25.7	-0.2	Negligible
R14	26.3	26.0	-0.3	Negligible
R15	26.5	26.4	-0.1	Negligible
R16	26.4	26.2	-0.2	Negligible
R17	25.5	25.3	-0.2	Negligible
R18	25.6	25.4	-0.2	Negligible
R19	26.2	26.0	-0.2	Negligible
R20	27.5	27.3	-0.2	Negligible
R21	25.8	25.7	-0.1	Negligible
R22	30.7	31.2	0.5	Negligible
R23	24.4	24.3	-0.1	Negligible
R24	25.0	24.8	-0.2	Negligible
R25	26.1	25.7	-0.4	Negligible
R26	26.5	26.0	-0.5	Negligible
R27	26.3	25.9	-0.4	Negligible
R28	29.7	29.3	-0.4	Negligible
R29	25.8	25.7	-0.1	Negligible
R30	25.7	25.6	-0.1	Negligible
R31	25.7	25.6	-0.1	Negligible
R32	25.6	25.5	-0.1	Negligible
R33	25.3	25.2	-0.1	Negligible
R34	26.7	26.4	-0.3	Negligible
R35	27.4	26.9	-0.5	Negligible
R36	27.3	27.1	-0.2	Negligible
R37	26.8	26.8	<0.1	Negligible
R38	24.2	24.1	-0.1	Negligible
R39	28.7	28.6	-0.1	Negligible
R40	30.5	30.2	-0.3	Negligible
R41	25.9	25.7	-0.2	Negligible
R42	27.3	27.0	-0.3	Negligible

Receptor ID	2021 Without Proposed Scheme	2021 With Proposed Scheme	Change	Impact of Change
R43	25.4	25.3	-0.1	Negligible
R44	25.5	25.3	-0.2	Negligible
R45	26.6	26.7	0.1	Negligible
R46	27.1	27.0	-0.1	Negligible
R47	27.1	27.0	-0.1	Negligible
R48	26.9	27.0	0.1	Negligible
R49	25.4	25.2	-0.2	Negligible
R50	26.0	25.8	-0.2	Negligible
R51	26.2	26.0	-0.2	Negligible
R52	24.8	24.7	-0.1	Negligible
R53	26.4	26.1	-0.3	Negligible
R54	25.5	25.4	-0.1	Negligible
R55	25.1	25.0	-0.1	Negligible
R56	24.8	24.7	-0.1	Negligible
R57	25.7	25.7	<0.1	Negligible
R58	25.2	25.1	-0.1	Negligible
R59	24.8	24.6	-0.2	Negligible
R60	25.4	25.2	-0.2	Negligible
R61	25.1	25.0	-0.1	Negligible
R62	23.0	22.9	-0.1	Negligible
R63	22.5	22.5	<0.1	Negligible
R64	25.3	25.1	-0.2	Negligible
R65	25.0	24.7	-0.3	Negligible
R66	24.2	23.9	-0.3	Negligible
R67	25.9	25.2	-0.7	Negligible
R68	24.5	24.2	-0.3	Negligible
R69	25.2	24.6	-0.6	Negligible

The change in concentrations presented has been calculated from rounded Without and With Proposed Scheme concentrations

Table 13 - Annual Mean PM_{10} Concentrations (µg/m^3), Exceedances of Daily Mean and Impact

Receptor ID	2022 Without Proposed Scheme	2022 With Proposed Scheme	Change	Impact of Change
R1	18.9 (2)	18.9 (2)	<0.1	Negligible
R2	19.1 (2)	19.1 (2)	<0.1	Negligible
R3	18.5 (2)	18.5 (2)	<0.1	Negligible
R4	18.4 (2)	18.3 (2)	-0.1	Negligible
R5	18.3 (2)	18.3 (2)	<0.1	Negligible
R6	18.4 (2)	18.4 (2)	<0.1	Negligible
R7	18.9 (2)	18.9 (2)	<0.1	Negligible
R8	18.9 (2)	18.9 (2)	<0.1	Negligible
R9	19.7 (3)	19.8 (3)	0.1	Negligible
R10	18.3 (2)	18.2 (2)	-0.1	Negligible
R11	18.6 (2)	18.6 (2)	<0.1	Negligible

Receptor ID	2022 Without Proposed Scheme	2022 With Proposed Scheme	Change	Impact of Change
R12	18.6 (2)	18.5 (2)	-0.1	Negligible
R13	18.6 (2)	18.5 (2)	-0.1	Negligible
R14	18.7 (2)	18.6 (2)	-0.1	Negligible
R15	18.7 (2)	18.7 (2)	<0.1	Negligible
R16	18.7 (2)	18.6 (2)	-0.1	Negligible
R17	18.4 (2)	18.4 (2)	<0.1	Negligible
R18	18.4 (2)	18.4 (2)	<0.1	Negligible
R19	18.5 (2)	18.5 (2)	<0.1	Negligible
R20	18.9 (2)	18.8 (2)	-0.1	Negligible
R21	18.4 (2)	18.4 (2)	<0.1	Negligible
R22	19.7 (3)	19.8 (3)	0.1	Negligible
R23	18.1 (1)	18.1 (1)	<0.1	Negligible
R24	18.2 (2)	18.2 (2)	<0.1	Negligible
R25	18.7 (2)	18.6 (2)	-0.1	Negligible
R26	18.7 (2)	18.6 (2)	-0.1	Negligible
R27	18.7 (2)	18.6 (2)	-0.1	Negligible
R28	19.1 (2)	19 (2)	-0.1	Negligible
R29	18.6 (2)	18.5 (2)	-0.1	Negligible
R30	18.5 (2)	18.5 (2)	<0.1	Negligible
R31	18.5 (2)	18.5 (2)	<0.1	Negligible
R32	18.5 (2)	18.5 (2)	<0.1	Negligible
R33	18.5 (2)	18.4 (2)	-0.1	Negligible
R34	18.8 (2)	18.7 (2)	-0.1	Negligible
R35	19 (2)	18.8 (2)	-0.2	Negligible
R36	18.8 (2)	18.8 (2)	<0.1	Negligible
R37	18.8 (2)	18.8 (2)	<0.1	Negligible
R38	18 (1)	18 (1)	<0.1	Negligible
R39	19.4 (3)	19.3 (3)	-0.1	Negligible
R40	19.8 (3)	19.8 (3)	<0.1	Negligible
R41	19.3 (3)	19.3 (3)	<0.1	Negligible
R42	19 (2)	18.9 (2)	-0.1	Negligible
R43	18.3 (2)	18.3 (2)	<0.1	Negligible
R44	18.4 (2)	18.3 (2)	-0.1	Negligible
R45	19.4 (3)	19.4 (3)	<0.1	Negligible
R46	18.6 (2)	18.6 (2)	<0.1	Negligible
R47	18.6 (2)	18.6 (2)	<0.1	Negligible
R48	19 (2)	19 (2)	<0.1	Negligible
R49	18.3 (2)	18.3 (2)	<0.1	Negligible
R50	18.5 (2)	18.5 (2)	<0.1	Negligible
R51	18.5 (2)	18.5 (2)	<0.1	Negligible
R52	18.2 (2)	18.2 (2)	<0.1	Negligible
R53	18.6 (2)	18.5 (2)	-0.1	Negligible

Receptor ID	2022 Without Proposed Scheme	2022 With Proposed Scheme	Change	Impact of Change
R54	18.3 (2)	18.3 (2)	<0.1	Negligible
R55	18.2 (2)	18.2 (2)	<0.1	Negligible
R56	18.2 (2)	18.1 (1)	-0.1	Negligible
R57	18.4 (2)	18.4 (2)	<0.1	Negligible
R58	18.3 (2)	18.3 (2)	<0.1	Negligible
R59	18.2 (2)	18.1 (1)	-0.1	Negligible
R60	18.5 (2)	18.4 (2)	-0.1	Negligible
R61	18.4 (2)	18.4 (2)	<0.1	Negligible
R62	17.6 (1)	17.6 (1)	<0.1	Negligible
R63	16.7 (1)	16.7 (1)	<0.1	Negligible
R64	18.3 (2)	18.3 (2)	<0.1	Negligible
R65	18.3 (2)	18.3 (2)	<0.1	Negligible
R66	17.9 (1)	17.8 (1)	-0.1	Negligible
R67	18.3 (2)	18.1 (1)	-0.2	Negligible
R68	17.9 (1)	17.9 (1)	<0.1	Negligible
R69	18.1 (1)	18 (1)	-0.1	Negligible

The change in concentrations presented has been calculated from rounded Without and With Proposed Scheme concentrations.

Table 14 - Annual Mean $PM_{2.5}$ Concentrations (µg/m^3) and Impact

Receptor ID	2022 Without Proposed Scheme	2022 With Proposed Scheme	Change	Impact of Change
R1	12.6	12.6	<0.1	Negligible
R2	12.7	12.7	<0.1	Negligible
R3	12.4	12.3	-0.1	Negligible
R4	12.3	12.2	-0.1	Negligible
R5	12.2	12.2	<0.1	Negligible
R6	12.3	12.3	<0.1	Negligible
R7	12.6	12.6	<0.1	Negligible
R8	12.6	12.6	<0.1	Negligible
R9	13.1	13.1	<0.1	Negligible
R10	12.2	12.2	<0.1	Negligible
R11	12.5	12.5	<0.1	Negligible
R12	12.5	12.5	<0.1	Negligible
R13	12.5	12.5	<0.1	Negligible
R14	12.6	12.5	-0.1	Negligible
R15	12.5	12.5	<0.1	Negligible
R16	12.5	12.4	-0.1	Negligible
R17	12.3	12.3	<0.1	Negligible
R18	12.3	12.3	<0.1	Negligible
R19	12.4	12.4	<0.1	Negligible
R20	12.6	12.5	-0.1	Negligible

R21	12.3	12.3	<0.1	Negligible
R22	13.1	13.1	<0.1	Negligible
R23	12.1	12.1	<0.1	Negligible
R24	12.2	12.2	<0.1	Negligible
R25	12.5	12.5	<0.1	Negligible
R26	12.6	12.5	-0.1	Negligible
R27	12.6	12.5	-0.1	Negligible
R28	12.7	12.6	-0.1	Negligible
R29	12.5	12.5	<0.1	Negligible
R30	12.5	12.5	<0.1	Negligible
R31	12.5	12.5	<0.1	Negligible
R32	12.5	12.5	<0.1	Negligible
R33	12.4	12.4	<0.1	Negligible
R34	12.6	12.6	<0.1	Negligible
R35	12.7	12.6	-0.1	Negligible
R36	12.6	12.5	-0.1	Negligible
R37	12.7	12.6	-0.1	Negligible
R38	12.1	12.1	<0.1	Negligible
R39	12.9	12.9	<0.1	Negligible
R40	13.2	13.2	<0.1	Negligible
R41	12.8	12.7	-0.1	Negligible
R42	12.7	12.7	<0.1	Negligible
R43	12.3	12.3	<0.1	Negligible
R44	12.3	12.3	<0.1	Negligible
R45	12.8	12.8	<0.1	Negligible
R46	12.4	12.4	<0.1	Negligible
R47	12.4	12.4	<0.1	Negligible
R48	12.5	12.5	<0.1	Negligible
R49	12.3	12.3	<0.1	Negligible
R50	12.4	12.3	-0.1	Negligible
R51	12.4	12.4	<0.1	Negligible
R52	12.2	12.2	<0.1	Negligible
R53	12.4	12.4	<0.1	Negligible
R54	12.3	12.3	<0.1	Negligible
R55	12.2	12.2	<0.1	Negligible
R56	12.2	12.2	<0.1	Negligible
R57	12.3	12.3	<0.1	Negligible
R58	12.2	12.2	<0.1	Negligible
R59	12.2	12.1	-0.1	Negligible
R60	12.4	12.4	<0.1	Negligible
R61	12.4	12.4	<0.1	Negligible
R62	11.8	11.8	<0.1	Negligible

R63	11.3	11.3	<0.1	Negligible
R64	12.3	12.2	-0.1	Negligible
R65	12.3	12.3	<0.1	Negligible
R66	12.0	11.9	-0.1	Negligible
R67	12.2	12.1	-0.1	Negligible
R68	12.0	12.0	<0.1	Negligible
R69	12.1	12.0	-0.1	Negligible

The change in concentrations presented has been calculated from rounded Without and With Proposed Scheme concentrations.