Archway Gyratory

Noise and Air Quality Impact Assessment

February 2016

Ref: 47072870/02

Prepared for:

Transport for London

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1. INTRODUCTION

1.1 Introduction

[redacted] has been appointed by Transport for London (TfL) to assess the potential impact of the proposed works to the Archway Gyratory junction on traffic noise levels and air pollutant concentrations. Traffic flows at the junction will be affected as the works will change the configuration and range of movements possible between the various arms of the junction.

The scope of this assessment is as follows:

- identify the closest potentially sensitive receptors to the junction;
- predict road traffic noise levels at a selection of identified receptors, both with and without the junction works for the anticipated year of opening (assumed to be 2017);
- predict concentrations of the main road traffic pollutants nitrogen dioxide (NO_2), particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$) at a selection of identified receptors both with and without the junction works, for the anticipated year of opening (assumed 2017);
- predict concentrations of the main road traffic pollutants NO_2, PM_{10} and $PM_{2.5}$ at a selection of identified receptors both with and without the junction works, for 2020, when the London Ultra Low Emission Zone (ULEZ) is in operation; and
- predict annual emissions of carbon both with and without the junction works for the anticipated scheme opening year (assumed to be 2017).

1.2 Site Description

The junction under consideration is the A1 Archway junction, within the London Borough of Islington (LBI). The junction currently consists of a gyratory system with clockwise movement of traffic and has 5 arms.

To the south-west of Archway Gyratory is Archway Tower, adjacent to Archway London Underground Station on the west side of the A400 Junction Road. This building consists of 16 floors of office space but is proposed to be redeveloped for residential use on floors 2-16. Also on the south-west side of the gyratory is Hamlyn House consisting of retail premises on the ground floor. The upper floors were previously office space but the building is currently being redeveloped as a Premier Inn hotel.

To the south on the A400 Junction Road the street generally consists of commercial and retail premises on the ground floor with several floors of residential above.

To the north-west of the gyratory along the B519 Highgate Hill there are residential flats on the south side of the street close to the junction, and also on the north side further from the junction. Also to the west of the gyratory, between Highgate Hill and Archway Road there is Archway Campus. These buildings are currently unoccupied and being sold by University College London UCL and Middlesex Universities.

To the north of the gyratory, Archway Park is located to the east of the A1 Archway Road, and the north-east arm of the gyratory. Further north there are residential properties on both sides of the A1 Archway Road.

To the north-east residential properties are located along St John's Way, extending along the south-east side of the gyratory which connects onto Sandridge Street.

To the south-east the A1 Holloway Road predominantly consists of retail premises on the ground floor with several floors of residential properties above.

Vorley Road and MacDonald Road are located to the south west of Archway Gyratory and link the A400 Junction Road with the B519 Highgate Hill. A bus stand is currently situated adjacent to these roads.

Archway Close and Flower Mews run through the centre of the gyratory from the south-east to the north-east arm. Both streets consist of commercial or retail premises on the ground floor with residential properties above. The Archway Tavern sits on the west corner.

A location plan is provided in **Figure 1** and various site photographs in Appendix A. The various buildings selected as receptors for the assessment (1 to 30) are also illustrated in **Figure 1**.

1.3 Proposed Scheme

The main works proposed at the Archway Gyratory is the removal of the south-west section of the junction (A1) between A400 Junction Road and B519 Highgate Hill. The proposed scheme also removes the one-way gyratory system and replaces it with two-way traffic operation. Vehicular access to Archway Close will be blocked and the one-way traffic direction of Flower Mews will be reversed. One-way movement of traffic on MacDonald Road and Vorley Road will also be reversed, and bus stands will be relocated to Archway Road. Changes to the position of the edge of the carriageway relative to the adjacent buildings are also proposed, in particular on the north-east and north corners of the junction adjacent to Archway Methodist Central Hall and properties on Flower Mews, respectively. Various changes to cycle lanes are also proposed.

The proposed scheme layout is overlaid on the existing road layout in Figure 1, all figures reference in the text to follow are provided at the end of this report.

2. PLANNING POLICY AND LEGISLATION

2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) published in March 2012 (Department for Communities and Local Government, 2012), paragraph 109 of the NPPF states that:

"The planning system should contribute to and enhance the natural and local environment by:

preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability…"

There are both national and local policies for the control of air pollution and local action plans for the management of local air quality within the LBI area. Paragraph 124 of the NPPF states that:

"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

With regard to noise the NPPF states that planning policies and decisions should aim to:

- *"avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established [subject to the provisions of the Environmental Protect Act 1990 and other relevant law]; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

2.2 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) (Defra 2010) sets out the long term vision of the government's noise policy, which is to "promote good health and a good quality of life through the effective management of noise within the context of policy on sustainable development".

This long term vision is supported by three aims:

- *"avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvements of health and quality of life."*

The long term policy vision and aims are designed to enable decisions to be made regarding what is an acceptable noise burden to place on society.

The 'Explanatory Note' within the NPSE provides further guidance on defining 'significant adverse effects' and 'adverse effects' using the concepts:

- No Observed Effect Level (NOEL) - the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established;
- Lowest Observed Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

The three aims can therefore be interpreted as follows:

- The first aim is to avoid noise levels above the SOAEL.
- The second aim considers situations where noise levels are between the LOAEL and SOAEL. In such circumstances, all reasonable steps should be taken to mitigate and minimise the effects. However this does not mean that such adverse effects cannot occur.
- The third aim considers situations where noise levels are between the LOAEL and NOEL. In these circumstances, where possible, reductions in noise levels should be sought through the pro-active management of noise.

The NPSE recognises that it is not possible to have single objective noise-based measures that define the SOAEL, LOAEL and NOEL that is applicable to all sources of noise in all situations. The levels are likely to be different for different noise sources, receptors and at different times of the day.

2.3 Planning Practice Guidance (PPG)

In March 2014, the Department for Communities and Local Government (DCLG, 2014) released its Planning Practice Guidance (PPG) web-based resource to support the NPPF.

With regard to noise the guidance advises that local planning authorities' should consider:

- whether or not a significant adverse effect is occurring or likely to occur;
- whether or not an adverse effect is occurring or likely to occur; and
- whether or not a good standard of amenity can be achieved.

This guidance introduced the additional concepts of NOAEL (No Observed Adverse Effect Level), and UAEL (Unacceptable Adverse Effect Level).

Factors to be considered in determining if noise is a concern are identified including the absolute noise level of the source, the existing ambient noise climate, time of day, frequency of occurrence, duration, character of the noise and cumulative impacts.

For air quality the PPG provides a summary of the air quality issues set out in the National Planning Policy Framework and goes on to note that the assessment should include the following information:

- The existing air quality in the study area (existing baseline)

- the future air quality without the development in place (future baseline), and
- the future air quality with the development in place (with mitigation).

The guidance then advises that the application should proceed to decision with appropriate planning conditions or planning obligation, if the proposed development (including mitigation) would not lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or fail to comply with the requirements of the Habitats Regulations.

2.4 National Air Quality Strategy

The Clean Air for Europe (CAFE) programme revisited the management of Air Quality within the EU and replaced the EU Framework Directive 96/62/EC (Council of European Communities, 1996), its associated Daughter Directives 1999/30/EC (Council of European Communities, 1999), 2000/69/EC (Council of European Communities, 2000), 2002/3/EC (Council of European Communities, 2002), and the Council Decision 97/101/EC (Council of European Communities, 1997) with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC (Council of European Communities, 2008).

Directive 2008/50/EC (Council of European Communities, 2008) is currently transcribed into UK legislation by the Air Quality Standards Regulations 2010 (H.M. Government, 2010), which came into force on 11th June 2010. These limit values are binding on the UK and have been set with the aim of avoiding, preventing or reducing harmful effects on human health and on the environment as a whole.

The UK National Air Quality Strategy (Defra, 2000) was initially published in 2000, under the requirements of the Environment Act 1995 (H.M. Government 1995). The most recent revision of the strategy (Defra, 2007) sets objective values for key pollutants as a tool to help Local Authorities manage local air quality improvements in accordance with the EU Air Quality Framework Directive. Some of these objective values have subsequently been laid out within the Air Quality (England) Regulations 2000 (H.M. Government, 2000) and later amendments (H.M. Government, 2002).

The air quality objective values referred to below have been set down in regulation solely for the purposes of local air quality management. Under the local air quality management regime, LBI has a duty to carry out regular assessments of air quality against the objective values and if it is unlikely that the objective values will be met in the given timescale, they must designate an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) with the aim of achieving the objective values. The boundary of an AQMA is set by the governing local authority to define the geographical area that is to be subject to the management measures to be set out in a subsequent action plan. Consequently it is not unusual for the boundary of an AQMA to include within it, relevant locations where air quality is not at risk of exceeding an air quality objective.

The UK's national air quality objective values for the pollutants of relevance to this assessment are displayed in Table 1.

Table 1: Air Quality Objective Values

Pollutant	Averaging period	Value	Maximum Permitted Exceedences	Target data
Nitrogen Dioxide (NO_2)	Annual Mean	40 µg/m^3	None	31/12/05
	Hourly Mean	200 µg/m^3	18 times per year	31/12/05

Pollutant	Averaging period	Value	Maximum Permitted Exceedences	Target data
Particulate Matter (PM_{10})	Annual Mean	40 µg/m^3	None	31/12/04
	24-hour	50 µg/m^3	35 times per year	31/12/04
Fine Particulate Matter ($PM_{2.5}$)	Annual Mean	25 µg/m^3	None	2020

2.5 Regional Planning Policy

The following regional planning policies apply to noise and/or air quality:

- The Greater London Authority (GLA) adopted its London Plan in July 2011 (GLA, 2011). Policy 7.14 emphasises the need to achieve reductions in pollutant emissions and public exposure to pollution. Policy 7.15: Reducing Noise and Enhancing Soundscapes states that development proposals should seek to reduce noise by:
  - "Minimising the existing and potential adverse impacts of noise on, from, within, or in the vicinity of, development proposals;
  - Separating new noise sensitive development from major noise sources wherever practicable through the use of distance, screening, or internal layout in preference to sole reliance on sound insulation; and
  - Promoting new technologies and improved practices to reduce noise at source."
- Revised Early Minor Alterations to the London Plan (REMA) (GLA, 2013) published in October 2013 sets out changes to the text supporting policy 7.14 'Improving Air Quality'. It confirms the intention of the Mayor to support Local Authorities with the development of Supplementary Planning Guidance to aid the determination of planning applications and to assist in identifying appropriate mitigation measures.
- The 2010 Air Quality Strategy for London (GLA, 2010a) targets 'air quality neutral' developments.
- The London Plan includes a policy relating to 'air quality neutral development' and aims to bring forward developments that are air quality neutral or better and that do not degrade air quality in areas where EU limit values (or air quality objectives) are not currently achieved. The "Air Quality Neutral Planning Support Update: GLA 80371" (Air Quality Consultants and Environ, 2014) was published in April 2014 to accompany the 2014 publication of the GLA's Sustainable Design and Construction Supplementary Planning Guidance (SPG) (GLA, 2014). It provides specialist consultants with a methodology to undertake an 'air quality neutral' assessment, as well as emission benchmarks for buildings and transport, against which the predicted values for the considered development will be compared.
- City Soundings: The Mayor's London Ambient Noise Strategy (GLA, 2004) aims to minimise the adverse impacts of noise on people living, working in and visiting London by using the best available practices and technologies within a sustainable development framework. The Strategy aims to work towards more compact city development, while minimising noise. This requires careful consideration of the adverse impact of noise on, from, within or in proximity to a development. With regard to road traffic noise, action to

maintain road surfaces, use quieter road surfacing, smooth vehicle flows, encourage quieter vehicles and encourage walking and cycling is proposed.

- The Mayor's Transport Strategy (GLA, 2010b) contains several transport related measures aimed at improving noise and/or air quality, including engineering and design solutions, and traffic management and signal control techniques.

- TfL produced the 'Improving the Health of Londoners Transport Action Plan' (TfL 2014) in 2014. It highlights the plans for reducing noise in the Mayors Transport Strategy and also a number of schemes aimed at reducing noise from fleet operators and road freight. With regard to air quality the Action Plan recognizes that poor air quality is an issue particularly inner London and that road transport is a key source. A range of measures are outlined to improve air quality including tightening of Low Emission Zone standards for HGVs, buses and coaches, use of hybrid buses and retiring the oldest and most polluting taxis.

2.6 Local Planning Policy

The London Borough of Islington (LBI) has published a series of local planning policy documents:

- Islington Core Strategy (LBI, 2011)

The Islington Core Strategy (LBI, 2011) *"provides the local picture. It sets set out where and how change will happen in Islington, indicates what supporting infrastructure will be needed, and how any environmental impact can be reduced"*. There are no specific policies with regard to noise, however, it acknowledges that noise can have a significant effect on the environment and on quality of life, and that in Islington transport is one of the principal sources of noise.

There are no specific policies regarding air quality, however the Sustainability Strategic Policy promotes sustainable transport choices, given the crowded nature of Islington's road network and resultant poor air quality.

- Islington Development Management Policies (LBI, 2013):

The Development Management Policies are used to determine applications for planning permission in Islington alongside strategic and spatial policies in the Core Strategy and other policies within the Development Plan. The policies are aimed at achieving development that helps deliver the vision and objectives set out in Islington's Core Strategy, to bring forward sustainable development. A number of policies on housing, heritage, entertainment, retail, industrial and commercial uses and open spaces include consideration of noise impacts. Additionally, policies on healthy development, sustainable design and construction consider air quality impacts. With specific regard to transport, Policy DM8.2 part vi) requires transport projects to *"have no significant negative impacts from transport arrangements on the local and wider environment"*. The environment is defined as including "impacts that would affect amenity, air quality and noise".

2.7 Local Air Quality Management

Under the requirements of Part IV of the Environment Act (H.M. Government, 1995), LBI have carried out a phased review and assessment of local air quality within their district (LBI, 2014a).

The whole Borough was declared as an AQMA for annual mean and hourly NO2 concentrations and 24-hr mean PM_{10} concentrations in 2001 on the basis of a detailed assessment.

An Air Quality Strategy was published by LBI in 2014 (LBI, 2014b), replacing the 2003 Air Quality Action Plan. This document presents 45 actions which the council is taking to improve air quality in Islington. Fifteen of the measures focus on transport, which is the main source of emissions in Islington.

With regards to planning and development, LBI requires that *"…all new developments to require air quality impact assessments with developers required to meet an "air quality neutral" standard"*.

Actions regarding highways state that the council will:

- *"Ensure that contractors conducting works to the Highways adhere to best practice measures to reduce local air pollution such as no idling and dust suppression techniques"; and*
- *"Continue working with TfL to ensure that all new road improvements are considerate of walking and cycling to create safer, cleaner spaces for active travel."*

2.8 Ultra Low Emission Zone (ULEZ)

An Ultra Low Emission Zone (ULEZ) is being introduced from 2020 to reduce emissions of NO_2, PM_{10} and $PM_{2.5}$ in central London. All vehicles (cars, motorcycles, vans, minibuses, buses, coaches, HGVs, buses and coaches) will be required to meet specific exhaust emission standards or pay a fee to travel in central London. This charge will apply all the time and is in addition to the current congestion charge and Low Emission Zone (LEZ) requirements.

3. METHODOLOGY

3.1 Traffic Data

Both the noise and air quality predictions are based on traffic data for Archway Gyratory and surrounding roads for the proposed year of opening (2017). Data, in the form of traffic flows, composition (percentage heavy duty vehicles, including buses and coaches) and speed, for the existing junction layout and the proposed layout, have been provided by Steer Davies Gleave, on behalf of TfL. Details of the traffic data are provided in Appendix B.

Steer Davies Gleave have confirmed that the traffic data supplied for the year of opening do-minimum and do-something scenarios is also representative of traffic conditions in 2020, which is modelled to quantify potential impacts as a result of the scheme, with the London ULEZ in operation.

3.2 Receptors

The air quality and traffic noise predictions have been completed for a selection of the closest buildings in the vicinity of the Archway Gyratory, and the surrounding arms of the junction.

The main focus is on residential buildings, as these are considered most sensitive to noise and air quality. However, a range of other buildings are also considered including commercial office and retail premises as appropriate. The selected receptors were agreed with TfL. The receptors are detailed below in Table 2 and are also presented on Figure 1. All the listed receptors include some existing or proposed residential use and therefore are potentially sensitive to changes in noise levels and air quality. For annual mean pollutant concentrations residential properties are considered to be sensitive. For short-term limits (e.g. hourly NO_2 limit), in addition to residential properties, there are other locations that may be considered sensitive as people can realistically be expected to be present for an extended period of time, but not to necessarily live there. These types of receptors include educational buildings and hotels.

In September 2015, [redacted] prepared a Technical Note summarising the effect of the proposed scheme on the Vorley Road/MacDonald Road area, where the Archway Children's Centre is located following local concerns. That assessment is provided in Appendix C of this report.

Table 2: Selected Receptors

Receptor		Façade Direction	No. of Floors	Use	Potentially Sensitive?	
					Noise	Air Quality
1	Junction Road	W	3	Floor 1 retail, floors 2-3 residential	Y	Y
2	Archway Tower, Junction Road & Holloway Road	N	16	Floors 1-16 currently offices, floor 2 upwards proposed for future residential	Y	Y
3	Archway Tower, Junction Road & Holloway Road	N	16	Floors 1-16 currently offices, floor 2 upwards proposed for future residential	Y	Y
4	Flowers Mews	SW	3	Floor 1 retail, floors 2-3 residential	Y	Y
5	Archway Tower, Holloway Road	N	16	Floor 1-16 currently offices, floor 2 upwards proposed for future residential	Y	Y
6	A1 & Highgate Hill	NW	3	Floor 1 commercial, floors 2-3 residential	Y	Y
7	Highgate Hill	NE	4	Floors 1-4 residential	Y	Y
8	Flowers Mews	NW	3	Floor 1 retail, floors 2-3 residential	Y	Y
9	Archway Road	NE	5	Floors 1-5 residential	Y	Y
10	Archway Road	SW	9	Floors 1-9 residential	Y	Y
11	End of Flowers Mews	NW	2	Floors 1-2 residential	Y	Y
12	St John's Way	SW	6	Floors 1-6 residential	Y	Y
13	St John's Way	SE	3	Floors 1-3 residential	Y	Y
14	St John's Way	NW	4	Floors 1-4 residential	Y	Y
15	Archway Road	NE	3	Floors 1-3 residential	Y	Y

Receptor		Façade Direction	No. of Floors	Use	Potentially Sensitive?	
					Noise	Air Quality
16	Harberton Road	SW	2	Floors 1-2 residential	Y	Y
17	St John's Way & Archway Road	NW	2	Floors 1-2 residential	Y	Y
18	St John's Way & Archway Road	NW	2	Floors 1-2 residential	Y	Y
19	St John's Way & Archway Road	NW	2	Floors 1-2 residential	Y	Y
20	Holloway Road	SW	3	Floor 1 retail, floors 2-3 residential	Y	Y
21	Junction Road	W	3	Floor 1 retail, floors 2-3 residential	Y	Y
22	Junction Road	E	3	Floor 1 retail, floors 2-3 residential	Y	Y
23	Holloway Road	S	3	Floor 1 retail, floors 2-3 residential	Y	Y
24	Holloway Road	NE	3	Floor 1 retail, floors 2-3 residential	Y	Y
25	Holloway Road	NE	3	Floor 1 retail, floors 2-3 residential	Y	Y
26	Junction Road, Holloway Road	W	3	Floors 1-2 commercial, floor 3 residential	Y	Y
27	Vorley Road	N	4	Floors 1-4 residential	Y	Y
28	Highgate Hill	NE	3	Floors 1-3 residential	Y	Y
29	Highgate Hill	SW	4	Floors 1-4 residential	Y	Y
30	Hamlyn House	N	9	Floor 1 retail, floors 2-9 proposed hotel	Y	Y

3.3 Traffic Noise Prediction Methodology

Noise from a flow of road traffic is generated by both vehicles' engines and the interaction of tyres with the road surface. The traffic noise level at a receptor, such as an observer at the roadside or occupants of a building, is influenced by a number of factors including traffic flow, speed, composition (percentage heavy duty vehicles (% HDV)), gradient, type of road surface, distance from the road and the presence of any obstructions between the road and the receptor.

Noise from a stream of traffic is not constant; therefore, to assess the noise impact a single figure estimate of the overall noise level is necessary. The index adopted by the Government in 'The Calculation of Road Traffic Noise' (CRTN) (DoE, 1994) to assess traffic noise is LA10,18h. This value is determined by taking the highest 10 % of noise readings in each of the eighteen 1 hour periods between 06.00 and 24.00, and then calculating the arithmetic mean. A reasonably good correlation has been shown to exist between this index and residents' perception of traffic noise over a wide range of exposures.

CRTN provides the standard methodology for predicting the LA10,18h road traffic noise level in the UK. Noise levels are predicted at a point 1 m (measured horizontally externally) from the façade of the building and therefore are 'façade' rather than 'free-field' levels. Façade levels include the reflection of noise from the building façade. CRTN applies a standard 'façade correction' of +2.5 dB to convert 'free-field' levels (unaffected by façade reflections) to 'façade' levels (including façade reflections).

Details of the existing and proposed road layout have been provided by TfL, along with corresponding traffic data and details of the existing and proposed road surfaces. Based on the provided information a noise model of the existing situation and the proposed situation in the scheme opening year has been developed using the SoundPLAN (v7.3) noise mapping software. SoundPLAN implements the standard UK CRTN road traffic noise prediction methodology. Further details of the traffic noise modelling are provided in Appendix D.

3.4 Air Quality Overview of Methodology

There is currently no statutory guidance on the method by which an air quality impact assessment should be undertaken. Several non-statutory bodies have published their own guidance relating to air quality and development control (EPUK, 2010) or to the assessment of the significance of air quality effects (IAQM, 2009).

This section will explain the methods used to assess the significance of the impact of road traffic exhaust emissions associated with the proposed junction works.

Potentially affected air quality sensitive receptors have been identified and the magnitude of the change in air quality statistics at each receptor has been considered. The methods used to determine the significance of effect associated with air quality impacts are described in Section 3.8.

3.4.1 *Road Traffic Emissions*

The incomplete combustion of fuel in vehicle engines results in the presence of hydrocarbons (HC) such as benzene and 1,3-butadiene, and sulphur dioxide (SO_2), carbon monoxide (CO), PM_{10} and $PM_{2.5}$ in exhaust emissions. In addition, at the high temperatures and pressures found within vehicle engines, some of the nitrogen in the air and the fuel is oxidised to form NO_X, mainly in the form of nitric oxide (NO), which is then converted to NO_2 in the atmosphere. NO_2 is associated with adverse effects on human health. Better emission control

technology and fuel specifications are expected to reduce emissions per vehicle in the long term.

Although SO_2, CO, benzene and 1,3-butadiene are also present in motor vehicle exhaust emissions, detailed consideration of the associated impacts on local air quality is not considered relevant in the context of this proposal. Road traffic emissions of these substances have been reviewed by LBI and nowhere within the administrative area is at risk of exceeding these objectives. The development proposals would not be capable of compromising the achievement of the relevant air quality objectives for the protection of human health. Emissions of SO_2, CO, benzene and 1, 3-butadiene from road traffic are therefore not considered further within this assessment.

Exhaust emissions from road vehicles affect the concentrations of principal pollutants of concern, NO_2 PM_{10} and $PM_{2.5}$, at sensitive receptors in the vicinity of the development. Therefore, these pollutants will be the focus of the assessment of the significance of road traffic impacts.

The magnitude of road traffic emissions for the baseline and with development scenarios are calculated from traffic flow data. The assessment considers the operational phase impact of road traffic emissions at receptors adjacent to roads in the vicinity of the proposed junction works, in both the year of opening (2017) and in 2020, when the London ULEZ will be in operation.

This assessment follows current guidance for the determination of pollutant concentrations, and uses emissions factors for road traffic calculated from Defra's Emission Factor Toolkit (EFT) (Version 6.0.2) (Defra, 2014a). Emission rates for 2013 have been used and are assumed to be conservatively representative of conditions in 2017 and 2020, due to the uncertainty in the rate at which vehicle emissions technology is improving and the evolution of the local vehicle fleet.

The 2020 assessment scenario takes into account the operation of the London ULEZ. Whilst the Archway Gyratory sits well beyond the extent of the ULEZ, the junction is on several bus routes where the buses access the ULEZ and therefore have to be ULEZ compliant. Bus routes 4, 17, 43, 134, 263 and 390 are serviced by double-decker buses and are therefore considered in this assessment to be EURO VI hybrid vehicles.

3.4.2 *Regional Impact Assessment*

The regional assessment considers changes in annual road transport emissions of carbon (C) that may be brought about by the scheme in the opening year, with and without the Scheme.

3.5 Use of Air Quality Measurement Data

LBI undertakes monitoring of NO_2 and PM_{10} concentration within its administrative area, using two automatic monitoring stations; however neither are located within the study area. Data from one diffusion tube is available from the road traffic study area (BIS/01 Archway Close).

3.6 Air Quality Sensitive Receptors

3.6.1 *Receptors Potentially Affected by Operational Emissions*

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

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

Impacts from road traffic have been quantified at 30 existing representative receptors in the vicinity of the junction works and local highway network, where there is the potential for a significant change in road traffic flows. Each of the receptors chosen represents the maximum level of exposure that could be experienced at other receptors in their vicinity. The receptors are listed in Table 2 and their location is displayed on Figure 1.

3.7 Prediction of Air Quality Impacts

This assessment has used the latest version of dispersion model software 'ADMS-Roads' (v3.2.4.0) to quantify baseline pollution levels at selected receptors due to road traffic emissions. ADMS-Roads is a modern dispersion model that has an extensive published track record of use in the UK for the assessment of local air quality impacts, including model validation and verification studies (CERC, 2013).

3.7.1 *Air Quality Dispersion Model Input Data and Model Conditions*

Details of general model conditions are provided in Table 3.

Table 3: General ADMS-Roads Model Conditions

Variables	ADMS-Roads Model Input: Road Traffic Model
Surface roughness at source	1.5m
Minimum Monin-Obukhov length for stable conditions	100m
Terrain types	Flat
Receptor location	x, y coordinates determined by GIS, z = various
Emissions	NO_x, PM_{10}, $PM_{2.5}$
Emission factors	EFT Version 6.0.2 emission factor dataset
Meteorological data	1 year (2013) hourly sequential data from Heathrow Airport meteorological station
Emission profiles	Yes. Hourly profile based on average of one traffic count location within the study area
Receptors	Selected receptors only
Model output	Long-term annual mean NO_x concentrations Long-term annual mean PM_{10} concentrations Long-term annual mean $PM_{2.5}$ concentrations

3.7.2 *Air Quality Emissions Profile*

Hourly traffic data were available for one location within the road traffic study area and therefore an hourly emissions profile was used for road traffic modelling. Hourly traffic counts were provided over a seven day period. Three profiles were determined for weekday traffic (Monday to Friday), Saturday and Sunday.

3.7.3 *Air Quality Meteorological Data*

One year (2013) of hourly sequential observation data from Heathrow Airport meteorological station has been used in this assessment. The station is located approximately 22 km southwest of the proposed development site and experiences meteorological conditions that are representative of those experienced in the LBI area.

3.7.4 *Air Quality Background Data*

Background data for NO_2, PM_{10} and $PM_{2.5}$ concentrations for 2013 have been sourced from Defra's 2011-based background maps (Defra, 2014b) for receptors within the nearest 1km-by-1km grid square. Primary A-roads within the grid square have been removed from the background maps because this road type is explicitly modelled in the assessment. Background data concentrations from 2013 were used for the opening year. Although background concentrations are expected to reduce, this provides a conservative approach. The background data used in this assessment are set out in Table 4. The data suggests that background air quality for NO_2 is below the annual average air quality objective within the study area.

Table 4: Annual Mean Background Pollutant Concentration data

Receptors	Background Grid Reference Centre Point	2013 Annual Mean Background Pollutant Concentrations (µg/m^3)		
		NO_2	PM_{10}	$PM_{2.5}$
R1 – R8, R11 – R12, R17 – R26, R27	529500, 186500	29.9	23.2	15.9
R9 – R10, R13 – R16, R28 – R30	529500, 187500	28.4	22.0	15.2

3.7.5 *Air Quality Model Verification of Road Contribution to Pollutant Concentrations*

Model verification has been informed by monitoring undertaken by LBI. The measurement data are for one location within the study area collected in 2013. Details of the monitoring site used in the verification process, and a summary of that process, are shown in Table 5 below:

Table 5: Summary of bias adjustment process

Diffusion Tube	Monitored Road NO_x (µg/m^3)	Modelled Road NO_x (µg/m^3)	Adjusted Modelled Road NO_x (µg/m^3)
BIS/01 (Archway Close)	52.6	39.4	52.6

Model bias was quantified by comparing the modelled total NO_2 and road NO_X values with the measured NO_2 and road NO_X values for the diffusion tubes. The bias was accounted for by applying the correction factor (1.34) to modelled road NO_X concentrations.

In the absence of PM_{10} and $PM_{2.5}$ monitoring data from within the air quality study area, the factors applied to the primary pollutant NO_2 have also been applied to these primary pollutants.

3.7.6 *Air Quality NO_X to NO_2 Conversion*

To accompany the publication of the guidance document LAQM TG(09), a NO_X to NO_2 converter was made available by Defra as a tool to calculate the road NO2 contribution from modelled road NO_X contributions (Defra, 2012). The tool comes in the form of an MS Excel spreadsheet and uses borough specific data to calculate annual mean concentrations of NO_2 from dispersion model output values of annual mean concentrations of NO_X. This tool was used to calculate the total NO_2 concentrations at receptors from the modelled road NO_X contribution and associated background concentration. Due to the location of the proposed Scheme, the London setting has been selected.

3.7.7 *Air Quality Predicting the Number of Days in which the PM_{10} 24hr-mean Objective is Exceeded*

The guidance document LAQM.TG(03) (Defra, 2003) sets out the method by which the number of days in which the PM10 24-hr objective is exceeded can be obtained based on a relationship with the predicted PM10 annual mean concentration. The most recent guidance LAQM.TG(09) (Defra, 2009) suggests no change to this method. As such, the formula used within this assessment is:

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

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

3.7.8 *Air Quality Predicting the Number of Days in which the NO_2 Hourly Mean Objective is Exceeded*

Research projects completed on behalf of Defra and the Devolved Administrations (Laxen and Marner (2003) and (AEAT, 2008)) have concluded that the hourly mean NO2 objective is unlikely to be exceeded if annual mean concentrations are predicted to be less the 60 µg/m3.

In 2003, Laxen and Marner concluded:

"…local authorities could reliably base decisions on likely exceedances of the 1-hour objective for nitrogen dioxide alongside busy streets using an annual mean of 60 µg/m3 and above."

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

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

Therefore this assessment will evaluate the likelihood of exceeding the hourly mean NO2 objective by comparing predicted annual mean NO_2 concentrations at all receptors to an annual mean equivalent threshold of 60 µg/m^3 NO_2. Where predicted concentrations are

below this value, it can be concluded that the hourly mean NO_2 objective (200 µg/m^3 NO_2 not more than 18 times per year) will be achieved.

3.7.9 *Air Quality Regional Impact Assessment*

This assessment has used the latest version of the Emission Factor Toolkit (v6.0.2) in the form of an MS Excel spreadsheet to quantify annual emissions of carbon from the Scheme due to road traffic emissions.

This tool was used to calculate the total carbon emissions from the Scheme and associated base emissions. An opening year of 2017 was assumed for the Scheme.

3.8 Method for Assessment of Significance

3.8.1 *Traffic Noise*

The assessment of the significance of effect on traffic noise levels at nearby receptors due to the proposed works is based on the guidance in the Design Manual for Roads and Bridges (DMRB) (HA, 2011) regarding the magnitude of traffic noise changes, combined with consideration of the sensitivity of the receptor. Table 6 is adapted from the DMRB classification of the magnitude of impact in the short term i.e. the year of opening.

Table 6: Road Traffic Noise Magnitude of Impact Criteria

Change in traffic noise level $L_{A10,18h}$ dB	Magnitude of Impact
0	No change
0.1-0.9	Imperceptible
1.0-2.9	Small
3.0-4.9	Medium
5.0+	Large

The significance of the effect is determined based on the matrix in Table 7.

Table 7: Road Traffic Noise Significance of Effect Matrix

Sensitivity of Receptor	Magnitude of Impact			
	Large	Medium	Small	Imperceptible
High	Substantial	Moderate	Slight	Negligible
Medium	Moderate	Slight	Negligible	Negligible
Low	Slight	Negligible	Negligible	Negligible
Very Low	Negligible	Negligible	Negligible	Negligible

Residential properties are considered to be of high sensitivity to changes in road traffic noise. Commercial and retail receptors are considered to be of low sensitivity to traffic noise

changes. R1-R29 contain some existing or proposed residential use on one or more floors. R30 is a proposed hotel, which may contain some permanent living accommodation for staff, therefore, all the selected receptors are ranked as 'high' sensitivity.

3.8.2 *Operational Air Quality Assessment of Significance*

With regard to road traffic emissions, the change in pollutant concentrations with respect to baseline concentrations has been described at receptors that are representative of exposure to impacts on local air quality within the study area. The absolute magnitude of pollutant concentrations in the baseline and with development scenario is also described and this is used to consider the risk of the air quality limit values being exceeded in each scenario.

For a change of a given magnitude, the Institute of Air Quality Management (IAQM) have published recommendations for describing the magnitude of impacts at individual receptors (Table 8) and describing the significance (Table 9) of such impacts (IAQM, 2009).

Table 8: Magnitude of Changes in Ambient Pollutant Concentrations of NO_2 and PM_{10}

Magnitude of Change	Annual Mean Concentrations of NO_2 ($\mu g/m^3$)	Annual Mean Concentrations of PM_{10} ($\mu g/m^3$)	Exceedances of the 24-hr mean objective for PM_{10} (days)
Large	Increase/decrease > 4	Increase/decrease > 4	Increase/decrease > 4
Medium	Increase/decrease 2 – 4	Increase/decrease 2 – 4	Increase/decrease 2 to 4
Small	Increase/decrease 0.4 – 2	Increase/decrease 0.4 – 2	Increase/decrease 1 to 2
Imperceptible	Increase/decrease < 0.4	Increase/decrease < 0.4	Increase/decrease < 1

A change in predicted annual mean concentrations of NO_2 or PM_{10} of less than 0.4 $\mu g/m^3$ is considered (IAQM, 2009) to be so small as to be imperceptible. A change (impact) that is imperceptible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

The magnitude of the change in the predicted number of exceedances of the 24-hr objective is directly derived from the predicted annual mean value using the relationship defined in LAQM.TG(09). The magnitude descriptors in the table above are as proposed by Environmental Protection UK (EPUK, 2010).

The criteria in Table 8 relate to air quality statistics that are elevated about the objective values in many urban locations, this is not the case with $PM_{2.5}$. A change in the annual mean concentration of $PM_{2.5}$ equivalent to 1% of the objective value is 0.25 $\mu g/m^3$.

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

For receptors that are predicted to experience a perceptible change, the effect of the change on local air quality and the risk of exceeding the air quality objective value is summarised in Table 9. A small increase in annual mean concentrations, at receptors exposed to baseline concentrations that are just below the objective value (36 µg/m^3 to 40 µg/m^3) is considered to have a slight adverse effect as the slight increase in the risk of exceeding the objective value is significant. However, a small increase in annual mean concentration at receptors exposed to baseline concentrations that are below or well below (< 36 µg/m^3) is not likely to affect the achievement of the objective value and is therefore not a significant effect (negligible).

Table 9: Air Quality Impact Descriptors for Changes in Ambient Pollutant Concentrations of NO_2 and PM_{10}

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value *With* Scheme (>40 µg/m^3)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value *With* Scheme (36-40 µg/m^3)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value *With* Scheme (30-36 µg/m^3)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value *With* Scheme (<30 µg/m^3)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value *Without* Scheme (>40 µg/m^3)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value *Without* Scheme (36-40 µg/m^3)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value *Without* Scheme (30-36 µg/m^3)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value *Without* Scheme (<30 µg/m^3)	Negligible	Negligible	Slight Beneficial

3.8.3 *Air Quality Assessment of Significance*

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

- Annual mean nitrogen dioxide (NO_2) concentration of 40 µg/m^3;
- Annual mean particulate matter (PM_{10}) concentration of 40 µg/m$_3$;
- Annual mean fine particulate matter ($PM_{2.5}$) concentrations of 25 µg/m^3;

- 24-hour mean PM_{10} concentration of 50 µg/m^3 not to be exceeded on more than 35 days per year; and
- 1-hour mean NO_2 concentration of 200 µg/m^3 not to be exceeded on more than 18 times per year.

The achievement of local authority goals for local air quality management are directly linked to the achievement of the air quality objective values described above and as such this assessment focuses on the likelihood of future achievement of the air quality objective values.

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

3.9 Updated Method for Assessment of Significance

Since the submission of the previous assessment in March 2015, the IAQM's guidance on assessing the significance of effects from local air quality impacts has been superseded by a combined EPUK and IAQM guidance document that was published in May 2015 (EPUK & IAQM, 2015). In order to maintain consistency with the original assessment and allow for the comparison of modelled predictions with and without the operation of the ULEZ in 2020, the main assessment described within this report refers to the former IAQM guidance published in 2009. However, an Appendix is provided to this revision of the report (Appendix E) that provides a description of the current IAQM and EPUK guidance, along with an impact assessment based on that guidance.

4. BASELINE AIR QUALITY MONITORING DATA

4.1 Nitrogen Dioxide (NO_2)

LBI monitor NO_2 using two automatic monitoring stations. Measured annual mean NO_2 concentrations at these locations have been sourced from the London Air Quality website. The annual mean concentrations measured between 2011 and 2013 are presented in Table 10.

Table 10: Annual mean NO_2 concentrations measured by the LBI automatic monitoring stations

Monitoring station	OS Grid Ref	Location type	Approx. Distance to Scheme	Annual mean of NO_2 concentrations ($\mu g/m^3$)			Number of exceedances of hourly limit		
				2011	2012	2013	2011	2012	2013
Arsenal (IS6)	531328 186067	Urban Background	3.4 km	37	36	**41**	0	1	10
Holloway Road (IS2)	530650 185750	Roadside	3.2 km	**60**	**55**	**52**	0	0	1
Objective value:				**40 $\mu g/m^3$**			**18**		

Note: **Bold** denotes an exceedance of an air quality objective

NO_2 annual mean concentrations are above the national air quality objective value at both monitoring sites, with an increase in concentration observed between 2011 and 2013 at the Arsenal (IS6) monitoring station. Arsenal (IS6) is an urban background monitoring site, and the monitored annual mean NO_2 concentration is just above the limit value at that location.

4.2 Particulate Matter (PM_{10})

PM_{10} is monitored by LBI at both automatic monitoring stations operated by the council.

Measured annual mean PM_{10} concentrations at these locations have been sourced from the London Air Quality website. The annual mean concentrations measured between 2011 and 2013 are presented in Table 11 over the page.

Table 11: Annual mean PM_{10} concentrations measured by the LBI automatic monitoring stations

Monitoring station	OS Grid Ref	Location type	Approx. Distance to Scheme	Annual mean of PM_{10} concentrations ($\mu g/m^3$)			Number of days exceedances of 50 $\mu g/m^3$ limit (days)		
				2011	2012	2013	2011	2012	2013
Arsenal (IS6)	531328 186067	Urban Background	3.4 km	22	24	23	15	20	7
Holloway Road (IS2)	530650 185750	Roadside	3.2 km	25	27	25	33	21	19
Objective value:				**40 $\mu g/m^3$**			**35**		

4.2.1 Annual PM_{10} concentrations are well below the national air quality objective at both monitoring stations within the boroughs.

LBI does not undertake any monitoring of $PM_{2.5}$ within their geographical area

5. PREDICTED IMPACTS

5.1 Traffic Noise

Table 12 below details the predicted road traffic noise levels for the existing situation (without scheme) and proposed situation (with scheme), in the opening year, and the difference between them, for each of the selected receptor locations. The majority of receptors consist of a number of floors. The results presented are for the floor which undergoes the predicted worst case change due to the proposed scheme. If all floors are predicted to experience an improvement in traffic noise, the floor which experiences the least improvement is reported. Note the ground floor is reported as floor 1, the first floor as floor 2 etc. Details of the location of each receptor are included on Figure 1.

The predicted existing (without scheme) and proposed (with scheme) traffic noise levels are illustrated graphically as noise contour plots in Figures 2 and 3. The predicted traffic noise level changes between the two modelled situations are illustrated in Figure 4. The Figure 2 and Figure 3 noise contour plots relate to traffic noise levels at the ground floor (floor 1), 1.5m above ground level, and are provided to give a broad illustration of free-field noise levels around the junctions. The free-field noise levels presented in the Figures are not directly comparable with the façade noise levels predicted for each receptor. The nature of the CRTN façade noise correction of +2.5 dB means it cannot be incorporated into the free-field noise map.

Table 12: Traffic Noise Results

Receptor		Façade Direction	Floor	Traffic Noise Level $L_{A10,18h}$ dB (façade)		Worst case Change dB	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect
				Existing	Proposed				
1	Junction Road	W	1	75.7	74.8	-0.9	Imperceptible	High	Negligible
2	Archway Tower, Junction Road & Holloway Road	N	16	68.9	67.8	-1.1	Small	High	Slight Beneficial
3	Archway Tower, Junction Road & Holloway Road	N	16	70	68.5	-1.5	Small	High	Slight Beneficial
4	Flowers Mews	SW	3	70.1	64.7	-5.4	Large	High	Substantial Beneficial
5	Archway Tower, Holloway Road	N	16	69.4	67.5	-1.9	Small	High	Slight Beneficial
6	A1 & Highgate Hill	NW	3	74.3	71.8	-2.5	Small	High	Slight Beneficial
7	Highgate Hill	NE	4	74	73.4	-0.6	Imperceptible	High	Negligible
8	Flowers Mews	NW	3	71.9	72.4	0.5	Imperceptible	High	Negligible
9	Archway Road	NE	5	72.3	74	1.7	Small	High	Slight Adverse
10	Archway Road	SW	1	74.6	76.9	1.8	Small	High	Slight Adverse
11	End of Flowers Mews	NW	1	74.6	76.9	2.3	Small	High	Slight Adverse
12	St John's Way	SW	6	67.2	68.7	1.5	Small	High	Slight Adverse
13	St John's Way	SE	1	72.7	72.4	-0.3	Imperceptible	High	Negligible
14	St John's Way	NW	1	69.5	69.3	-0.2	Imperceptible	High	Negligible
15	Archway Road	NE	1	73.8	76	2.2	Small	High	Slight Adverse

Receptor		Façade Direction	Floor	Traffic Noise Level $L_{A10,18h}$ dB (façade)		Worst case Change dB	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect
				Existing	Proposed				
16	Harberton Road	SW	2	70.3	72.2	1.9	Small	High	Slight Adverse
17	St John's Way & Archway Road	NW	1	71.7	73.8	2.1	Small	High	Slight Adverse
18	St John's Way & Archway Road	NW	2	75.7	76.9	1.2	Small	High	Slight Adverse
19	St John's Way & Archway Road	NW	1	71.7	72.4	0.7	Imperceptible	High	Negligible
20	Holloway Road	SW	3	74.9	74.9	0	No Change	High	No Change
21	Junction Road	W	1	75.8	75.3	-0.5	Imperceptible	High	Negligible
22	Junction Road	E	3	74.7	72.9	-1.8	Small	High	Slight Beneficial
23	Holloway Road	S	1	77	77.2	0.3	Imperceptible	High	Negligible
24	Holloway Road	NE	1	75.8	76.1	0.3	Imperceptible	High	Negligible
25	Holloway Road	NE	3	73.7	73	-0.7	Imperceptible	High	Negligible
26	Junction Road, Holloway Road	W	1	76.3	75.6	-0.7	Imperceptible	High	Negligible
27	Vorley Road	N	1	67.6	66.7	-0.9	Imperceptible	High	Negligible
28	Highgate Hill	NE	1	74.3	74.3	0	No Change	High	No Change
29	Highgate Hill	SW	1	73.9	73.8	0	No Change	High	No Change
30	Hamlyn House	N	9	72.5	70.1	-2.4	Small	High	Slight Beneficial

5.1.1 As would be expected, receptors facing onto the south-west arm of the junction, which is removed by the proposed Scheme (receptors 2, 3, 5: Archway Tower, and receptor 30: Hamyln House), experience a reduction in traffic noise levels. The results reported in Table 12 indicate a small reduction (1 to 2.9 dB) at these receptors, though this relates to the top floor of each building where the beneficial effect is at a minimum. The top floor is furthest away from the road immediately in front of the building and is more exposed to more distant road traffic noise. At lower floors the magnitude of the reduction is medium (3 to 4.9 dB) or large (≥ 5 dB) at these receptors.

5.1.2 The removal of the south-west arm of the junction also contributes to the small (1 to 2.9 dB) reduction in the traffic noise level at receptor 6: Archway Tavern, combined with the reduction in traffic on the north-west arm of the junction. The removal of the south-west arm of the roundabout, and the closure of Flower Mews, results in a large (≥ 5 dB) reduction in traffic noise level at receptor 4.

5.1.3 On the B519 Highgate Hill to the north-west of the junction an imperceptible (< 1 dB) change in traffic noise levels is predicted close to the Archway junction and MacDonald Road (receptor 7), whilst further away at receptors 28 and 29 no change in traffic noise levels is expected. Virtually no change in traffic conditions is predicted on B519 Highgate Hill, however close to the junction in the vicinity of receptor 7 the introduction of a cycle lane relocates the traffic slightly further away from the building.

5.1.4 On the A1 Archway Road to the north of the junction a small increase (1 to 2.9 dB) in traffic noise levels is predicted, as illustrated by the results for receptors 9, 10, 15 and 16. On the northbound carriageway overall 18 hour traffic flows reduce slightly with the Scheme in operation, although the % HDV increases. On the southbound side both the overall flow and % HDV increases.

5.1.5 At receptor 8 within the centre of the junction, the facade facing the north-west arm is predicted to experience an imperceptible (< 1 dB) change in road traffic noise level. This is due to the combination of a number of factors including the reduction in traffic on the north-west arm of the junction, the large increase in traffic on the north-east arm of the junction, the realignment of the lanes of traffic within this area of the junction and the changes to Flower Mews. At receptor 11 within the centre of the junction, but further to the north than receptor 8 and facing onto the north-east arm of the junction, a small (1 to 2.9 dB) increase in traffic noise is predicted. The change from one-way to two-way traffic on this arm of the junction results in an increase in the 18 hour traffic flows from just under 22,000 to over 34,000. The closure of the south-west arm of the junction means traffic travelling from the south-east (A1 Holloway Road) to the north-west (B519 Highgate Hill) is redirected anti-clockwise around the Archway junction with the proposed Scheme in place.

5.1.6 On St Johns Way to the north-east of the junction, a small (1 to 2.9 dB) increase in traffic noise levels is predicted close to the junction, at receptors 12 and 17. Two-way traffic flows on St Johns Way actually reduce very slightly with the Scheme in place, resulting in the imperceptible (< 1 dB) change at receptors 13 and 14 further to the north-east. However, the south-west façade of receptor 12 and the west façade of receptor 17 face towards the north-east arm of the junction, which undergoes a large increase in traffic flows.

5.1.7 On the south-east side of the junction a small (1 to 2.9 dB) increase in traffic noise levels is predicted at receptor 18. As for the north-east arm of the junction, the south-east arm also undergoes a large increase in 18 hour traffic flows from just under 22,000 to over 38,000. Although this is slightly offset by the introduction of a cycle lane which relocates the traffic slightly further away. At receptor 19, set slightly further back from the south-east arm of the junction, the change in traffic noise levels is predicted to be imperceptible (<1 dB).

5.1.8 On the A1 Holloway Road to the south-east of the junction, traffic flows increase slightly with the Scheme in place resulting in the predicted imperceptible (< 1 dB) change at receptors 23 and 24. At receptor 20 closer to the junction on the north side of the road, the introduction of the cycle lane relocates the traffic slightly further away resulting overall in no predicted change to traffic noise levels. At receptor 25 on the south side of the road close to the junction, an imperceptible (< 1 dB) change is predicted. Although traffic flows increase slightly the road is realigned further away from the buildings to the south.

5.1.9 On the A400 Junction Road to the south of the junction an imperceptible (< 1 dB) change is predicted at receptors 26, 1 and 21 to the east of the road and a small (1 to 2.9 dB) decrease at 22 to the west. Traffic flows on the southbound carriageway increase, although this is outweighed by the decrease on the northbound carriageway, and therefore overall the two-way traffic flows decrease with the Scheme in place.

5.1.10 At receptor 27 on Vorley Road/MacDonald Road an imperceptible (< 1 dB) change in traffic noise levels is predicted. On these roads both existing and proposed flows are low, the Scheme results in an increase in flow, but a reduction in % HDV, due to the relocation of the bus stands.

5.2 Air Quality

5.2.1 *Nitrogen Dioxide (NO_2), Particulate Matter (PM_{10}) and Fine Particulate Matter ($PM_{2.5}$)*

Table 13 to Table 15 detail the predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations for the existing and proposed situations, and the difference between them for each of the selected receptor positions for the year of operation scenario (2017).

Table 16 to Table 18 detail the predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations for the existing and proposed situations, and the difference between them for each of the selected receptor positions for the year of ULEZ operation scenario (2020).

Each receptor has been modelled at each floor of the building considered. The results presented here are for the first residential floor of the building, where there is residential use; otherwise ground floor results are presented. For all receptors, concentration decreased with increasing floor level, as did the magnitude of change. Note the ground floor is reported as floor 1, the first floor as floor 2 etc. The magnitude of change at each receptor as outlined below is also presented on Figure 5 for NO_2, Figure 6 for PM_{10} and Figure 7 for $PM_{2.5}$.

Table 13: Nitrogen Dioxide Results for the Year of Opening (2017)

Receptor		Floor	Existing Annual Mean NO_2 Concentration ($\mu g/m^3$)	Proposed Annual Mean NO_2 Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Magnitude of Impact	Significance of Effect
1	Junction Road	2	**43.2**	**41.1**	-2.1	Medium	Moderate Beneficial
2	Archway Tower, Junction Road & Holloway Road	2	**44.8**	38.3	-6.5	Large	Substantial Beneficial
3	Archway Tower, Junction Road & Holloway Road	2	**44.5**	37.2	-7.3	Large	Substantial Beneficial
4	Flowers Mews	2	**40.2**	39.2	-1.0	Small	Slight Beneficial
5	Archway Tower, Holloway Road	2	**41.2**	36.3	-4.9	Large	Substantial Beneficial
6	A1 & Highgate Hill	2	**47.9**	**40.3**	-7.7	Large	Substantial Beneficial
7	Highgate Hill	1	**45.0**	**44.0**	-0.9	Small	Slight Beneficial
8	Flowers Mews	2	**41.7**	**42.5**	+0.7	Small	Slight Adverse
9	Archway Road	1	37.0	**41.3**	+4.4	Large	Substantial Adverse
10	Archway Road	1	38.9	**45.1**	+6.3	Large	Substantial Adverse
11	End of Flowers Mews	1	**47.0**	**57.0**	+10.0	Large	Substantial Adverse
12	St John's Way	1	36.2	37.0	+0.8	Small	Slight Adverse
13	St John's Way	1	36.5	36.2	-0.4	Imperceptible	Negligible Beneficial
14	St John's Way	1	33.8	33.7	-0.1	Imperceptible	Negligible Beneficial
15	Archway Road	1	36.6	**41.2**	+4.6	Large	Substantial Adverse
16	Harberton Road	1	34.0	37.3	+3.4	Medium	Moderate Adverse

Receptor		Floor	Existing Annual Mean NO_2 Concentration ($\mu g/m^3$)	Proposed Annual Mean NO_2 Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Magnitude of Impact	Significance of Effect
17	St John's Way & Archway Road	1	**41.2**	**45.1**	+3.9	Medium	Moderate Adverse
18	St John's Way & Archway Road	1	**47.1**	**52.3**	+5.2	Large	Substantial Adverse
19	St John's Way & Archway Road	1	**41.1**	**42.8**	+1.7	Small	Slight Adverse
20	Holloway Road	2	**40.2**	**41.3**	+1.0	Small	Slight Adverse
21	Junction Road	2	**40.6**	38.4	-2.2	Medium	Moderate Beneficial
22	Junction Road	2	39.2	36.5	-2.6	Medium	Moderate Beneficial
23	Holloway Road	2	38.4	39.1	+0.7	Small	Slight Adverse
24	Holloway Road	2	38.8	39.6	+0.8	Small	Slight Adverse
25	Holloway Road	2	**42.1**	**41.2**	-0.9	Small	Slight Beneficial
26	Junction Road, Holloway Road	3	39.6	38.1	-1.5	Small	Slight Beneficial
27	Vorley Road	1	34.8	33.9	-1.0	Small	Negligible Beneficial
28	Highgate Hill	1	**40.0**	39.3	-0.7	Small	Slight Beneficial
29	Highgate Hill	1	39.0	38.6	-0.4	Imperceptible	Negligible Beneficial
30*	Hamlyn House	2	**41.9**	38.9	-3.0	Medium	Moderate Beneficial

*Receptors only considered for short-term impacts.
Note: **Bold** denotes an exceedance of an air quality objective

Table 14: PM_{10} Results for the Year of Opening (2017)

Receptor		Floor	Existing Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Proposed Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Magnitude of Impact	Significance of Effect
1	Junction Road	2	24.5	24.4	-0.1	Imperceptible	Negligible Beneficial
2	Archway Tower, Junction Road & Holloway Road	2	24.6	24.1	-0.6	Small	Negligible Beneficial
3	Archway Tower, Junction Road & Holloway Road	2	24.6	23.9	-0.7	Small	Negligible Beneficial
4	Flowers Mews	2	24.2	24.1	-0.1	Imperceptible	Negligible Beneficial
5	Archway Tower, Holloway Road	2	24.3	23.8	-0.5	Small	Negligible Beneficial
6	A1 & Highgate Hill	2	24.9	24.1	-0.8	Small	Negligible Beneficial
7	Highgate Hill	1	24.6	24.5	-0.1	Imperceptible	Negligible Beneficial
8	Flowers Mews	2	24.4	24.4	<0.1	Imperceptible	Negligible Adverse
9	Archway Road	1	23.1	23.3	+0.2	Imperceptible	Negligible Adverse
10	Archway Road	1	23.4	23.7	+0.3	Imperceptible	Negligible Adverse
11	End of Flowers Mews	1	25.2	26.3	+1.1	Small	Negligible Adverse
12	St John's Way	1	23.9	23.9	+0.1	Imperceptible	Negligible Adverse
13	St John's Way	1	22.9	22.9	<0.1	Imperceptible	Negligible Adverse
14	St John's Way	1	22.6	22.6	<0.1	Imperceptible	Negligible Beneficial
15	Archway Road	1	23.1	23.3	+0.2	Imperceptible	Negligible Adverse
16	Harberton Road	1	22.7	22.9	+0.1	Imperceptible	Negligible Adverse

Receptor		Floor	Existing Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Proposed Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Magnitude of Impact	Significance of Effect
17	St John's Way & Archway Road	1	24.4	24.9	+0.5	Small	Negligible Adverse
18	St John's Way & Archway Road	1	25.1	25.9	+0.8	Small	Negligible Adverse
19	St John's Way & Archway Road	1	24.4	24.6	+0.2	Imperceptible	Negligible Adverse
20	Holloway Road	2	24.4	24.5	+0.1	Imperceptible	Negligible Adverse
21	Junction Road	2	24.2	24.1	<0.1	Imperceptible	Negligible Beneficial
22	Junction Road	2	24.0	23.9	-0.1	Imperceptible	Negligible Beneficial
23	Holloway Road	2	24.3	24.3	<0.1	Imperceptible	Negligible Adverse
24	Holloway Road	2	24.3	24.3	<0.1	Imperceptible	Negligible Adverse
25	Holloway Road	2	24.6	24.5	-0.1	Imperceptible	Negligible Beneficial
26	Junction Road, Holloway Road	3	24.1	24.0	-0.1	Imperceptible	Negligible Beneficial
27	Vorley Road	1	23.6	23.6	<0.1	Imperceptible	Negligible Beneficial
28	Highgate Hill	1	23.0	23.0	<0.1	Imperceptible	Negligible Beneficial
29	Highgate Hill	1	22.9	22.9	<0.1	Imperceptible	Negligible Beneficial
30*	Hamlyn House	2	24.3	24.0	-0.3	Imperceptible	Negligible Beneficial

*Receptors only considered for short-term impacts

Table 15: $PM_{2.5}$ Results for the Year of Opening (2017)

Receptor		Floor	Existing Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Proposed Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Magnitude of Impact	Significance of Effect
1	Junction Road	2	16.8	16.7	-0.1	Imperceptible	Negligible Beneficial
2	Archway Tower, Junction Road & Holloway Road	2	16.8	16.4	-0.4	Small	Negligible Beneficial
3	Archway Tower, Junction Road & Holloway Road	2	16.8	16.3	-0.5	Small	Negligible Beneficial
4	Flowers Mews	2	16.5	16.5	-0.1	Imperceptible	Negligible Beneficial
5	Archway Tower, Holloway Road	2	16.6	16.3	-0.3	Small	Negligible Beneficial
6	A1 & Highgate Hill	2	17.0	16.5	-0.5	Small	Negligible Beneficial
7	Highgate Hill	1	16.8	16.7	<0.1	Imperceptible	Negligible Beneficial
8	Flowers Mews	2	16.7	16.7	<0.1	Imperceptible	Negligible Adverse
9	Archway Road	1	15.9	16.1	+0.1	Imperceptible	Negligible Adverse
10	Archway Road	1	16.1	16.3	+0.2	Imperceptible	Negligible Adverse
11	End of Flowers Mews	1	17.2	17.9	+0.8	Small	Negligible Adverse
12	St John's Way	1	16.3	16.4	<0.1	Imperceptible	Negligible Adverse
13	St John's Way	1	15.8	15.8	<0.1	Imperceptible	Negligible Adverse
14	St John's Way	1	15.6	15.6	<0.1	Imperceptible	Negligible Beneficial
15	Archway Road	1	15.9	16.0	+0.2	Imperceptible	Negligible Adverse
16	Harberton Road	1	15.7	15.8	+0.1	Imperceptible	Negligible Adverse

Receptor		Floor	Existing Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Proposed Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Magnitude of Impact	Significance of Effect
17	St John's Way & Archway Road	1	16.7	17.0	+0.3	Small	Negligible Adverse
18	St John's Way & Archway Road	1	17.2	17.7	+0.5	Small	Negligible Adverse
19	St John's Way & Archway Road	1	16.7	16.8	+0.1	Imperceptible	Negligible Adverse
20	Holloway Road	2	16.7	16.7	+0.1	Imperceptible	Negligible Adverse
21	Junction Road	2	16.5	16.5	<0.1	Imperceptible	Negligible Beneficial
22	Junction Road	2	16.4	16.3	-0.1	Imperceptible	Negligible Beneficial
23	Holloway Road	2	16.6	16.6	<0.1	Imperceptible	Negligible Adverse
24	Holloway Road	2	16.6	16.6	<0.1	Imperceptible	Negligible Adverse
25	Holloway Road	2	16.8	16.7	-0.1	Imperceptible	Negligible Beneficial
26	Junction Road, Holloway Road	3	16.5	16.4	-0.1	Imperceptible	Negligible Beneficial
27	Vorley Road	1	16.1	16.1	<0.1	Imperceptible	Negligible Adverse
28	Highgate Hill	1	15.9	15.9	<0.1	Imperceptible	Negligible Beneficial
29	Highgate Hill	1	15.8	15.8	<0.1	Imperceptible	Negligible Beneficial
30*	Hamlyn House	2	16.6	16.4	-0.2	Imperceptible	Negligible Beneficial

Table 16: Nitrogen Dioxide Results for the Year of ULEZ Operation (2020)

Receptor		Floor	Existing Annual Mean NO_2 Concentration ($\mu g/m^3$)	Proposed Annual Mean NO_2 Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Magnitude of Impact	Significance of Effect
1	Junction Road	2	39.9	38.3	-1.5	Small	Slight Beneficial
2	Archway Tower, Junction Road & Holloway Road	2	**41.3**	36.3	-5.0	Large	Substantial Beneficial
3	Archway Tower, Junction Road & Holloway Road	2	**41.2**	35.5	-5.7	Large	Substantial Beneficial
4	Flowers Mews	2	38.0	37.2	-0.9	Small	Slight Beneficial
5	Archway Tower, Holloway Road	2	38.7	34.9	-3.8	Medium	Moderate Beneficial
6	A1 & Highgate Hill	2	**43.9**	38.1	-5.9	Large	Substantial Beneficial
7	Highgate Hill	1	**41.9**	**41.2**	-0.7	Small	Slight Beneficial
8	Flowers Mews	2	39.3	39.4	+0.2	Imperceptible	Negligible Adverse
9	Archway Road	1	35.4	38.4	+3.1	Medium	Moderate Adverse
10	Archway Road	1	37.0	**41.4**	+4.4	Large	Substantial Adverse
11	End of Flowers Mews	1	**43.7**	**50.9**	+7.3	Large	Substantial Adverse
12	St John's Way	1	35.5	36.0	+0.5	Small	Slight Adverse
13	St John's Way	1	36.3	35.9	-0.4	Small	Slight Beneficial
14	St John's Way	1	33.5	33.4	-0.1	Imperceptible	Negligible Beneficial
15	Archway Road	1	35.1	38.3	+3.2	Medium	Moderate Adverse
16	Harberton Road	1	33.0	35.3	+2.3	Medium	Slight Adverse

Receptor		Floor	Existing Annual Mean NO_2 Concentration ($\mu g/m^3$)	Proposed Annual Mean NO_2 Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Magnitude of Impact	Significance of Effect
17	St John's Way & Archway Road	1	39.7	**42.7**	+3.0	Medium	Moderate Adverse
18	St John's Way & Archway Road	1	**43.7**	**48.1**	+4.4	Large	Substantial Adverse
19	St John's Way & Archway Road	1	38.9	**40.2**	+1.3	Small	Slight Adverse
20	Holloway Road	2	38.3	39.0	+0.7	Small	Slight Adverse
21	Junction Road	2	37.5	36.1	-1.4	Small	Slight Beneficial
22	Junction Road	2	36.4	34.5	-1.9	Small	Slight Beneficial
23	Holloway Road	2	36.9	37.3	+0.4	Small	Slight Adverse
24	Holloway Road	2	37.2	37.6	+0.5	Small	Slight Adverse
25	Holloway Road	2	39.5	38.7	-0.8	Small	Slight Beneficial
26	Junction Road, Holloway Road	3	37.3	36.1	-1.2	Small	Slight Beneficial
27	Vorley Road	1	33.5	32.6	-0.8	Small	Negligible Beneficial
28	Highgate Hill	1	37.7	37.1	-0.5	Small	Slight Beneficial
29	Highgate Hill	1	36.9	36.5	-0.3	Imperceptible	Negligible Beneficial
30*	Hamlyn House	2	39.2	36.9	-2.2	Medium	Moderate Beneficial

*Receptors only considered for short-term impacts.
Note: **Bold** denotes an exceedance of an air quality objective

Table 17: PM_{10} Results for the Year of ULEZ Operation (2020)

Receptor		Floor	Existing Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Proposed Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Magnitude of Impact	Significance of Effect
1	Junction Road	2	24.6	24.5	-0.2	Imperceptible	Negligible Beneficial
2	Archway Tower, Junction Road & Holloway Road	2	24.7	24.1	-0.7	Small	Negligible Beneficial
3	Archway Tower, Junction Road & Holloway Road	2	24.7	23.9	-0.8	Small	Negligible Beneficial
4	Flowers Mews	2	24.3	24.1	-0.2	Imperceptible	Negligible Beneficial
5	Archway Tower, Holloway Road	2	24.3	23.8	-0.5	Small	Negligible Beneficial
6	A1 & Highgate Hill	2	25.1	24.1	-0.9	Small	Negligible Beneficial
7	Highgate Hill	1	24.7	24.6	-0.1	Imperceptible	Negligible Beneficial
8	Flowers Mews	2	24.5	24.4	-0.1	Imperceptible	Negligible Adverse
9	Archway Road	1	23.2	23.4	+0.3	Imperceptible	Negligible Adverse
10	Archway Road	1	23.5	23.8	+0.4	Imperceptible	Negligible Adverse
11	End of Flowers Mews	1	25.3	26.3	+1.1	Small	Negligible Adverse
12	St John's Way	1	23.9	24.0	+0.1	Imperceptible	Negligible Adverse
13	St John's Way	1	22.9	22.9	<0.1	Imperceptible	Negligible Adverse
14	St John's Way	1	22.6	22.6	<0.1	Imperceptible	Negligible Beneficial
15	Archway Road	1	23.1	23.4	+0.3	Imperceptible	Negligible Adverse
16	Harberton Road	1	22.8	22.9	+0.2	Imperceptible	Negligible Adverse

Receptor		Floor	Existing Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Proposed Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Magnitude of Impact	Significance of Effect
17	St John's Way & Archway Road	1	24.5	25.0	+0.5	Small	Negligible Adverse
18	St John's Way & Archway Road	1	25.2	26.1	+0.8	Small	Negligible Adverse
19	St John's Way & Archway Road	1	24.5	24.7	+0.2	Imperceptible	Negligible Adverse
20	Holloway Road	2	24.5	24.6	+0.1	Imperceptible	Negligible Adverse
21	Junction Road	2	24.2	24.1	-0.1	Imperceptible	Negligible Beneficial
22	Junction Road	2	24.0	23.9	-0.2	Imperceptible	Negligible Beneficial
23	Holloway Road	2	24.3	24.3	<0.1	Imperceptible	Negligible Adverse
24	Holloway Road	2	24.4	24.4	<0.1	Imperceptible	Negligible Adverse
25	Holloway Road	2	24.6	24.5	-0.1	Imperceptible	Negligible Beneficial
26	Junction Road, Holloway Road	3	24.2	24.1	-0.1	Imperceptible	Negligible Beneficial
27	Vorley Road	1	23.6	23.6	-0.1	Imperceptible	Negligible Beneficial
28	Highgate Hill	1	23.1	23.1	<0.1	Imperceptible	Negligible Beneficial
29	Highgate Hill	1	23.0	23.0	<0.1	Imperceptible	Negligible Beneficial
30*	Hamlyn House	2	24.4	24.0	-0.4	Imperceptible	Negligible Beneficial

*Receptors only considered for short-term impacts

Table 18: $PM_{2.5}$ Results for the Year of ULEZ Operation (2020)

Receptor		Floor	Existing Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Proposed Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Magnitude of Impact	Significance of Effect
1	Junction Road	2	16.8	16.7	-0.1	Imperceptible	Negligible Beneficial
2	Archway Tower, Junction Road & Holloway Road	2	16.9	16.5	-0.5	Small	Negligible Beneficial
3	Archway Tower, Junction Road & Holloway Road	2	16.9	16.4	-0.6	Small	Negligible Beneficial
4	Flowers Mews	2	16.6	16.5	-0.1	Imperceptible	Negligible Beneficial
5	Archway Tower, Holloway Road	2	16.7	16.3	-0.4	Small	Negligible Beneficial
6	A1 & Highgate Hill	2	17.2	16.5	-0.6	Small	Negligible Beneficial
7	Highgate Hill	1	16.9	16.8	-0.1	Imperceptible	Negligible Beneficial
8	Flowers Mews	2	16.7	16.7	-0.1	Imperceptible	Negligible Adverse
9	Archway Road	1	16.0	16.2	+0.2	Imperceptible	Negligible Adverse
10	Archway Road	1	16.2	16.4	+0.3	Imperceptible	Negligible Adverse
11	End of Flowers Mews	1	17.3	18.0	+0.7	Small	Negligible Adverse
12	St John's Way	1	16.3	16.4	+0.1	Imperceptible	Negligible Adverse
13	St John's Way	1	15.8	15.8	<0.1	Imperceptible	Negligible Adverse
14	St John's Way	1	15.6	15.6	<0.1	Imperceptible	Negligible Beneficial
15	Archway Road	1	15.9	16.1	+0.2	Imperceptible	Negligible Adverse
16	Harberton Road	1	15.7	15.8	+0.1	Imperceptible	Negligible Adverse

Receptor		Floor	Existing Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Proposed Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Magnitude of Impact	Significance of Effect
17	St John's Way & Archway Road	1	16.7	17.1	+0.3	Small	Negligible Adverse
18	St John's Way & Archway Road	1	17.3	17.8	+0.5	Small	Negligible Adverse
19	St John's Way & Archway Road	1	16.7	16.9	+0.1	Imperceptible	Negligible Adverse
20	Holloway Road	2	16.7	16.8	+0.1	Imperceptible	Negligible Adverse
21	Junction Road	2	16.6	16.5	-0.1	Imperceptible	Negligible Beneficial
22	Junction Road	2	16.4	16.3	-0.1	Imperceptible	Negligible Beneficial
23	Holloway Road	2	16.6	16.6	<0.1	Imperceptible	Negligible Adverse
24	Holloway Road	2	16.6	16.6	<0.1	Imperceptible	Negligible Adverse
25	Holloway Road	2	16.8	16.7	-0.1	Imperceptible	Negligible Beneficial
26	Junction Road, Holloway Road	3	16.6	16.5	-0.1	Imperceptible	Negligible Beneficial
27	Vorley Road	1	16.2	16.1	<0.1	Imperceptible	Negligible Adverse
28	Highgate Hill	1	16.0	16.0	<0.1	Imperceptible	Negligible Beneficial
29	Highgate Hill	1	15.9	15.9	<0.1	Imperceptible	Negligible Beneficial
30*	Hamlyn House	2	16.7	16.4	-0.3	Imperceptible	Negligible Beneficial

The results displayed in Table 13 indicate that annual mean concentrations of NO_2 are predicted to exceed the National Air Quality Objective (40 µg/m^3) at 13 residential locations across the site with the proposed scheme in place, in the 2017 scenario. The hourly mean NO_2 objective is not likely to be exceeded at any receptors, including receptors only considered for short-term impacts (Hamlyn House (30)).

Annual mean NO_2 concentrations decrease with increasing height above the ground, so that receptors located on the highest floors are predicted to experience concentrations that are lower than that experienced on the lowest floors.

To the north of the Scheme on the A1 Archway Road a substantial worsening of air quality is predicted (9, 10 and 15). A moderate worsening of air quality is also predicted further away from the road at Harberton Road (16). This worsening is due to an increase in the proportion of HDVs caused by the relocation of bus stands from Vorley Road to the A1 Archway Road, along with an increase in total traffic.

On the north-east section of the junction, a substantial worsening of air quality is predicted at Flower Mews (11). A slight worsening of air quality is predicted further away from Archway Road on Flower Mews (8). A substantial worsening of air quality is also predicted on the south-east section of the junction where the A1 Archway Road and St John's Way merge (18). This worsening is due to the Archway junction changing from one to two-way traffic flow. Traffic travelling from the south-east (A1 Holloway Road) to the north-west (B519 Highgate Hill) is redirected anti-clockwise around the Archway junction in the proposed Scheme, therefore resulting in an increased traffic flow of 13,817 along the north-east arm (Archway Road) and an increase of 19,705 on the south-east arm (St John's Way) of the junction. Additionally, realignment of the carriageway brings traffic closer to sensitive properties on the north corner of the junction near Flower Mews.

This traffic increase on the junction also results in a moderate worsening of air quality north east of the junction on St John's Way (17) and a slight worsening further away from Archway Road (12). A negligible change in air quality is predicted near Ashbrook Road (13 and 14), greater than 200m from the junction.

The increase in traffic on the south-east section of the junction also results in a slight worsening of air quality being predicted south-east of the junction along the A1 Holloway Road (19, 20, 23 and 24).

To the south of the scheme, moderate (1 and 26) or slight (25) improvements in air quality are predicted on the A400 Junction Road. This is due to the proximity of these receptors to the south-west arm of the junction which is closed to traffic in the proposed scheme. Realignment of the junction between Holloway Road and Archway also moves the edge of the carriageway further away from receptor 25. Further south on Junction Road, there are also moderate improvements (21 and 22) in air quality due to reduced traffic flows on Junction Road.

On the south-west arm of the scheme, substantial improvements in air quality are predicted at the junction of the B519 Highgate Hill and Archway (2, 3, 5 and 6). This improvement is due to the closure of the south-west arm of the junction. Slight improvements in air quality are predicted on the corner of MacDonald Road with Highgate Hill (7) and on Vorley Road (27). Although traffic flow increases on both of these links as a result of the scheme, there is a large decrease in the proportion of HDVs (from 55 to 10%), due to the relocation of bus stands from Vorley Road to Archway Road.

To the west of the scheme, a slight (28) to negligible (29) improvement in air quality is predicted on the B519 Highgate Hill. This is likely due to the small decrease in traffic flows and percentage of HDVs along Highgate Hill as result of the scheme.

In the centre of the gyratory, a slight improvement is predicted on Archway Close (4). This is due to the closure of Archway Close to traffic and removal of the south-west arm of the junction in the proposed Scheme.

The results displayed in Table 16 indicate that annual mean concentrations of NO_2 are predicted to exceed the National Air Quality Objective (40 µg/m^3) at 6 residential locations across the site with the proposed scheme in place, in the 2020 scenario. The hourly mean NO_2 objective is not likely to be exceeded at any receptors, including receptors only considered for short-term impacts (Hamlyn House (30)).

This scenario, which takes into account the operation of the ULEZ through the emissions of buses on routes 4, 17, 43, 134, 263 and 390 through the junction, would see a substantial worsening of air quality at locations on A1 Archway Road that are represented by receptor 9. Receptors 10 and 15 are predicted to experience a moderate adverse worsening of air quality adjacent to the same road, and receptor 16 a slight adverse worsening.

On the north-east section of the junction, with the operation of the ULEZ in 2020, a substantial worsening of air quality is still predicted to occur at Flower Mews (11). A negligible worsening of air quality is predicted further away from Archway Road on Flower Mews (8). A substantial worsening of air quality is also still predicted on the south-east section of the junction where the A1 Archway Road and St John's Way merge (18).

In this scenario, there is also a moderate worsening of air quality north east of the junction on St John's Way (17) and a slight worsening further away from Archway Road (12). A negligible change in air quality is predicted near Ashbrook Road (13) as well as a slight beneficial change (14), at locations which are greater than 200m from the junction. The increase in traffic on the south-east section of the junction in this 2020 scenario also results in a slight worsening of air quality being predicted south-east of the junction along the A1 Holloway Road (19, 20, 23 and 24).

To the south of the scheme, slight or slight improvements in air quality are predicted on the A400 Junction Road (1, 25 and 26), and further south on Junction Road (21 and 22). On the south-west arm of the scheme, substantial improvements in air quality are predicted at the junction of the B519 Highgate Hill and Archway (2, 3 and 6), as well as a moderate improvement at receptor 5. Slight improvements in air quality are predicted on the corner of MacDonald Road with Highgate Hill (7) and a negligible improvement on Vorley Road (27).

To the west of the scheme, a slight (28) to negligible (29) improvement in air quality is predicted on the B519 Highgate Hill, and in the centre of the gyratory, a slight improvement is also predicted on Archway Close (4).

Annual mean concentrations of PM_{10} and $PM_{2.5}$ are predicted to be below the respective air quality objective values for all receptors (see Table 14 and Table 15 respectively), both with and without the scheme in place, in 2017. There are no predicted exceedances of the 24 hour PM_{10} objective value. Changes in particulate concentrations (PM_{10} and $PM_{2.5}$) are all of negligible significance. The same is also predicted for annual mean concentrations of PM_{10} and $PM_{2.5}$ both with and without the scheme in place, in 2020, with the ULEZ in operation (see Table 17 and Table 18 respectively).

5.2.2 *Regional Impact Assessment for Carbon*

Table 16 details the predicted annual emissions for the existing and proposed Scheme for Carbon and the predicted change with the revised junction layout.

Table 16: Regional Emissions (2017)

Pollutant	Total Emissions (tonnes/year)		Change (tonnes/year)
	Existing	Proposed	
Carbon	5,722	6,242	+520

Annual emissions of carbon are predicted to increase as a result of the proposed Scheme. Although the south west section of the existing junction is removed, the total link length for the scheme increases, due to the creation of new lanes by changing several links from one- to two-way flows. The increase is small and not significant.

6. CONCLUSIONS

6.1 Traffic Noise

At half of the selected receptors around the Archway junction, when comparing the predicted existing situation (without scheme) and the proposed situation (with scheme), either no change or an imperceptible (<1 dB) change in traffic noise levels is expected, resulting in either no effect or a negligible significance of effect. A slight to substantial beneficial effect is expected at receptors close to the south-west arm of the junction, which is closed with the Scheme in place. A slight adverse effect is predicted to the north of Archway junction on the A1 Archway Road, and around the north-east and south-east arms of the junction, due to the changes in traffic conditions with the Scheme in place. The closure of the south-west arm of the junction means traffic travelling from the south-east (A1 Holloway Road) to the north-west (B519 Highgate Hill) is redirected anti-clockwise around the Archway junction with the proposed Scheme in place, resulting in large increases in traffic flows on the north-east and south-east arms of the junction.

6.2 Traffic Noise Recommendations

Based on the predicted magnitude of the changes in road traffic noise levels and consideration of the sensitivity of the affected receptors, the significance of the worst case adverse effects of the scheme are ranked as slight. Conversely some slight to substantial beneficial effects are predicted at receptors close to the south-west arm of the junction, which is closed with the Scheme in place. In such circumstances mitigation would not normally be considered to be required.

Potential traffic noise mitigation measures are limited in an urban situation such as the Archway junction. Significant road realignments or the introduction of noise barriers along the roadside are not practical options. In addition, traffic speeds are low, below the level at which current advice from the Highways Agency (HA, 2011) suggests a low noise surface would provide any benefit.

6.3 Air Quality

At 13 of the selected locations around the Archway Junction the proposed scheme results in adverse change to annual mean concentrations of NO_2. There are beneficial changes in air quality at 13 locations, and a negligible change at 4 locations. The effects of the Scheme on air quality are therefore a mixture of beneficial and adverse effects. This includes Large changes (leading to substantial worsening or benefits) are seen at some locations, as set out in 5.2.

In the 2020 scenario, which accounts for the operation of the London ULEZ through the emissions of buses that operate in both the ULEZ and around the Archway Gyratory, there is an adverse change to annual mean NO_2 concentrations at 12 selected locations around the Archway Junction. There will be 14 locations where there is predicted to be a beneficial change and 4 locations where there is predicted to be a negligible change.

Annual mean concentrations of PM_{10} and $PM_{2.5}$ are predicted to be below the respective air quality objective values for all receptors, both with and without the scheme in place in 2017 and 2020. There are no predicted exceedances of the 24 hour PM_{10} objective value. Changes in particulate concentrations (PM_{10} and $PM_{2.5}$) are all of negligible significance for both scenarios.

6.4 Air Quality Recommendations

It is recommended that a review of options for mitigation is undertaken for the Scheme to establish what opportunities there are to adjust the scheme alignments, or operational profile or provide mitigation to nearby receptors which are predicted to experience a substantial worsening.

Additionally, consideration should also be given to extending the extent of the air quality assessment to the north west of the Scheme along Archway Road to delineate any wider effects of the Scheme.

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APPENDIX A – SITE PHOTOGRAPHS

Figure A1.1: View NW from South corner of Archway Gyratory towards Highgate Hill

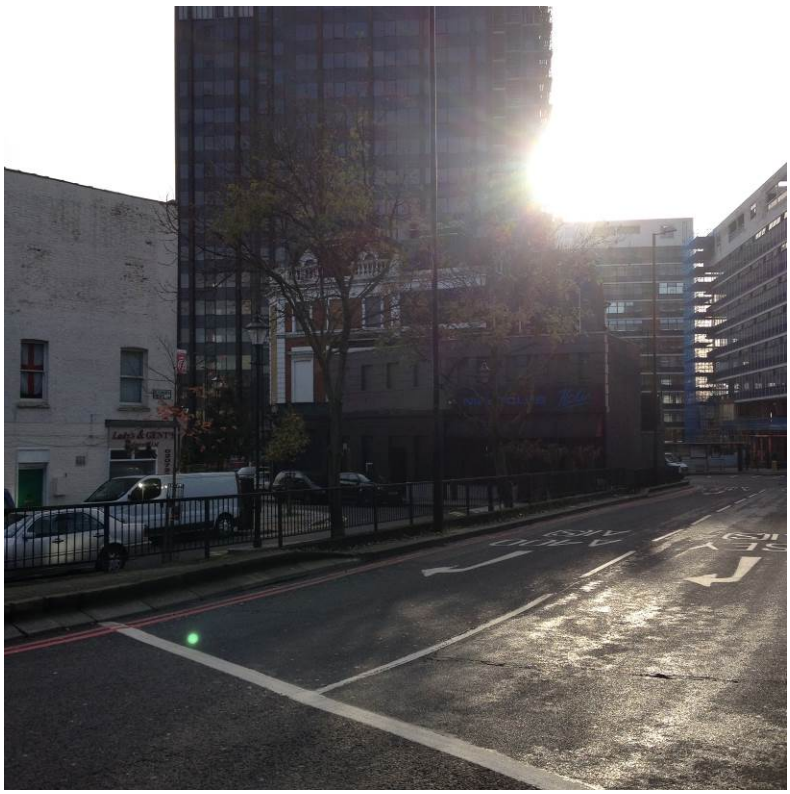


Figure A1.2: View SW from North corner of Archway Gyratory showing Flower Mews to the left

Figure A1.3: View NW from North corner of Archway Gyratory towards Archway Road

Figure A1.4: View East from North corner of Archway Gyratory towards Archway Road

Figure A1.5: View NE from NE corner of Archway Gyratory towards St John's Way

Figure A1.6: View South from NE corner of Archway Gyratory towards St John's Way

Figure A1.7: View SE from East section of Archway Gyratory towards Sandridge Street

Figure A1.8: View East from South corner of Archway Gyratory towards Holloway Road

Figure A1.9: View North from South corner of Archway Gyratory towards Archway Close/Flower Mews

Figure A1.10: View South from Junction Road towards Junction Road/Vorley Road

APPENDIX B – TRAFFIC DATA

Table B.1: Summary of Traffic Data Used for Air Quality

Link and Direction		Existing (Opening Year)			Proposed (including junction upgrade) (Opening Year)		
		24hr AADT	24hr % HDV	Speed (km/hr)	24hr AADT	24hr % HDV	Speed (km/hr)
1	MacDonald Road from B519 Highgate Hill to Vorley Road, SB in existing future baseline, NB in proposed scheme	1849	55.0	43	3799	9.7	15
2a	B519 Highgate Hill from A1 Tollhouse Way to B540 Dartmouth Park Hill, NW	8931	8.6	10	8846	8.7	15
2b	B519 Highgate Hill from B540 Dartmouth Park Hill to A1 Tollhouse Way, NW	7303	12.1	12	7364	12.2	13
3a	A1 Tollhouse Way from B519 Highgate Hill to A1 Archway Road, NE	-	-	-	7649	15.0	15
3b	A1 Tollhouse Way from Flower Mews to MacDonald Road, SW	-	-	-	6422	10.2	8
3c	A1 Archway Road filter lane 1 from A1 Tollhouse Way to A1 Archway Road, N	-	-	-	760	64.8	15
3d	A1 Archway Road filter lane 2 from A1 Tollhouse Way to A1 Archway Road, NE	10728	7.8	10	6890	8.6	10
3e	A1 Tollhouse Way filter lane from A1 Archway Road (Flower Mews) to A1 Tollhouse Way (Flower Mews), SW	-	-	-	6413	10.2	12
4a	A1 Archway Road from A1 Archway Road filter lane 1 to Hornsey Lane Gardens, NW	12813	7.5	37	12607	13.9	28
4b	A1 Archway Road from Hornsey Lane Gardens to Archway Road filter lane 2, SE	14975	6.3	32	15947	11.3	18

Link and Direction		Existing (Opening Year)			Proposed (including junction upgrade) (Opening Year)		
		24hr AADT	24hr % HDV	Speed (km/hr)	24hr AADT	24hr % HDV	Speed (km/hr)
5a	A1 Archway Road from A1 St John's Way to Flower Mews, W	-	-	-	17580	7.9	17
5b	A1 Archway Road from A1 Tollhouse Way to St John's Way filter lane, E	-	-	-	22004	8.5	18
6	Flower Mews from A1 Archway Road to A1 Tollhouse Way, SW	-	-	-	87	6.0	7
7	Archway Road from A1 Archway Road (Flower Mews) to A1 Archway Road filter lane 1, W	-	-	-	11847	10.4	34
8a	St John's Way from St John's Way filter lane to Mulkern Road, NE	6163	6.4	21	6341	6.3	27
8b	St John's Way from Mulkern Road to A1 Sandridge Street, SW	6137	6.3	21	5849	6.8	22
9a	St John's Way filter lane 1 from A1 Archway Road to A1 St John's Way, SE	19604	7.0	11	18869	7.6	10
9b	St John's Way filter lane 2 from A1 Archway Road to St John's Way, NE	-	-	-	3135	14.6	5
10	A1 St John's Way from A1 Holloway Road to St John's Way, NE	-	-	-	3206	0.1	15
11a	A1 St John's Way from A1 Holloway Road to St John's Way, NE	-	-	-	20786	6.6	24
11b	A1 St John's Way from A1 Sandridge Street to A1 Holloway Road, SW	-	-	-	11195	8.8	8
12a	A1 Holloway Road from A1 St John's Way to Fortnam Road, SE	13981	6.4	24	13465	6.5	23
12b	A1 Holloway Road from Fortnam Road to A1 St John's Way, NW	15607	5.4	28	15098	5.7	20
13a	A400 Junction Road from A1 Holloway Road to Cathcart Hill, S	9148	5.1	31	11195	8.8	33
13b	A400 Junction Road from Cathcart Hill to A1 Holloway Road, N	8262	18.1	14	5698	9.0	6

Link and Direction		Existing (Opening Year)			Proposed (including junction upgrade) (Opening Year)		
		24hr AADT	24hr % HDV	Speed (km/hr)	24hr AADT	24hr % HDV	Speed (km/hr)
14	A1 St John's Way from A1 Sandridge Street to Flower Mews, SW	11741	7.5	9	-	-	-
15	A1 St John's Way from Flower Mews to A1 Holloway Road, SW	11511	7.7	12	-	-	-
16	A1 Highgate Hill from A1 St John's Way to B519 Highgate Hill, NW	26230	10.5	16	-	-	-
17	A1 Tollhouse Way filter lane from A1 Highgate Hill to A1 Tollhouse Way, N	16804	8.7	10	-	-	-
18	A1 Tollhouse Way from B519 Highgate Hill to A1 Archway Road, NE	23541	7.6	16	-	-	-
19	B519 Highgate Hill from A1 Highgate Hill to MacDonald Road, NW	9427	13.5	15	-	-	-
20	Flower Mews from A1 St John's Way to A1 Archway Road, N	230	0.0	33	-	-	-
21	A1 Archway Road from A1 Tollhouse Way to St John's Way filter lane, E	25767	6.9	20	-	-	-
22	A1 St John's Way from St John's Way to A1 Holloway Road, SW	25741	6.8	19	24660	7.4	22
23	Vorley Road from MacDonald Road to A400 Junction Road, E	1790	54.3	15	3528	9.8	43

Table B.2: Summary of Traffic Data Used for Noise

Link and Direction		Existing (Opening Yeat)			Proposed (including junction upgrade) (Opening Year)		
		18hr AAWT	18hr % HDV	Speed* (km/hr)	18hr AAWT	18hr % HDV	Speed* (km/hr)
1	MacDonald Road from B519 Highgate Hill to Vorley Road, SB in existing future baseline, NB in proposed scheme	1561	55.0	43	3208	9.7	20
2a	B519 Highgate Hill from A1 Tollhouse Way to B540 Dartmouth Park Hill, NW	7541	8.6	20	7469	8.7	20
2b	B519 Highgate Hill from B540 Dartmouth Park Hill to A1 Tollhouse Way, NW	6166	12.1	20	6218	11.6	20
3a	A1 Tollhouse Way from B519 Highgate Hill to A1 Archway Road, NE	-	-	-	6459	14.3	20
3b	A1 Tollhouse Way from Flower Mews to MacDonald Road, SW	-	-	-	5422	10.0	20
3c	A1 Archway Road filter lane 1 from A1 Tollhouse Way to A1 Archway Road, N	-	-	-	641	64.2	20
3d	A1 Archway Road filter lane 2 from A1 Tollhouse Way to A1 Archway Road, NE	9059	7.8	20	5818	8.3	20
3e	A1 Tollhouse Way filter lane from A1 Archway Road (Flower Mews) to A1 Tollhouse Way (Flower Mews), SW	-	-	-	5415	10.0	20
4a	A1 Archway Road from A1 Archway Road filter lane 1 to Hornsey Lane Gardens, NW	10819	7.5	37	10645	13.4	29
4b	A1 Archway Road from Hornsey Lane Gardens to Archway Road filter lane 2, SE	12645	6.3	32	13465	10.9	20
5a	A1 Archway Road from A1 St John's Way to Flower Mews, W	-	-	-	14844	7.6	20

Link and Direction		Existing (Opening Yeat)			Proposed (including junction upgrade) (Opening Year)		
		18hr AAWT	18hr % HDV	Speed* (km/hr)	18hr AAWT	18hr % HDV	Speed* (km/hr)
5b	A1 Archway Road from A1 Tollhouse Way to St John's Way filter lane, E	-	-	-	18580	8.2	20
6	Flower Mews from A1 Archway Road to A1 Tollhouse Way, SW	-	-	-	73	5.2	20
7	Archway Road from A1 Archway Road (Flower Mews) to A1 Archway Road filter lane 1, W	-	-	-	10004	10.1	34
8a	St John's Way from St John's Way filter lane to Mulkern Road, NE	5204	6.4	21	5354	6.2	26
8b	St John's Way from Mulkern Road to A1 Sandridge Street, SW	5182	6.3	21	4939	6.6	21
9a	St John's Way filter lane 1 from A1 Archway Road to A1 St John's Way, SE	16553	7.0	20	15932	7.3	20
9b	St John's Way filter lane 2 from A1 Archway Road to St John's Way, NE	-	-	-	2647	13.8	20
10	A1 St John's Way from A1 Holloway Road to St John's Way, NE	-	-	-	2707	0.1	20
11a	A1 St John's Way from A1 Holloway Road to St John's Way, NE	-	-	-	17551	6.4	23
11b	A1 St John's Way from A1 Sandridge Street to A1 Holloway Road, SW	-	-	-	9453	8.0	20
12a	A1 Holloway Road from A1 St John's Way to Fortnam Road, SE	11806	6.4	24	11369	6.5	23
12b	A1 Holloway Road from Fortnam Road to A1 St John's Way, NW	13178	5.4	28	12748	5.6	20
13a	A400 Junction Road from A1 Holloway Road to Cathcart Hill, S	7724	5.1	31	9453	8.0	33
13b	A400 Junction Road from Cathcart Hill to A1 Holloway Road, N	6976	18.1	20	4811	8.7	20
14	A1 St John's Way from A1 Sandridge Street to Flower Mews, SW	9914	7.5	20	-	-	-

Link and Direction		Existing (Opening Yeat)			Proposed (including junction upgrade) (Opening Year)		
		18hr AAWT	18hr % HDV	Speed* (km/hr)	18hr AAWT	18hr % HDV	Speed* (km/hr)
15	A1 St John's Way from Flower Mews to A1 Holloway Road, SW	9720	7.7	20	-	-	-
16	A1 Highgate Hill from A1 St John's Way to B519 Highgate Hill, NW	22148	10.5	20	-	-	-
17	A1 Tollhouse Way filter lane from A1 Highgate Hill to A1 Tollhouse Way, N	14189	8.7	20	-	-	-
18	A1 Tollhouse Way from B519 Highgate Hill to A1 Archway Road, NE	19878	7.6	20	-	-	-
19	B519 Highgate Hill from A1 Highgate Hill to MacDonald Road, NW	7960	13.5	20	-	-	-
20	Flower Mews from A1 St John's Way to A1 Archway Road, N	194	0.0	33	-	-	-
21	A1 Archway Road from A1 Tollhouse Way to St John's Way filter lane, E	21757	6.9	20	-	-	-
22	A1 St John's Way from St John's Way to A1 Holloway Road, SW	21735	6.8	20	20822	7.1	22
23	Vorley Road from MacDonald Road to A400 Junction Road, E	1512	54.3	20	2979	10.0	43

* Provided speeds below 20km/hr adjusted to 20km/hr as this is the minimum speed allowable within the CRTN prediction methodology

APPENDIX C – NOISE AND AIR QUALITY TECHNICAL NOTE ON VORLEY ROAD / MACDONALD ROAD

Archway Gyratory

Noise and Air Quality Technical Note on Vorley Road/MacDonald Road

CONTENTS

1 Introduction

[redacted] to assess the potential impact of the proposed works to the Archway Gyratory junction on traffic noise levels and air quality. As a result of the proposed works, traffic flows at the junction will be affected as the works will change the configuration and range of movements possible between the various arms of the junction.

The scope of this assessment completed during March 2015 was as follows:

- identify the closest potentially sensitive receptors to the junction;
- predict road traffic noise levels at a selection of identified receptors, both with and without the junction works;
- predict concentrations of the main road traffic pollutants nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) at a selection of identified receptors both with and without the junction works; and
- predict annual emissions of carbon both with and without the junction works.

Following completion of the assessments and reporting on the impacts on noise levels and air quality, there have been some concerns raised by members of the public regarding the impacts specifically along Vorley Road/MacDonald Road, where the Archway Children's Centre is located. The purpose of this technical note is to focus on the predicted impacts along this road as a result of the proposed works, in order to address the concerns raised.

2 Assessment of Significance

2.1 Traffic Noise Assessment of Significance

The assessment of the significance of effect on traffic noise levels at nearby receptors due to the proposed works was based on the guidance in the Design Manual for Roads and Bridges (DMRB) (HA, 2011) regarding the magnitude of traffic noise changes, combined with consideration of the sensitivity of the receptor. **Table 1** is adapted from the DMRB classification of the magnitude of impact in the short term i.e. the year of opening.

Table 1: Road Traffic Noise Magnitude of Impact Criteria

Change in traffic noise level $L_{A10,18h}$ dB	***Magnitude of Impact***
0	No change
0.1-0.9	Imperceptible
1.0-2.9	Small
3.0-4.9	Medium
5.0+	Large

The significance of the effect is determined based on the matrix presented in **Table 2**.

Table 2: Road Traffic Noise Significance of Effect Matrix

Sensitivity of Receptor	*Magnitude of Impact*			
	Large	***Medium***	***Small***	***Imperceptible***
High	Substantial	Moderate	Slight	Negligible
Medium	Moderate	Slight	Negligible	Negligible
Low	Slight	Negligible	Negligible	Negligible
Very Low	Negligible	Negligible	Negligible	Negligible
High	Substantial	Moderate	Slight	Negligible

Residential properties and buildings for educational use are considered to be of high sensitivity to changes in road traffic noise. Commercial and retail receptors are considered to be of low sensitivity to traffic noise changes.

2.2 Operational Air Quality Assessment of Significance

With regard to road traffic emissions, the change in pollutant concentrations with respect to baseline concentrations has been described at receptors that are representative of exposure to impacts on local air quality within the study area. The absolute concentration of pollutants in the baseline and with development scenario is also described and this is used to consider the risk of the air quality limit values being exceeded in each scenario.

For a change of a given magnitude, the Institute of Air Quality Management (IAQM) have published recommendations for describing the magnitude of impacts at individual receptors (**Table 3**) and describing the significance (**Table 4**) of such impacts (IAQM, 2009).

Table 3: Magnitude of Changes in Ambient Pollutant Concentrations of NO_2 and PM_{10}

Magnitude of Change	***Annual Mean Concentrations of NO_2 ($\mu g/m^3$)***	***Annual Mean Concentrations of PM_{10} ($\mu g/m^3$)***	***Exceedances of the 24-hr mean objective for PM_{10} (days)***
Large	Increase/decrease > 4	Increase/decrease > 4	Increase/decrease > 4
Medium	Increase/decrease 2 – 4	Increase/decrease 2 – 4	Increase/decrease 2 to 4
Small	Increase/decrease 0.4 – 2	Increase/decrease 0.4 – 2	Increase/decrease 1 to 2
Imperceptible	Increase/decrease < 0.4	Increase/decrease < 0.4	Increase/decrease < 1

A change in predicted annual mean concentrations of NO_2 or PM_{10} of less than 0.4 $\mu g/m^3$ is considered (IAQM, 2009) to be so small as to be imperceptible. A change (impact) that is imperceptible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

The magnitude of the change in the predicted number of exceedances of the 24-hr objective is directly derived from the predicted annual mean value using the relationship defined in LAQM.TG(09). The magnitude descriptors in the table above are as proposed by Environmental Protection UK (EPUK, 2010).

The criteria in Table 8 relate to air quality statistics that are elevated about the objective values in many urban locations, this is not the case with $PM_{2.5}$. A change in the annual mean concentration of $PM_{2.5}$ equivalent to 1% of the objective value is 0.25 µg/m^3.

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

For receptors that are predicted to experience a perceptible change, the effect of the change on local air quality and the risk of exceeding the air quality objective value is summarised in **Table 4**. A small increase in annual mean concentrations, at receptors exposed to baseline concentrations that are just below the objective value (36 µg/m^3 to 40 µg/m^3) is considered to have a slight adverse effect as the slight increase in the risk of exceeding the objective value is significant. However, a small increase in annual mean concentration at receptors exposed to baseline concentrations that are below or well below (< 36 µg/m^3) is not likely to affect the achievement of the objective value and is therefore not a significant effect (negligible).

Table 4: Air Quality Impact Descriptors for Changes in Ambient Pollutant Concentrations of NO_2 and PM_{10}

Absolute Concentration in Relation to Objective/Limit Value	***Change in Concentration***		
	Small	***Medium***	***Large***
Increase with Scheme			
Above Objective/Limit Value With Scheme (>40 µg/m^3)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36-40 µg/m^3)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30-36 µg/m^3)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30 µg/m^3)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value Without Scheme (>40 µg/m^3)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value Without Scheme (36-40 µg/m^3)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value Without Scheme (30-36 µg/m^3)	Negligible	Slight Beneficial	Slight Beneficial

Well Below Objective/Limit Value Without Scheme (<30 µg/m^3)	Negligible	Negligible	Slight Beneficial

2.2.1 Air Quality Assessment of Significance

The significance of all of the reported impacts is then considered for the development in overall terms. The potential for the scheme to contribute to or interfere with the successful implementation of policies and strategies for the management of local air quality are considered if relevant, but the principle focus is any change to the likelihood of future achievement of the air quality objective values for the following pollutants:

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

The achievement of local authority goals for local air quality management are directly linked to the achievement of the air quality objective values described above and as such this assessment focuses on the likelihood of future achievement of the air quality objective values.

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

3 Predicted Impacts

The following sections review the findings of the noise and air quality assessment, focussing on the impacts predicted along Vorley Road/MacDonald Road. One receptor on this road was modelled in the assessment of effects for the Scheme, receptor 27, which is shown on the attached Figure 1. This receptor is representative of other receptors located along Vorley Road and MacDonald Road, including the Archway Children's Centre.

3.1 Predicted Traffic Noise impacts on Vorley Road

Table 5 below details the predicted road traffic noise levels for the existing situation (without scheme) and proposed situation (with scheme), in the opening year, and the difference between them, for the selected receptor location on Vorley Road. The results presented are for the floor which undergoes the predicted worst case change due to the proposed scheme.

Table 5: Traffic Noise Results at Receptor 27 on Vorley Road

Receptor		***Façade Direction***	***Floor***	***Traffic Noise Level $L_{A10,18h}$ dB (façade)***		***Worst case Change dB***	***Magnitude of Impact***	***Sensitivity of Receptor***	***Significance of Effect***
				Existing	***Proposed***				
27	Vorley Road	N	1	67.6	66.7	-0.9	Imperceptible	High	Negligible

At receptor 27 on Vorley Road an imperceptible (< 1 dB) change in traffic noise levels is predicted.

3.2 Predicted Air Quality Impacts on Vorley Road

Table 6 details the predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations for the existing and proposed situations, and the difference between them for each of the selected receptor positions. The receptor (Receptor 27) has been modelled for the ground floor of the building, where predicted concentrations of pollutants are at their highest.

Table 6: Air Quality Results at Receptor 27 on Vorley Road

Receptor		***Pollutant***	***Existing Annual Mean Pollutant Concentration (µg/m^3)***	***Proposed Annual Mean Pollutant Concentration (µg/m$_3$)***	***Change (µg/m^3)***	***Magnitude of Impact***	***Significance of Effect***
27	Vorley Road	NO_2	34.8	33.9	-1.0	Small	Negligible
27	Vorley Road	PM_{10}	23.6	23.6	<0.1	Imperceptible	Negligible
27	Vorley Road	$PM_{2.5}$	16.1	16.1	<0.1	Imperceptible	Negligible

Concentrations of NO_2, PM_{10} and $PM_{2.5}$ are below their respective annual mean objective values of 40 µg/m^3 for NO_2 and PM_{10} and 25 µg/m^3 for $PM_{2.5}$, in both the existing scenario and with the proposed works.

Small improvements in annual mean NO_2 concentrations are predicted on Vorley Road (27), with imperceptible changes in PM_{10} and $PM_{2.5}$ concentrations. As annual mean concentrations of NO_2 are below the objective value, the overall changes are of negligible significance.

4 Conclusions

Although the overall traffic flow increases on Vorley Road as a result of the scheme, there is a large decrease in the proportion of HDVs (from 55% to 10%), due to the relocation of bus stands from Vorley Road to Archway Road.

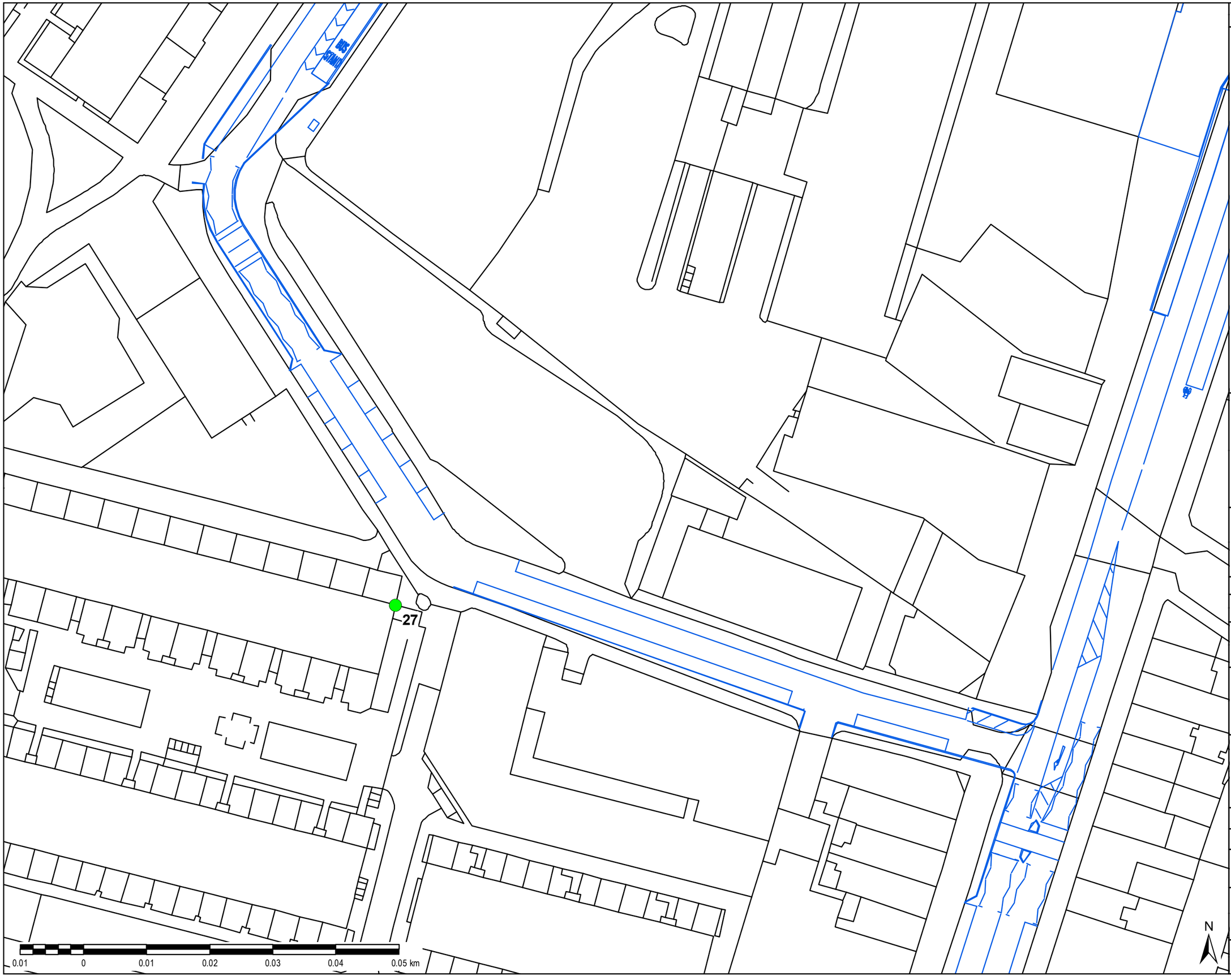
As a result, the impacts on both noise and air quality are considered to be of negligible significance, with small improvements or imperceptible changes in both noise levels and pollutant concentrations predicted.

References

Highways Agency (2011), Design Manual for Roads and Bridges Volume 11 Part 7

Institute of Air Quality Management (IAQM) (2009), Position on the description of air quality impacts on their significance. Institute of Air Quality Management

EPUK (2010), Development Control: Planning for Air Quality (2010 Update): Update guidance from Environmental Protection UK on dealing with air quality concerns within the development control process.



THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

- Receptor 27
- Proposed Scheme

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: FINAL

Client: TRANSPORT FOR LONDON

Project Title: ARCHWAY GYRATORY

Drawing Title: MODELLED SELECTED RECEPTOR 27

Drawn	Checked	Approved	Date
FB	EC	DD	30/09/2015

47072870 | Scale @ A3: 1:550

Drawing Number: **FIGURE 1** | Rev: **01**

APPENDIX D – NOISE MODELLING

Data:

- Existing ground heights: 2m contours: file NextMap_2m_Contours.dbf' purchased from Emapsite 18/02/15. A topo survey of the existing ground heights around the junction has been completed on behalf of TfL However, both TfL and Steer Davies Gleave have only been able to provide the results in 2d format, rather than 3d. Therefore, it has not been possible to utilize the existing topo survey and the 2m contours from Emapsite have been used for the whole study area
- Proposed ground heights on the scheme: no 3d scheme design available from TfL therefore the proposed road layout has been laid over the digital ground model created from the existing 2m contours
- Existing road layout: file 'x-Topo.dwg' from Steer Davies Gleave 12/02/15
- Proposed road layout: file 'x-OptK_SDG055.dwg' from Steer Davies Gleave 12/02/15
- OS mapping: file 'Topo_Line_polyline.shx' from Steer Davies Gleave 01/12/14
- Traffic data: file 'AADT Calculations for EA_160115.xls from Steer Davies Gleave 19/01/15

Modelling Assumptions:

- Hard ground assumed across the study area (ground absorption 0.0)
- Existing road surface: predominantly hot rolled asphalt (HRA) with some surface dressing at the junction), provided by TfL 01/12/14
- Proposed road surface: low textured 14mm Fibrovia or a Low textured 14mm UL-M. Other roads beyond the junctions remain as: standard hot rolled asphalt (HRA), provided by TfL 01/12/14
- Road surface correction existing and proposed: all traffic speeds in the study area less than 75 km/hr, therefore road surface correction of -1 dB(A) applied to all roads in accordance with guidance in DMRB and CRTN for impervious road surfaces
- Building heights and number of floors based on a combination of observations on site visit and aerial photography (http://www.bing.com/maps bird's eye view and https://maps.google.co.uk/ street view)
- 5m grid used to produce traffic noise contour plots
- Noise contour plots at height 1.5m above ground (ground floor)

APPENDIX E – ALTERNATIVE AIR QUALITY ASSESSMENT SIGNFICANCE CRITERIA

Method

This Appendix provides the results predicted for both 2017 and 2020 do-minimum and do-something scenarios, as shown in the main report, but with the description of effects undertaken in line with current EPUK and LAQM guidance, published in May, 2015 (EPUK & IAQM, 2015).

With regard to road traffic emissions, the change in pollutant concentrations with respect to baseline concentrations has been described at receptors that are representative of exposure to impacts on local air quality within the study area. The absolute magnitude of pollutant concentrations in the baseline and with development scenario is also described and this is used to consider the risk of the air quality limit values being exceeded in each scenario.

For a change in annual mean concentration, or hourly mean NO_2 concentration, of a given magnitude, the EPUK and IAQM have published recommendations for describing the effects of such impacts at individual receptors (EPUK and IAQM, 2015), as shown in Table E1.

Table E1: Effects Descriptors at Individual Receptors – Annual Mean NO_2 and PM_{10}

Annual Mean Pollutant Concentration at Receptor in Assessment Year	Change in Annual Mean Concentration of NO_2/PM_{10} (µg/m^3 as Proportion of Objective Value)				
	< 1%	1% - 2%	2%-5%	5% - 10%	>10%
≤30.2	Negligible	Negligible	Negligible	Minor	Moderate
30.2 – 37.8	Negligible	Negligible	Minor	Moderate	Moderate
37.8 – 41.0	Negligible	Minor	Moderate	Moderate	Major
41.0 – 43.8	Negligible	Moderate	Moderate	Major	Major
≥43.8	Negligible	Moderate	Major	Major	Major

The EPUK / IAQM guidance includes seven explanatory notes to accompany the terminology for the effect descriptors. In particular it is noted that the descriptors are for individual receptors only and that overall significance is determined using professional judgement. Additionally, it is noted that it is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the objective value. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the objective value, rather than being exactly equal to it.

A change in predicted annual mean concentrations of NO_2 or PM_{10} of less than 0.5% (0.2 µg/m^3) is considered to be so small as to be negligible. A change (impact) that is negligible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

A change in predicted annual mean concentrations of $PM_{2.5}$ of less than 0.5% (0.12 µg/m^3) is considered to be so small as to be negligible. A change (impact) that is negligible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

The EPUK / IAQM guidance indicates that it is the intention of the effect descriptors for smaller changes in pollutant concentrations to capture the potential risk associated with cumulative development. Changes of 1% of a relevant air quality objective could, under the EPUK / IAQM guidance, result in slight to moderate air quality effects at individual receptors. In practice this assessment inherently considers cumulative impacts through the use of traffic data, Defra background concentrations and predictions at committed developments. Therefore, it is considered highly unlikely that significant air quality impacts could occur with the Proposed Development for changes in concentrations of 1%.

Additionally, the EPUK / IAQM guidance also includes the potential for minor to major air quality effects as a result of changes in pollutant concentrations between 2 and 5% of relevant air quality objectives. For annual average NO_2 concentrations, this relates to changes in concentrations ranging from 0.6–2.1 µg/m^3. In practice, changes in concentration of this magnitude, and in particular changes at the lower end of this band are likely to be very difficult to distinguish through any post operational monitoring regime due to the number of sources of NO_2 in an urban environment and the inter annual effects of varying meteorological conditions. Therefore, in the overall evaluation of significance the potential for significant air quality impacts within this band will be considered in this context.

Changes in concentration of more than 5% (the two highest bands) are considered to be of a magnitude which is far more likely to be discernible and as such carry additional weight within the overall evaluation of significance for air quality.

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

Assessment

Table E1 to Table E3 detail the predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations for the existing and proposed situations, and the difference between them for each of the selected receptor positions for the year of operation scenario (2017).

Table E4 to Table E6 detail the predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations for the existing and proposed situations, and the difference between them for each of the selected receptor positions for the year of ULEZ operation scenario (2020).

Each receptor has been modelled at each floor of the building considered. The results presented here are for the first residential floor of the building, where there is residential use; otherwise ground floor results are presented. For all receptors, concentration decreased with increasing floor level, as did the magnitude of change. Note the ground floor is reported as floor 1, the first floor as floor 2 etc.

Table E1: Nitrogen Dioxide Results for the Year of Opening (2017)

Receptor		Floor	Existing Annual Mean NO_2 Concentration ($\mu g/m^3$)	Proposed Annual Mean NO_2 Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Effect Descriptor
1	Junction Road	2	**43.2**	**41.1**	-2.1	Moderate Beneficial
2	Archway Tower, Junction Road & Holloway Road	2	**44.8**	38.3	-6.5	Substantial Beneficial
3	Archway Tower, Junction Road & Holloway Road	2	**44.5**	37.2	-7.3	Substantial Beneficial
4	Flowers Mews	2	**40.2**	39.2	-1.0	Moderate Beneficial
5	Archway Tower, Holloway Road	2	**41.2**	36.3	-4.9	Substantial Beneficial
6	A1 & Highgate Hill	2	**47.9**	**40.3**	-7.7	Substantial Beneficial
7	Highgate Hill	1	**45.0**	**44.0**	-0.9	Substantial Beneficial
8	Flowers Mews	2	**41.7**	**42.5**	0.7	Moderate Adverse
9	Archway Road	1	37.0	**41.3**	4.4	Substantial Adverse
10	Archway Road	1	38.9	**45.1**	6.3	Substantial Adverse
11	End of Flowers Mews	1	**47.0**	**57.0**	10.0	Substantial Adverse
12	St John's Way	1	36.2	37.0	0.8	Slight Adverse
13	St John's Way	1	36.5	36.2	-0.4	Negligible
14	St John's Way	1	33.8	33.7	-0.1	Negligible
15	Archway Road	1	36.6	**41.2**	4.6	Substantial Adverse
16	Harberton Road	1	34.0	37.3	3.4	Moderate Adverse
17	St John's Way & Archway Road	1	**41.2**	**45.1**	3.9	Substantial Adverse

Receptor		Floor	Existing Annual Mean NO_2 Concentration ($\mu g/m^3$)	Proposed Annual Mean NO_2 Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Effect Descriptor
18	St John's Way & Archway Road	1	**47.1**	**52.3**	5.2	Substantial Adverse
19	St John's Way & Archway Road	1	**41.1**	**42.8**	1.7	Moderate Adverse
20	Holloway Road	2	**40.2**	**41.3**	1.0	Moderate Adverse
21	Junction Road	2	**40.6**	38.4	-2.2	Moderate Beneficial
22	Junction Road	2	39.2	36.5	-2.6	Moderate Beneficial
23	Holloway Road	2	38.4	39.1	0.7	Moderate Adverse
24	Holloway Road	2	38.8	39.6	0.8	Moderate Adverse
25	Holloway Road	2	**42.1**	**41.2**	-0.9	Moderate Beneficial
26	Junction Road, Holloway Road	3	39.6	38.1	-1.5	Moderate Beneficial
27	Vorley Road	1	34.8	33.9	-1.0	Slight Beneficial
28	Highgate Hill	1	**40.0**	39.3	-0.7	Moderate Beneficial
29	Highgate Hill	1	39.0	38.6	-0.4	Slight Beneficial
30*	Hamlyn House	2	**41.9**	38.9	-3.0	Substantial Beneficial

*Receptors only considered for short-term impacts.
Note: **Bold** denotes an exceedance of an air quality objective

Table E2: PM_{10} Results for the Year of Opening (2017)

Receptor		Floor	Existing Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Proposed Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Effect Descriptor
1	Junction Road	2	24.5	24.4	-0.1	Negligible Beneficial
2	Archway Tower, Junction Road & Holloway Road	2	24.6	24.1	-0.6	Negligible Beneficial
3	Archway Tower, Junction Road & Holloway Road	2	24.6	23.9	-0.7	Negligible Beneficial
4	Flowers Mews	2	24.2	24.1	-0.1	Negligible Beneficial
5	Archway Tower, Holloway Road	2	24.3	23.8	-0.5	Negligible Beneficial
6	A1 & Highgate Hill	2	24.9	24.1	-0.8	Negligible Beneficial
7	Highgate Hill	1	24.6	24.5	-0.1	Negligible Beneficial
8	Flowers Mews	2	24.4	24.4	<0.1	Negligible
9	Archway Road	1	23.1	23.3	0.2	Negligible Adverse
10	Archway Road	1	23.4	23.7	0.3	Negligible Adverse
11	End of Flowers Mews	1	25.2	26.3	1.1	Negligible Adverse
12	St John's Way	1	23.9	23.9	0.1	Negligible Adverse
13	St John's Way	1	22.9	22.9	<0.1	Negligible
14	St John's Way	1	22.6	22.6	<0.1	Negligible
15	Archway Road	1	23.1	23.3	0.2	Negligible Adverse
16	Harberton Road	1	22.7	22.9	0.1	Negligible Adverse
17	St John's Way & Archway Road	1	24.4	24.9	0.5	Negligible Adverse

Receptor		Floor	Existing Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Proposed Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Effect Descriptor
18	St John's Way & Archway Road	1	25.1	25.9	0.8	Negligible Adverse
19	St John's Way & Archway Road	1	24.4	24.6	0.2	Negligible Adverse
20	Holloway Road	2	24.4	24.5	0.1	Negligible Adverse
21	Junction Road	2	24.2	24.1	<0.1	Negligible
22	Junction Road	2	24.0	23.9	-0.1	Negligible Beneficial
23	Holloway Road	2	24.3	24.3	<0.1	Negligible
24	Holloway Road	2	24.3	24.3	<0.1	Negligible
25	Holloway Road	2	24.6	24.5	-0.1	Negligible Beneficial
26	Junction Road, Holloway Road	3	24.1	24.0	-0.1	Negligible Beneficial
27	Vorley Road	1	23.6	23.6	<0.1	Negligible
28	Highgate Hill	1	23.0	23.0	<0.1	Negligible
29	Highgate Hill	1	22.9	22.9	<0.1	Negligible
30*	Hamlyn House	2	24.3	24.0	-0.3	Negligible Beneficial

*Receptors only considered for short-term impacts

Table E3: $PM_{2.5}$ Results for the Year of Opening (2017)

Receptor		Floor	Existing Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Proposed Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Effect Descriptor
1	Junction Road	2	16.8	16.7	-0.1	Negligible Beneficial
2	Archway Tower, Junction Road & Holloway Road	2	16.8	16.4	-0.4	Negligible Beneficial
3	Archway Tower, Junction Road & Holloway Road	2	16.8	16.3	-0.5	Negligible Beneficial
4	Flowers Mews	2	16.5	16.5	-0.1	Negligible Beneficial
5	Archway Tower, Holloway Road	2	16.6	16.3	-0.3	Negligible Beneficial
6	A1 & Highgate Hill	2	17.0	16.5	-0.5	Negligible Beneficial
7	Highgate Hill	1	16.8	16.7	<0.1	Negligible
8	Flowers Mews	2	16.7	16.7	<0.1	Negligible
9	Archway Road	1	15.9	16.1	0.1	Negligible Adverse
10	Archway Road	1	16.1	16.3	0.2	Negligible Adverse
11	End of Flowers Mews	1	17.2	17.9	0.8	Negligible Adverse
12	St John's Way	1	16.3	16.4	<0.1	Negligible
13	St John's Way	1	15.8	15.8	<0.1	Negligible
14	St John's Way	1	15.6	15.6	<0.1	Negligible
15	Archway Road	1	15.9	16.0	0.2	Negligible Adverse
16	Harberton Road	1	15.7	15.8	0.1	Negligible Adverse

Receptor		Floor	Existing Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Proposed Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Effect Descriptor
17	St John's Way & Archway Road	1	16.7	17.0	0.3	Negligible Adverse
18	St John's Way & Archway Road	1	17.2	17.7	0.5	Negligible Adverse
19	St John's Way & Archway Road	1	16.7	16.8	0.1	Negligible Adverse
20	Holloway Road	2	16.7	16.7	0.1	Negligible Adverse
21	Junction Road	2	16.5	16.5	<0.1	Negligible
22	Junction Road	2	16.4	16.3	-0.1	Negligible Beneficial
23	Holloway Road	2	16.6	16.6	<0.1	Negligible
24	Holloway Road	2	16.6	16.6	<0.1	Negligible
25	Holloway Road	2	16.8	16.7	-0.1	Negligible Beneficial
26	Junction Road, Holloway Road	3	16.5	16.4	-0.1	Negligible Beneficial
27	Vorley Road	1	16.1	16.1	<0.1	Negligible
28	Highgate Hill	1	15.9	15.9	<0.1	Negligible
29	Highgate Hill	1	15.8	15.8	<0.1	Negligible
30*	Hamlyn House	2	16.6	16.4	-0.2	Negligible Beneficial

Table E4: Nitrogen Dioxide Results for the Year of ULEZ Operation (2020)

Receptor		Floor	Existing Annual Mean NO_2 Concentration ($\mu g/m^3$)	Proposed Annual Mean NO_2 Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Effect Descriptor
1	Junction Road	2	39.9	38.3	-1.5	Moderate Beneficial
2	Archway Tower, Junction Road & Holloway Road	2	**41.3**	36.3	-5.0	Substantial Beneficial
3	Archway Tower, Junction Road & Holloway Road	2	**41.2**	35.5	-5.7	Substantial Beneficial
4	Flowers Mews	2	38.0	37.2	-0.9	Moderate Beneficial
5	Archway Tower, Holloway Road	2	38.7	34.9	-3.8	Moderate Beneficial
6	A1 & Highgate Hill	2	**43.9**	38.1	-5.9	Substantial Beneficial
7	Highgate Hill	1	**41.9**	**41.2**	-0.7	Moderate Beneficial
8	Flowers Mews	2	39.3	39.4	+0.2	Slight Adverse
9	Archway Road	1	35.4	38.4	+3.1	Moderate Adverse
10	Archway Road	1	37.0	**41.4**	+4.4	Substantial Adverse
11	End of Flowers Mews	1	**43.7**	**50.9**	+7.3	Substantial Adverse
12	St John's Way	1	35.5	36.0	+0.5	Negligible
13	St John's Way	1	36.3	35.9	-0.4	Negligible
14	St John's Way	1	33.5	33.4	-0.1	Negligible
15	Archway Road	1	35.1	38.3	+3.2	Moderate Adverse
16	Harberton Road	1	33.0	35.3	+2.3	Moderate Adverse
17	St John's Way & Archway Road	1	39.7	**42.7**	+3.0	Substantial Adverse

Receptor		Floor	Existing Annual Mean NO_2 Concentration ($\mu g/m^3$)	Proposed Annual Mean NO_2 Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Effect Descriptor
18	St John's Way & Archway Road	1	**43.7**	**48.1**	+4.4	Substantial Adverse
19	St John's Way & Archway Road	1	38.9	**40.2**	+1.3	Moderate Adverse
20	Holloway Road	2	38.3	39.0	+0.7	Moderate Adverse
21	Junction Road	2	37.5	36.1	-1.4	Slight Beneficial
22	Junction Road	2	36.4	34.5	-1.9	Slight Beneficial
23	Holloway Road	2	36.9	37.3	+0.4	Negligible
24	Holloway Road	2	37.2	37.6	+0.5	Negligible
25	Holloway Road	2	39.5	38.7	-0.8	Moderate Beneficial
26	Junction Road, Holloway Road	3	37.3	36.1	-1.2	Slight Beneficial
27	Vorley Road	1	33.5	32.6	-0.8	Slight Beneficial
28	Highgate Hill	1	37.7	37.1	-0.5	Negligible
29	Highgate Hill	1	36.9	36.5	-0.3	Negligible
30*	Hamlyn House	2	39.2	36.9	-2.2	Moderate Beneficial

*Receptors only considered for short-term impacts.
Note: **Bold** denotes an exceedance of an air quality objective

Table E5: PM_{10} Results for the Year of ULEZ Operation (2020)

Receptor		Floor	Existing Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Proposed Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Effect Descriptor
1	Junction Road	2	24.6	24.5	-0.2	Negligible Beneficial
2	Archway Tower, Junction Road & Holloway Road	2	24.7	24.1	-0.7	Negligible Beneficial
3	Archway Tower, Junction Road & Holloway Road	2	24.7	23.9	-0.8	Negligible Beneficial
4	Flowers Mews	2	24.3	24.1	-0.2	Negligible Beneficial
5	Archway Tower, Holloway Road	2	24.3	23.8	-0.5	Negligible Beneficial
6	A1 & Highgate Hill	2	25.1	24.1	-0.9	Negligible Beneficial
7	Highgate Hill	1	24.7	24.6	-0.1	Negligible Beneficial
8	Flowers Mews	2	24.5	24.4	-0.1	Negligible Beneficial
9	Archway Road	1	23.2	23.4	+0.3	Negligible Adverse
10	Archway Road	1	23.5	23.8	+0.4	Negligible Adverse
11	End of Flowers Mews	1	25.3	26.3	+1.1	Negligible Adverse
12	St John's Way	1	23.9	24.0	+0.1	Negligible Adverse
13	St John's Way	1	22.9	22.9	<0.1	Negligible
14	St John's Way	1	22.6	22.6	<0.1	Negligible
15	Archway Road	1	23.1	23.4	+0.3	Negligible Adverse
16	Harberton Road	1	22.8	22.9	+0.2	Negligible Adverse
17	St John's Way & Archway Road	1	24.5	25.0	+0.5	Negligible Adverse

Receptor		Floor	Existing Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Proposed Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Effect Descriptor
18	St John's Way & Archway Road	1	25.2	26.1	+0.8	Negligible Adverse
19	St John's Way & Archway Road	1	24.5	24.7	+0.2	Negligible Adverse
20	Holloway Road	2	24.5	24.6	+0.1	Negligible Adverse
21	Junction Road	2	24.2	24.1	-0.1	Negligible Beneficial
22	Junction Road	2	24.0	23.9	-0.2	Negligible Beneficial
23	Holloway Road	2	24.3	24.3	<0.1	Negligible
24	Holloway Road	2	24.4	24.4	<0.1	Negligible
25	Holloway Road	2	24.6	24.5	-0.1	Negligible Beneficial
26	Junction Road, Holloway Road	3	24.2	24.1	-0.1	Negligible Beneficial
27	Vorley Road	1	23.6	23.6	-0.1	Negligible
28	Highgate Hill	1	23.1	23.1	<0.1	Negligible
29	Highgate Hill	1	23.0	23.0	<0.1	Negligible
30*	Hamlyn House	2	24.4	24.0	-0.4	Negligible Beneficial

*Receptors only considered for short-term impacts

Table E6: $PM_{2.5}$ Results for the Year of ULEZ Operation (2020)

Receptor		Floor	Existing Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Proposed Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Effect Descriptor
1	Junction Road	2	16.8	16.7	-0.1	Negligible Beneficial
2	Archway Tower, Junction Road & Holloway Road	2	16.9	16.5	-0.5	Negligible Beneficial
3	Archway Tower, Junction Road & Holloway Road	2	16.9	16.4	-0.6	Negligible Beneficial
4	Flowers Mews	2	16.6	16.5	-0.1	Negligible Beneficial
5	Archway Tower, Holloway Road	2	16.7	16.3	-0.4	Negligible Beneficial
6	A1 & Highgate Hill	2	17.2	16.5	-0.6	Negligible Beneficial
7	Highgate Hill	1	16.9	16.8	-0.1	Negligible Beneficial
8	Flowers Mews	2	16.7	16.7	-0.1	Negligible Beneficial
9	Archway Road	1	16.0	16.2	+0.2	Negligible Adverse
10	Archway Road	1	16.2	16.4	+0.3	Negligible Adverse
11	End of Flowers Mews	1	17.3	18.0	+0.7	Negligible Adverse
12	St John's Way	1	16.3	16.4	+0.1	Negligible Adverse
13	St John's Way	1	15.8	15.8	<0.1	Negligible
14	St John's Way	1	15.6	15.6	<0.1	Negligible
15	Archway Road	1	15.9	16.1	+0.2	Negligible Adverse
16	Harberton Road	1	15.7	15.8	+0.1	Negligible Adverse

Receptor		Floor	Existing Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Proposed Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)	Change ($\mu g/m^3$)	Effect Descriptor
17	St John's Way & Archway Road	1	16.7	17.1	+0.3	Negligible Adverse
18	St John's Way & Archway Road	1	17.3	17.8	+0.5	Negligible Adverse
19	St John's Way & Archway Road	1	16.7	16.9	+0.1	Negligible Adverse
20	Holloway Road	2	16.7	16.8	+0.1	Negligible Adverse
21	Junction Road	2	16.6	16.5	-0.1	Negligible Beneficial
22	Junction Road	2	16.4	16.3	-0.1	Negligible Beneficial
23	Holloway Road	2	16.6	16.6	<0.1	Negligible
24	Holloway Road	2	16.6	16.6	<0.1	Negligible
25	Holloway Road	2	16.8	16.7	-0.1	Negligible Beneficial
26	Junction Road, Holloway Road	3	16.6	16.5	-0.1	Negligible Beneficial
27	Vorley Road	1	16.2	16.1	<0.1	Negligible
28	Highgate Hill	1	16.0	16.0	<0.1	Negligible
29	Highgate Hill	1	15.9	15.9	<0.1	Negligible
30*	Hamlyn House	2	16.7	16.4	-0.3	Negligible Beneficial

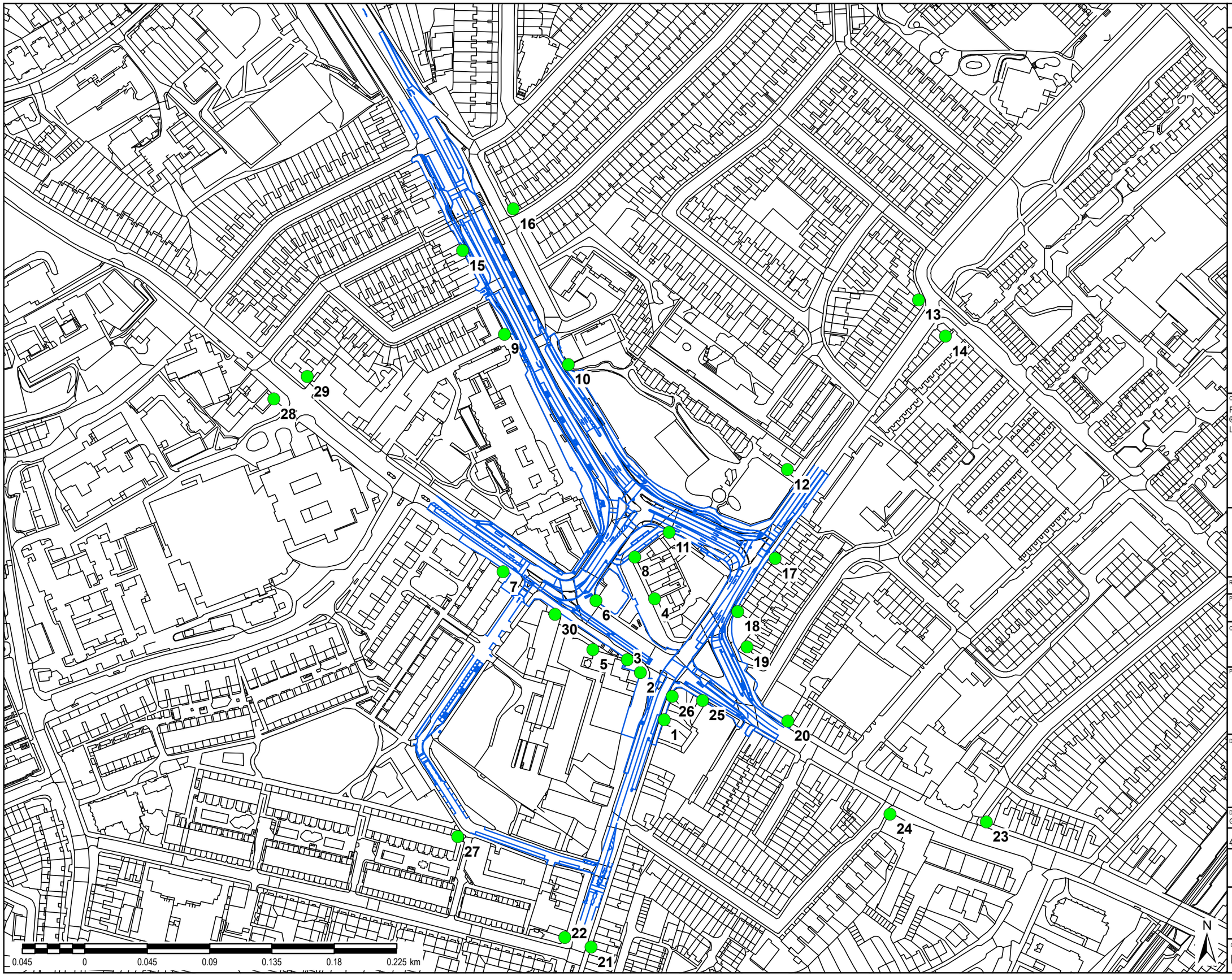
The results listed in Table E1 show that in 2017 it is predicted that there would be 15 beneficial impacts (2 slight, 7 moderate and 6 substantial), 13 adverse impacts (1 slight, 6 moderate and 6 substantial) and 2 negligible impacts, with regards to annual mean NO_2, based on the current EPUK and IAQM guidance (EPUK & IAQM, 2015).

The results listed in Table E4 show that in 2020, with the London ULEZ in operation, it is predicted that there would be 13 beneficial impacts (4 slight, 6 moderate and 3 substantial), 10 adverse impacts (1 slight, 5 moderate and 4 substantial) and 7 negligible impacts, with regards to annual mean NO_2, based on the same guidance. Therefore the use of Euro VI hybrid buses is predicted to improve air quality in 2020.

The results listed in Table E2 and Table E3, for annual mean concentrations of PM_{10} and $PM_{2.5}$ in the 2017 scenario, and Table E5 and Table E6, for annual mean concentrations of PM_{10} and $PM_{2.5}$ in the 2020 scenario, negligible impacts are predicted across the study area.

The above re-evaluation of significance would not alter the recommendations made for air quality in the above assessment, i.e. that a review of potential mitigation measures should be undertaken for the proposed scheme to establish if there are any further opportunities to mitigate areas of adverse impact.

FIGURES



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Noise and Air Quality Receptors

Proposed Scheme

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: DRAFT

Client: TRANSPORT FOR LONDON

Project Title: ARCHWAY GYRATORY

Drawing Title: MODELLED SELECTED RECEPTORS AND PROPOSED SCHEME

Drawn	Checked	Approved	Date
GH	SS	DD	16/02/2016

47072870 | Scale @ A3: 1:2,500

Drawing Number: FIGURE 1 | Rev: 01

N

16 15 9 10 13 14 29 28 12 11 8 17 7 6 4 18 30 19 5 3 2 26 25 1 20 27 24 23 22 21

LEGEND

- Noise Receptors

$L_{A10,\ 18h}$ dB at 1.5m (free-field)

- <=42
- 42 - 46
- 46 - 52
- 52 - 57
- 57 - 62
- 62 - 67
- 67 - 72
- >72

0.04 0 0.04 0.08 0.12 0.16 0.2 km

Project Title/Drawing Title

ARCHWAY GYRATORY:
EXISTING TRAFFIC NOISE LEVELS
(WITHOUT SCHEME - YEAR OF OPENING)

Client: TRANSPORT FOR LONDON

Drawn	Checked	Approved
NC	SS	DD
Date	Scale @ A3	Purpose of Issue
16/02/2016	1:2,000	DRAFT
Drawing Number		Rev
FIGURE 2		01

N

16
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12
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3
2
26
25
1
20
27
24
23
22
21

LEGEND

- Noise Receptors
- Proposed Scheme

$L_{A10,\ 18h}$ dB at 1.5m (free-field)

- <=42
- 42 - 47
- 47 - 52
- 52 - 57
- 57 - 62
- 62 - 67
- 67 - 72
- >72

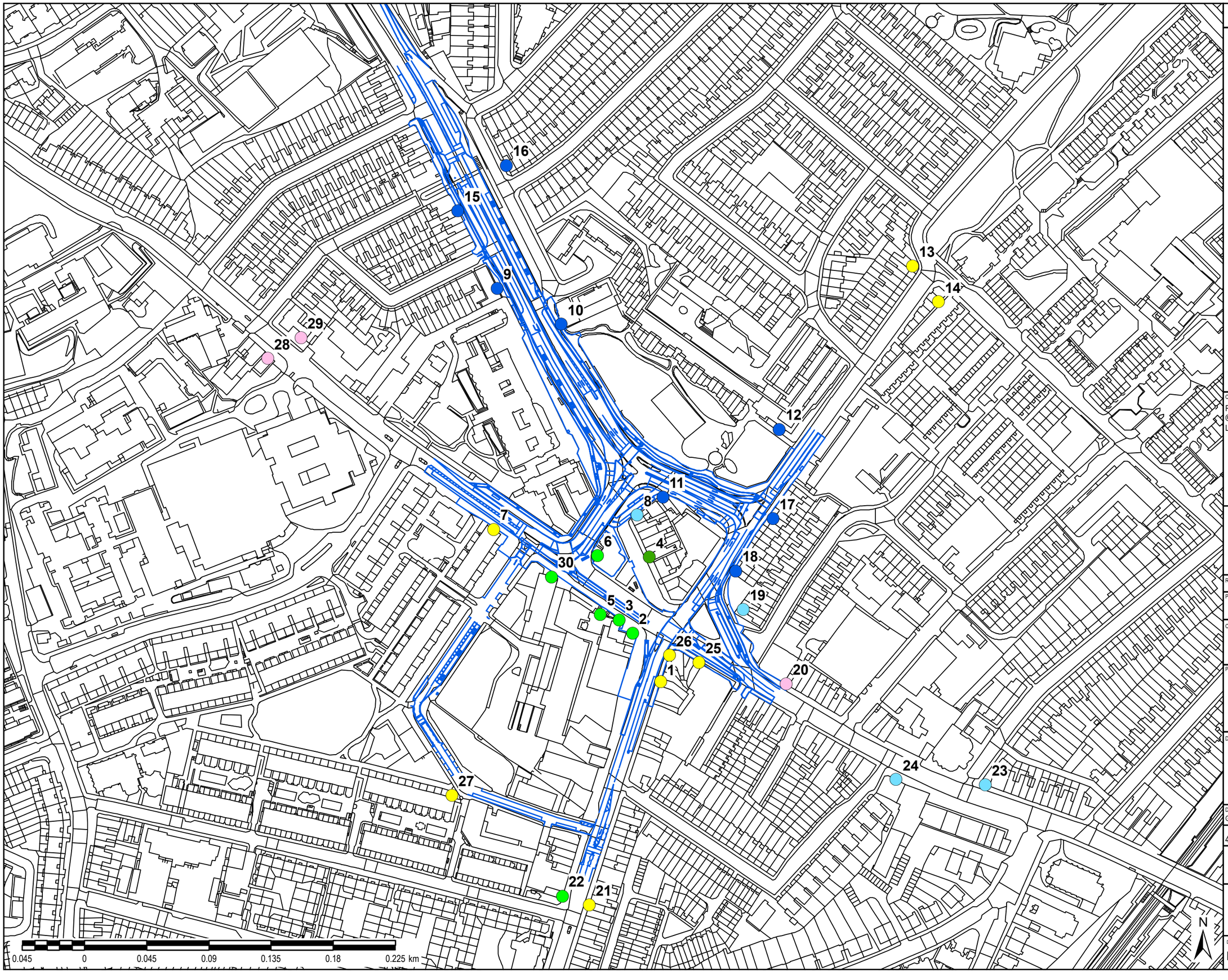
0.04 0 0.04 0.08 0.12 0.16 0.2 km

Project Title/Drawing Title

ARCHWAY GYRATORY:
PROPOSED TRAFFIC NOISE LEVELS
(WITH SCHEME – YEAR OF OPENING)

Client: TRANSPORT FOR LONDON

Drawn	Checked	Approved
GH	SS	DD
Date	Scale @ A3	Purpose of Issue
16/02/2016	1:2,000	DRAFT
Drawing Number		Rev
FIGURE 3		01



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LEGEND

Worst Case Change

- Decrease ≥ 5 dB
- Decrease 1.0 to 2.9 dB
- Decrease 0.1 to 0.9 dB
- No Change
- Increase 0.1 to 0.9 dB
- Increase 1.0 to 2.9 dB
- Proposed Scheme

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: DRAFT

Client: TRANSPORT FOR LONDON

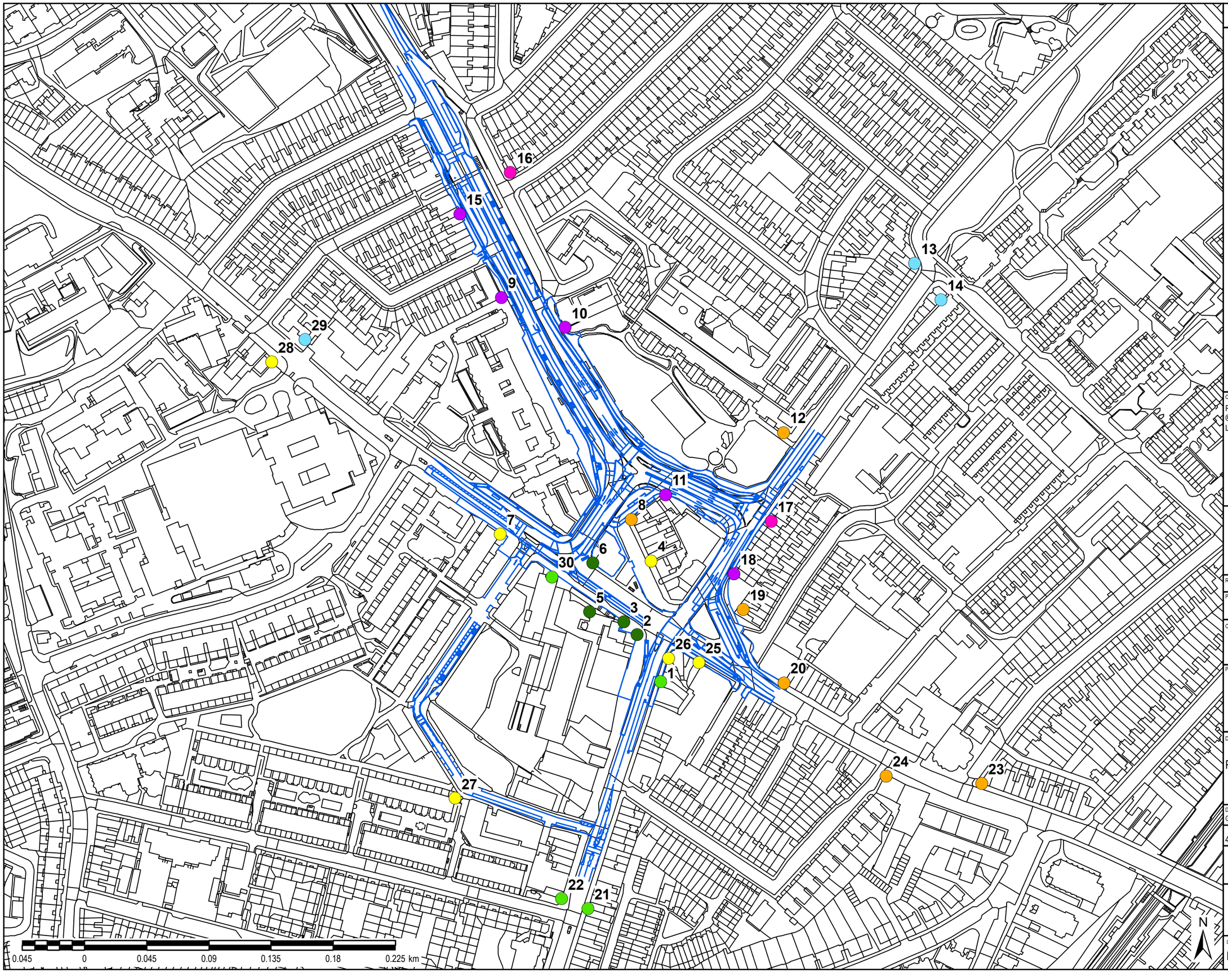
Project Title: ARCHWAY GYRATORY

Drawing Title: TRAFFIC NOISE CHANGES AT SELECTED RECEPTORS (WITH SCHEME MINUS WITHOUT SCHEME)

Drawn	Checked	Approved	Date
GH	SS	DD	16/02/2016

47072870 | Scale @ A3: 1:2,500

Drawing Number: FIGURE 4 | Rev: 01



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LEGEND

Nitrogen Dioxide Results

- Decrease >4 µg/m^3
- Decrease 2 - 4 µg/m^3
- Decrease 0.4 - 2 µg/m^3
- Imperceptible Change
- Increase 0.4 - 2 µg/m^3
- Increase 2- 4 µg/m^3
- Increase >4 µg/m^3
- Proposed Scheme

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: DRAFT

Client: TRANSPORT FOR LONDON

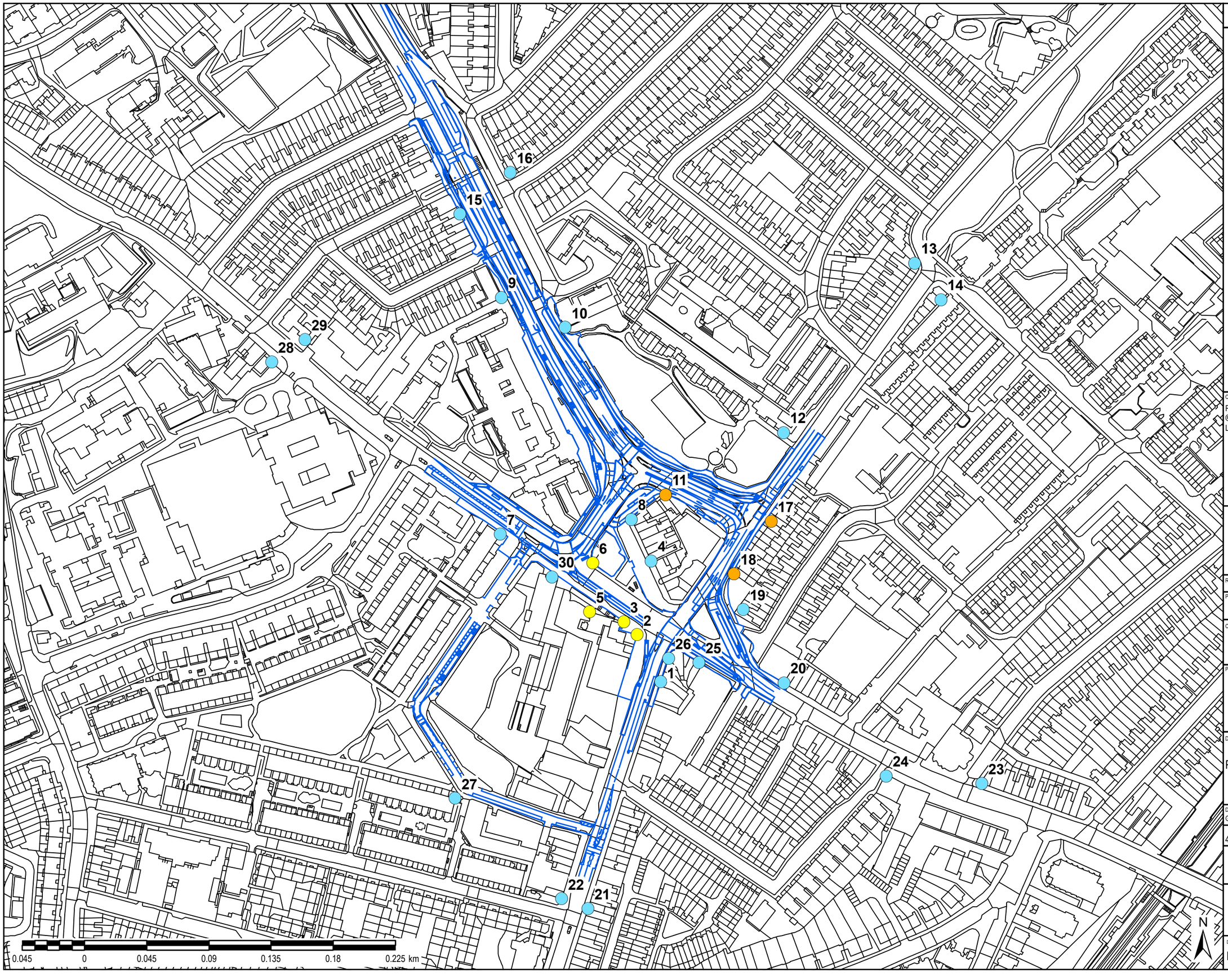
Project Title: ARCHWAY GYRATORY

Drawing Title: PREDICTED CHANGES IN ANNUAL MEAN NO_2 CONCENTRATIONS

Drawn	Checked	Approved	Date
GH	JM	DD	16/02/2016

47072870 | Scale @ A3: 1:2,500

Drawing Number: FIGURE 5 | Rev: 01



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LEGEND

PM_{10} Results

- Decrease >4 µg/m^3
- Decrease 2 - 4 µg/m^3
- Decrease 0.4 - 2 µg/m^3
- Imperceptible Change
- Increase 0.4 - 2 µg/m^3
- Increase 2- 4 µg/m^3
- Increase >4 µg/m^3
- Proposed Scheme

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: DRAFT

Client: TRANSPORT FOR LONDON

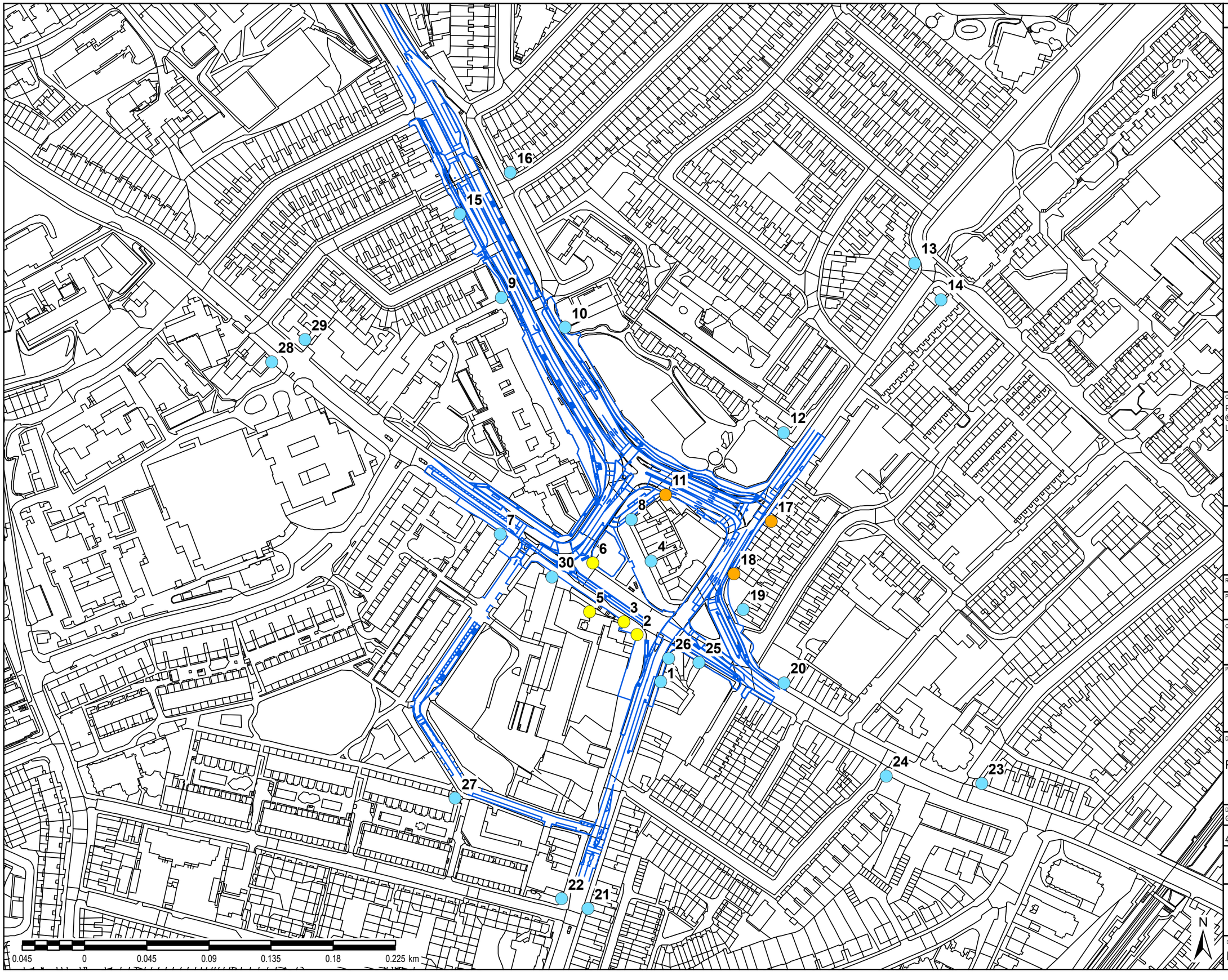
Project Title: ARCHWAY GYRATORY

Drawing Title: PREDICTED CHANGES IN ANNUAL MEAN PM_{10} CONCENTRATIONS

Drawn	Checked	Approved	Date
GH	JM	DD	16/02/2016

47072870 | Scale @ A3: 1:2,500

Drawing Number: **FIGURE 6** | Rev: **01**



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LEGEND

$PM_{2.5}$ Results

- Decrease >2.5 µg/m³
- Decrease 1.25 -2.5 µg/m³
- Decrease 0.25 - 1.25 µg/m³
- Imperceptible Change
- Increase 0.25 - 1.25 µg/m³
- Increase 1.25 - 2.5 µg/m³
- Increase >2.5 µg/m³
- Proposed Scheme

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: DRAFT

Client: TRANSPORT FOR LONDON

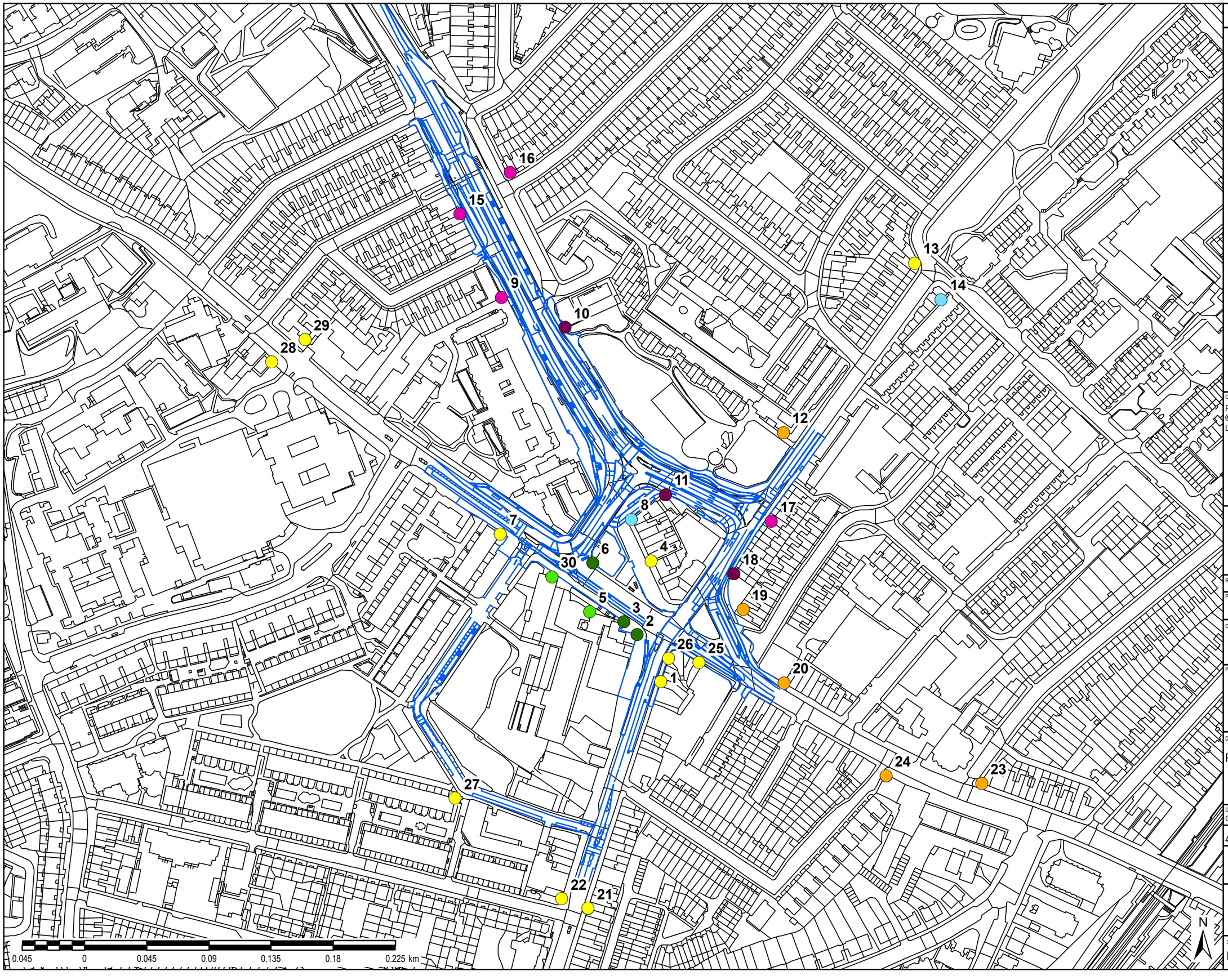
Project Title: ARCHWAY GYRATORY

Drawing Title: PREDICTED CHANGES IN ANNUAL MEAN $PM_{2.5}$ CONCENTRATIONS

Drawn	Checked	Approved	Date
GH	JM	DD	16/02/2016

47072870	Scale @ A3 1:2,500

Drawing Number	Rev
FIGURE 7	01



THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

AQ Results

Nitrogen Dioxide Results

- Decrease >4 µg/m^3
- Decrease 2 - 4 µg/m^3
- Decrease 0.4 - 2 µg/m^3
- Imperceptible Change
- Increase 0.4 - 2 µg/m^3
- Increase 2- 4 µg/m^3
- Increase >4 µg/m^3
- Proposed Scheme

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: DRAFT

Client: TRANSPORT FOR LONDON

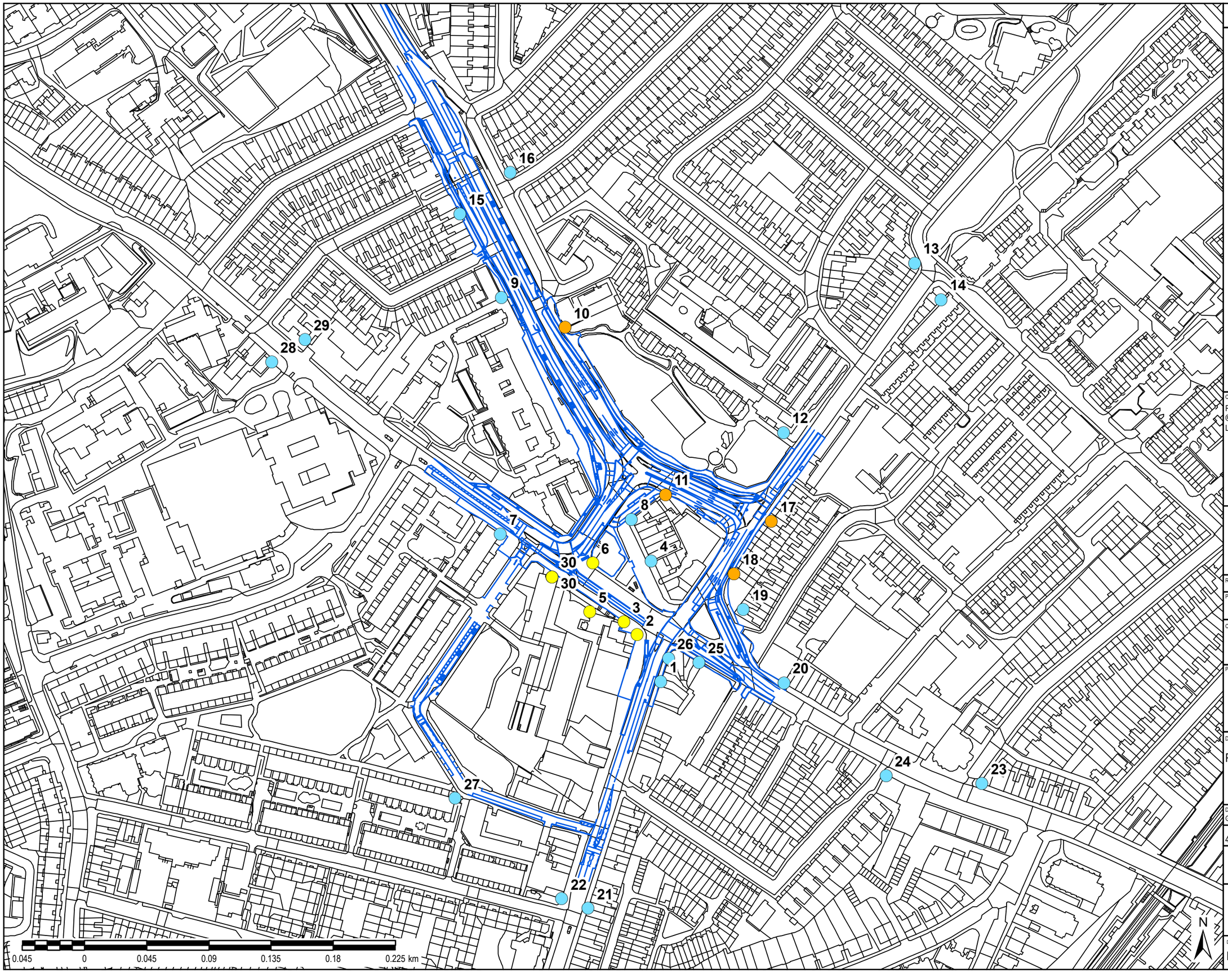
Project Title: ARCHWAY GYRATORY

Drawing Title: PREDICTED CHANGES IN ANNUAL MEAN NO_2 CONCENTRATIONS 2020 ULEZ SCENARIO

Drawn	Checked	Approved	Date
GH	JM	DD	16/02/2016

47072870 | Scale @ A3: 1:2,500

Drawing Number: FIGURE 8 | Rev: 01



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LEGEND

AQ Results

PM_{10} Results

- Decrease >4 µg/m^3
- Decrease 2 - 4 µg/m^3
- Decrease 0.4 - 2 µg/m^3
- Imperceptible Change
- Increase 0.4 - 2 µg/m^3
- Increase 2- 4 µg/m^3
- Increase >4 µg/m^3
- Proposed Scheme

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: DRAFT

Client: TRANSPORT FOR LONDON

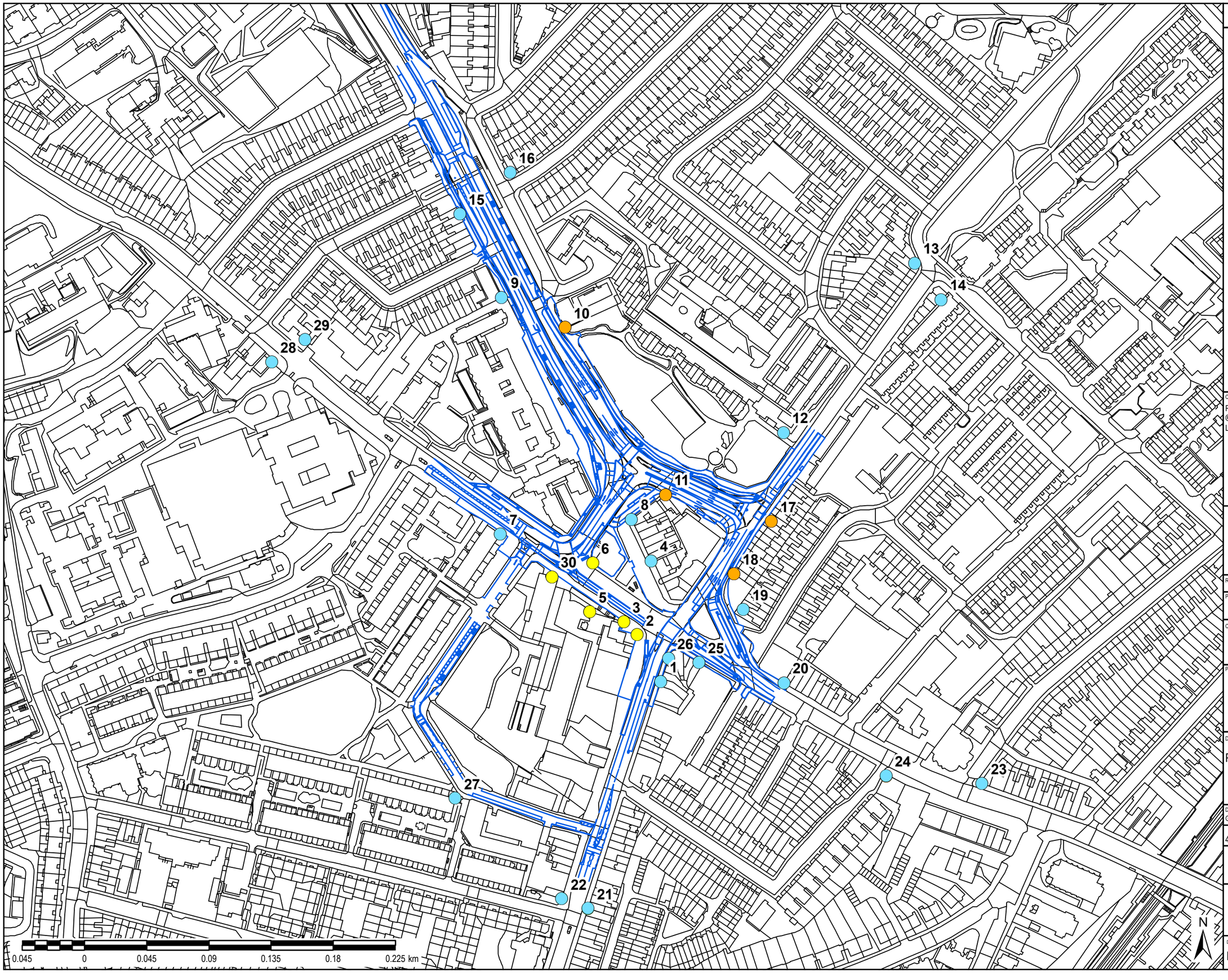
Project Title: ARCHWAY GYRATORY

Drawing Title: PREDICTED CHANGES IN ANNUAL MEAN PM_{10} CONCENTRATIONS 2020 ULEZ SCENARIO

Drawn	Checked	Approved	Date
GH	JM	DD	16/02/2016

47072870 | Scale @ A3: 1:2,500

Drawing Number: FIGURE 9 | Rev: 01



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LEGEND

AQ Results

$PM_{2.5}$ Results

- Decrease >2.5 µg/m^3
- Decrease 1.25 -2.5 µg/m^3
- Decrease 0.25 - 1.25 µg/m ^{3}
- Imperceptible Change
- Increase 0.25 - 1.25 µg/m^3
- Increase 1.25 - 2.5 µg/m^3
- Increase >2.5 µg/m^3
- Proposed Scheme

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: DRAFT

Client: TRANSPORT FOR LONDON

Project Title: ARCHWAY GYRATORY

Drawing Title: PREDICTED CHANGES IN ANNUAL MEAN $PM_{2.5}$ CONCENTRATIONS 2020 ULEZ SCENARIO

Drawn	Checked	Approved	Date
GH	JM	DD	16/02/2016

47072870 | Scale @ A3: 1:2,500

Drawing Number: FIGURE 10 | Rev: 01