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LAND TO THE WEST OF HATFIELD

Environmental Statement – Chapter 7: Air Quality Addendum

Arlington Business Parks GP Limited

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1 CONTENTS

7 AIR QUALITY

7.1 CHAPTER ALTERATIONS

In 2018, SLR provided an Air Quality Impact Assessment and Air Quality Chapter to the Environmental Statement (ES), to support the planning application for a proposed residential-led development (the 'proposed development'), on land at Hatfield Business Park (the 'Application Site') (Welwyn Hatfield Council (WHC) application reference: 6/2018/2768/OUTLINE).

Following submission of this application, a Peer Review of the Air Quality Chapter to the Hatfield Business Park ES was prepared by Bureau Veritas (BV report reference: AIR6485266, dated March 2019), as part of the wider The Environment Partnership (TEP) review to the Environmental Impact Assessment (EIA) (TEP report reference: 7494.001, dated March 2019). Within the Peer Review, BV highlighted a number of 'recommendations' to increase the robustness of the assessment.

Furthermore, in the interim since the 2018 application and Air Quality Chapter to the ES was prepared, there has been an update to the traffic data applied as part of the assessment in terms of the design horizon year, inclusion of committed developments and routing of traffic, as well as updates to a number of air quality tools and datasets utilised within the previous assessment.

Therefore, this Air Quality Chapter Addendum provides an updated assessment of change in development trips during the operational phase based upon the provision of new traffic data, air quality tools and datasets, and addresses those comments made by BV during the Peer Review.

A summary of BV review comments, and response to comments made, is provided in Section 7.2.

7.2 BV REVIEW COMMENTS

BV comments:

7.2.1 Construction Dust Impact Assessment

7.2.1.1 BV comments:

"The assessment of dust impacts from the construction phase have been qualitatively assessed in accordance with IAQM best practice guidance and mitigation measures have been recommended based on the designation risk of impact in terms of dust soiling impacts and human health impacts. Due to following the IAQM assessment process, and providing subsequent mitigation from the guidance, the dust assessment has been completed in a robust manner and the outcomes are appropriate to the scale of the proposed development."

7.2.1.2 SLR Response:

No response required.

7.2.2 Mineral Dust Impact Assessment

7.2.2.1 BV comments:

It is not clear within the assessment of operational mineral dust how the risk of impact from the Furze Field, Hatfield Quarry site has been considered to have a 'not significant' effect on air quality on the proposed development. From the completed DIA it is stated that three receptor locations, close to the proposed development boundary, are likely to witness a 'slight adverse' impact from mineral dust. After an explanation of this within the AQA, it is stated that in accordance with IAQM minerals guidance, the predicted impact is considered to be a 'not significant' effect on air quality. This doesn't provide a clear explanation as to why the effects have been defined as not significant when there is a slight adverse impact predicted. For this statement to be robust and defensible further clarification would need to be provided within the AQA on the mitigation measures outlined within the DIA.

Following clarification of these points it would be appropriate for the Consultant to complete a Source-Pathway-Receptor assessment of the potential impacts from the quarry extension upon the residential parcels within the proposed development. We would recommend that further consultation with the Council is completed as to the level of assessment that is required.

7.2.2.2 SLR Response:

SLR disagrees with BV's above review on the basis that impacts and effects arising from mineral dust generated by the Furze Field Quarry Extension Site have already been accepted by WHC / Hertfordshire County Council (HCC) at receptor locations of an identical separation distance / direction to that of proposed residential parcels on the northern boundary associated with the Land at Hatfield Business Park development. The Furze Field Quarry Extension Site was granted consent by HCC on 19th October 2018 (application reference: 5/3720-16).

A 'Dust & Air Quality Assessment'[1] was submitted in support of the planning application for the consented Furze Field Quarry Extension Site. As part of the WYG assessment, impacts from operational dust was assessed at 5No. receptor locations. This included 3No. receptors on the northern boundary of the Application Site: R1 Astwick Manor; R2 Aswick Manor Lodge; and R3 Astwick Manor Cottages. Reference should be made to 'Figure 1 Air Quality Assessment Area' of the submitted WYG assessment for an illustration of the location of these receptors relative to the consented Furze Field Quarry Extension Site and the Application Site.

The submitted WYG assessment for the consented Furze Field Quarry Extension Site predicted a maximum 'slight adverse' impact at these receptors, then concluded a not significant effect based upon the application of dust control measures.

SLR notes that Institute of Air Quality Management (IAQM) 'Guidance on the assessment of mineral dust impacts for planning' (v1.1, 2016) states:

"6.3.1 Distance between dust source and receptors

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[1] Hatfield Quarry Extension – Furze Field, Hatfield, Hertfordshire. Dust & Air Quality Assessment, February 2016. WYG.

> *The dust that has become suspended in the air will dilute, disperse and deposit from the air (as deposited dust) with the resultant airborne PM concentration decreasing rapidly as a function of distance from its source."*

In consideration of the 'Pathway' element of the Source-Pathway-Receptor conceptual model, impacts at receptor locations 500m from a dust source will be correspondingly lower than those impacts at a receptor location 100m from a dust source, for example. Therefore, as worst-case receptor locations corresponding to the northern boundary of the Land at Hatfield Business Park development were concluded to witness a 'slight adverse' impact / not significant effect, proportionate lessor impacts would occur at receptor locations within the Land at Hatfield Business Park development at increasing separation distances from the consented Furze Field Quarry Extension Site (i.e. the source of dust). The effect would remain to be 'not significant'.

As part of their review, and in regard to the determination of impact and effect on mineral dust referenced from the WYG assessment, BV state:

> *"This doesn't provide a clear explanation as to why the effects have been defined as not significant when there is a slight adverse impact predicted. For this statement to be robust and defensible further clarification would need to be provided within the AQA on the mitigation measures outlined within the DIA.*
>
> *Following clarification of these points it would be appropriate for the Consultant to complete a Source-Pathway-Receptor assessment of the potential impacts from the quarry extension upon the residential parcels within the proposed development. We would recommend that further consultation with the Council is completed as to the level of assessment that is required."*

During formal consultation on the Furze Field Quarry Extension, WHC provided a consultation response which ultimately did not raise any grounds for objection relating to mineral dust, and recommend approval subject to conditions. None of these conditions relate to a requirement to update the dust assessment to re-evaluate the predicted impacts or provide further clarification and evidence base to support the predicted effect. Therefore, the determination of the impact and effect, and conclusions to the WYG assessment for the consented Furze Field Quarry Extension Site has been accepted by the WHC Environmental Health Officer as part of their statutory consultee role to HCC. As discussed above, this accepted impact / effect includes receptor locations which are directly comparable (from a distance / direction stance) to proposed residential parcels on the northern boundary associated with the Land at Hatfield Business Park development.

SLR notes that the Furze Field Quarry Extension Site was granted consent subject to a number of planning conditions, including the following pertaining to air quality:

10. The operator shall ensure at all times that areas outside of the boundary of the site are not affected by dust nuisance resulting from the mineral extraction and processing operation. As a minimum, the operation shall put in place the following measures:

i) tracked vehicles shall be used for soil stripping, mineral excavation and re-spreading of soil, with the exception of wheeled vehicles for the transport of soil and mineral,

ii) minimising vehicle speeds within the site to 10mph;
iii) avoiding soil stripping in extremely dry conditions;
iv) the use of a water bowser or sprays on haul routes or areas trafficked by vehicles or plant;
v) minimising drop heights into the conveyor hopper;
vi) minimising drop heights at transfer points where a change in direction of the conveyor takes place.

The above dust control measures shall be monitored and implemented by the operator at all times.

Reason: to ensure no significant degradation of the air from dust and emissions will occur, in accordance with Minerals Policy 18 (ix) of the Hertfordshire Minerals Local Plan 2002-2016 (Adopted March 2007).
Air Quality Management Plan

11. Prior to the commencement of development a detailed air quality management plan to address the method of working at the extraction site shall be submitted to and agreed in writing by the Mineral Planning Authority. The plan shall include:
   (a) precise arrangements for the measurement of wind speed on the site;
   (b) dust monitoring points around the site boundary;
   (c) monitoring frequency and procedures to make available monitoring information to the Mineral Planning Authority;
   (d) proposals to mitigate the effects of dust on air quality, including contingency working methods at times of dry and windy conditions;

Reason: to ensure no significant degradation of the air from dust and emissions will occur, in accordance with Minerals Policy 18 (ix) of the Hertfordshire Minerals Local Plan 2002-2016 (Adopted March 2007).

Dust control measures (condition 10) and / or air quality management plan measures (condition 11) are required as part of the Furze Field Quarry Extension site consent to minimise dust / air quality impacts beyond the site boundary, including those receptors on the northern boundary of the Land at Hatfield Business Park development. Proposed residential dwellings / parcels within the Land at Hatfield Business Park development would ultimately be afforded the same level of protection required by these planning conditions.

Therefore, SLR considers that the previously determined 'not significant' effect on air quality at the Application Site arising from mineral dust associated with the Furze Field Quarry Extension Site remains robust and defensible.

7.2.3 Operational Phase Impact Assessment

7.2.3.1 BV comments:

"The assessment of air quality impacts from the operation phase have been qualitatively assessed in accordance with EPUK/IAQM best practice guidance. It was concluded, that based on using future year emission factors and background map concentrations, that the overall effect of the proposed development upon NO_2, PM_{10} and $PM_{2.5}$ concentrations is 'not significant'. A sensitivity analysis where emission rates and background concentrations from the future year has been completed but is not discussed within the conclusions of the AQA.

The conclusions, that have been made based upon the predicted concentration results, are in accordance with best practice guidance but there are a number of queries that we have raised in relation to the model inputs used that lead to a level of uncertainty within the completed modelling and cast doubt upon the robustness of the assessment and as to whether the modelled predictions are appropriate to the initial objectives of the AQA. A number of recommendations have been made in relation to the model inputs that would increase the level of accuracy of the model and the level of appropriateness of the assessment.

Are there any Deficiencies or Errors

Within the AQA there are no errors where data has been incorrectly calculated or presented, but there are a number of deficiencies within the dispersion modelling completed that will affect the overall accuracy of the assessment. There are a number of model inputs that should be scrutinised including the road links used within the model and the diffusion tubes that have been used to verify the concentration outputs of the model. A full list of the identified deficiencies is provided below:

- *The A1(M) road link not included within the modelling assessment*
- *Diffusion tube locations WH24 and WH27 no* [sic] *used within the verification calculations.*
- *The RMSE for the verification calculations being above 10%.*
- *Diffusion tube WH16 not being report upon* [sic] *in terms of background concentrations.*
- *The Sector Removal Tool not being utilised.*
- *Clarification on traffic data baseline factors.*
- *Clarification on model inputs, canyons, terrain, etc.*
- *A diurnal profile not included within the modelling assessment.*
- *Limited information on the classification of potential impacts from the quarry extension.*
- *Results of the sensitivity analysis not being discussed.*

From completing a review of the AQA and associated documents our recommendations are provided below. A number of these are further clarifications on existing details within the AQA and aesthetic improvements that would enable those reading the assessment to be greater informed in relation to the information and processes used within the assessment. In addition there are improvements recommended to the modelling processes that would improve the accuracy of the dispersion modelling completed.

Recommendations for Improvements

A number of improvements could be made to the AQA to improve the robustness of the assessment:

- *Inclusion of a monitoring location map – A map of modelled road links and receptor locations in relation to the Site has been included but it would be beneficial to also include the locations of pollution monitoring close to the Site.*
- *Updating the Furze Field DIA – The meteorological data used within the DIA has been taken from Luton Airport for 2008, and 2017 data from Luton Airport has been used within the AQA. It would be prudent to use this updated data to complete a revised Source-Pathway-Receptor analysis in relation to potential dust impacts from the Furze Field, Hatfield Quarry extension.*
- *Inclusion of the A1(M) within the modelled domain – Although the proposed development was not predicted to have an impact on vehicle flows on either the Northbound or Southbound flows on the A1(M) including the link within the baseline model would have improved the verification at monitoring locations WH19, WH25 and WH26. This would require the model to include the Hatfield Tunnel and subsequent road elevations to be assessed surrounding the tunnel.*
- *Clarification on a number of model inputs – How the 2017 traffic data has been derived from the 2018 data presented within the TA, details on any street canyons included within the modelled, any terrain data used, and following the inclusion of the A1(M) tunnels and heights of roads.*
- *Review of model verification – Sites WH24 and WH27 should be included within the initial step for model verification and all model inputs should be reviewed to potentially improve the accuracy of the verification leading to a lower verification factor. Once completed it should be ensured that the RMSE is below 10%.*
- *Use of background monitoring data – The Sector Removal Tool was not used to remove the road sources from the background maps before the calculation of annual mean concentrations, this would alter the verification calculations and annual mean concentration predictions. In addition the background monitoring site WH16 was not referred to within the AQA, this should have been investigated as a possible source for NO_2 background concentrations.*
- *Inclusion of a diurnal profile – A diurnal profile within the dispersion model to take account of changing traffic flows throughout weekday and weekend time periods.*
- *The addition of gridded receptors – If a layer of gridded receptors was added it would allow the plotting of pollution contours to present how concentrations change in relation to distance from the modelled road links.*
- *The inclusion of receptors within the Site – This will give predictions into the potential exposure that future residents of the proposed development would experience. Due to the application being for Outline Planning Permission, this can be assessed at the detailed stage of planning when the internal road layout has been confirmed.”*

7.2.3.2 SLR response:

A summary response to those comments above is provided within Table 7.1.

Table 7.1 : Summary of Peer Review Comments

BV Comment	SLR Response Summary
Inclusion of a monitoring location map – A map of modelled road links and receptor locations in relation to the Site has been included but it would be beneficial to also include the locations of pollution monitoring close to the Site.	Reference should be made to updated Drawing AQ2 for an illustration of modelled road links, receptor locations and air quality monitoring locations relative to the Application Site.
The A1(M) road link not included within the modelling assessment	The A1(M) road link has now been included within the dispersion modelling assessment. This includes consideration of tunnel portals corresponding the Hatfield Tunnel section of the A1(M) using the 'road tunnel' module within ADMS Roads. It is noted that only tunnel portal emissions have been considered: there are no 'tunnel vents' associated with the Hatfield Tunnel. Reference should be made to Appendix 7.1 for further information.
Diffusion tube locations WH24 and WH27 no [sic] used within the verification calculations.	Diffusion tube WH24 was not previously included within the verification calculations, as a review of streetview imagery could not corroborate the exact positioning of this diffusion tube to ensure accurate placement as part of the dispersion modelling. Diffusion tube WH27 was not previously included within the verification calculations, as no traffic data was previously available / provided for the B197 Wellfield Road. WH27 is positioned such that SLR considers the B197 Wellfield Road would represent a dominant source of monitored road traffic emissions. As such, as the B197 Wellfield Road was not expressly modelled, any calculated verification factor may have potentially underestimated modelled road oxides of nitrogen (NOx) concentrations at this location and skewed the verification calculations. Notwithstanding, diffusion tubes WH24 and WH27 are now included within the verification calculation, due to availability of road traffic data / identification of diffusion tube positioning (with the release of updated streetview imagery).
The RMSE for the verification calculations being above 10%.	SLR notes that Local Air Quality Management Technical Guidance (LAQM.TG(16)) states:

BV Comment	SLR Response Summary
	"Para 7.542 If the RMSE values are higher than ±25% of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. […] Ideally an RMSE within 10% of the air quality objective would be derived, which equates to 4µg/m^3 for the annual average NO_2 objective." Based upon the above, SLR notes that LAQM.TG(16) **does not** require for the RMSE to be within 10% of the applied objective. The Root Mean Square Error (RMSE) calculated and presented within Appendix 7.2 to Chapter 7 Air Quality (October 2018) of the Environmental Statement (ES) was within 25% of the applied objective, and therefore considered appropriate based upon LAQM.TG(16) guidance. Notwithstanding, updated verification based upon 2018 monitoring data, which includes updated consideration of model performance (including RMSE) is considered and presented within Appendix 7.1.
Diffusion tube WH16 not being report upon [sic] in terms of background concentrations.	Consideration of diffusion tube WH16 as a background concentration for application as part of the assessment is discussed within Section 7.4.2.5.
The Sector Removal Tool not being utilised.	SLR acknowledges that the 'Sector Removal Tool' was not utilised as part of the previously submitted Air Quality Chapter to the ES. The updated assessment presented herein includes use of the latest 'Sector Removal Tool' (presently v7.0 May 2019 publication) to exclude road sources from the DEFRA mapped 1km grid square background concentrations already accounted for within the ADMS roads dispersion model. It is noted that in the interim since the previously submitted Air Quality Chapter to the ES (dated October 2018), DEFRA has published an update to the mapped background concentration datasets, adopting a revised 2017 base year (May 2019 publication). These updated background datasets (2017 base year) have been used within the updated Air Quality Assessment. Reference should be made to Section 7.4.2.4 for further information.

BV Comment	SLR Response Summary
Clarification on traffic data baseline factors.	Baseline traffic data was provided by Vectos, transport consultants to the applicant, as a 2017 base year. As air quality consultants, it is not known how Vectos calculated corresponding 2017 flows from the 2018 base-year dataset. Notwithstanding, updated verification has been undertaken utilising a 2018 base-year dataset. Reference should be made to Appendix 7.1 for further information.
Clarification on model inputs, canyons, terrain, etc.	Reference should be made to Appendix 7.1 for further information.
A diurnal profile not included within the modelling assessment.	Reference should be made to Appendix 7.1 for further information.
Limited information on the classification of potential impacts from the quarry extension.	Reference should be made to Section 7.2.2.2 for further information.
Results of the sensitivity analysis not being discussed.	Reference should be made to Section 7.5.1.2 and Appendix 7.2 for further information.
The addition of gridded receptors – If a layer of gridded receptors was added it would allow the plotting of pollution contours to present how concentrations change in relation to distance from the modelled road links.	SLR questions the value in providing such a gridded contour. Neither LAQM.TG(16) nor EPUK & IAQM guidance advocate a requirement for such gridded outputs to illustrate concentration change.
The inclusion of receptors within the Site – This will give predictions into the potential exposure that future residents of the proposed development would experience. Due to the application being for Outline Planning Permission, this can be assessed at the detailed stage of planning when the internal road layout has been confirmed.	Pre-assessment contact was made to the Environmental Health Technical Officer within Welwyn Hatfield Borough Council (WHBC) in order to agree upon the scope of assessment. As the Application Site is not located within, or in close proximity to an AQMA / area of monitored exceedence, it was not considered relevant or proposed to undertake a site-suitability assessment to predict air pollutant concentrations at the location of the proposed development site. The WHBC Environmental Health Technical Officer agreed the assessment scope on this basis.

BV Comment	SLR Response Summary
	Notwithstanding, SLR notes that there are a number of existing receptors which have been modelled at locations corresponding to the boundary of the Application Site (i.e. R7, R8 and R30) which are situated at comparable set-back distances from the same road, and as such are likely to experience similar modelled concentrations. At these locations, no exceedences of the considered AQALs are predicted in the development opening year scenario. As concentrations reduce at increasing distance from the kerbside of a road, concentrations further within the Application Site and at increasing distance from the road are expected to be lower in comparison.

An update to the assessment of operational phase effects to address comments, where relevant, is provided in Section 7.5. The methodology applied to this assessment is consistent with that applied as part of the Air Quality Chapter to the ES prepared in October 2018. Where relevant, updates have been made to reflect change in policy / guidance, for example, or to address those comments in Table 7.1.

Reference should be made to the sections below for further information.

7.3 METHODOLOGY

The Air Quality assessment has been undertaken within the context of relevant planning policies, guidance documents and legislative instruments. These are summarised below.

7.3.1 Legislation and Planning Policy Guidance

7.3.1.1 National Air Quality Strategy

The United Kingdom Air Quality Strategy (UK AQS) for England, Scotland, Wales and Northern Ireland[2], last updated in 2007, sets out the Government's policies aimed at delivering cleaner air in the United Kingdom (UK). It sets out a strategic framework within which air quality policy will be taken forward in the short to medium term, and the roles that Government, industry, the Environment Agency (EA), local government, business, individuals and transport have in protecting and improving air quality.

7.3.1.2 Air Quality Standards

The Air Quality Standards Regulations 2010 (the regulations) transpose the Ambient Air Quality Directive (2008/50/EC), and the Fourth Daughter Directive (2004/107/EC) within UK legislation. The regulations include Limit Values, Target Values, Objectives, Critical Levels and Exposure Reduction Targets for the protection of human health and the environment (collectively termed Air Quality Assessment Levels (AQAL) throughout this report).

Those relevant to this Air Quality Assessment are presented within Table 7.2.

[2] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA. July 2007.

Table 7.2: Relevant Air Quality Strategy Standards and Objectives

Pollutant	Standard (µg/m^3)	Measured As	Equivalent percentile
Nitrogen Dioxide (NO_2)	40	Annual Mean	-
	200	1-hour Mean	99.79th percentile of 1-hour means (equivalent to 18 1-hour exceedences)
Particulate matter within an aerodynamic diameter of less than 10µm (PM_{10}) (gravimetric)	40	Annual Mean	-
	50	24-hour mean	90.41th percentile of 24-hour means (equivalent to 35 24-hour exceedences)
Particulate matter within an aerodynamic diameter of less than 2.5µm ($PM_{2.5}$) (gravimetric)	25	Annual Mean	-

7.3.1.3 Local Air Quality Management

Section 82 of the Environment Act 1995 (Part IV) requires local authorities to periodically review and assess the quality of air within their administrative area. The reviews have to consider the present and future air quality and whether any AQALs prescribed in regulations are being achieved or are likely to be achieved in the future.

Where any of the prescribed AQALs are not likely to be achieved the authority concerned must designate an Air Quality Management Area (AQMA). For each AQMA the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the AQAL. As such, Local Authorities (LAs), have formal powers to control air quality through a combination of LAQM and by use of their wider planning policies.

7.3.1.4 Applicable Public Exposure

In accordance with the Department for Environment, Food and Rural Affairs' (DEFRA) technical guidance on Local Air Quality Management (LAQM.TG(16)), the AQALs should be assessed at locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. A summary of relevant exposure for the objectives presented in Table 7.2 are shown below in Table 7.3.

Table 7.3: Relevant Public Exposure

Objective Averaging Period	Relevant Locations	Objectives should apply at	Objectives should not apply at
Annual Mean	Where individuals are exposed for a cumulative period of 6-months in a year	Building facades of residential properties, schools, hospitals etc.	Facades of offices Hotels Gardens of residences Kerbside sites

Objective Averaging Period	Relevant Locations	Objectives should apply at	Objectives should not apply at
24-hour mean	Where individuals may be exposed for eight hours or more in a day	As above together with hotels and gardens of residential properties	Kerbside sites where public exposure is expected to be short term
1-hour mean	Where individuals might reasonably be expected to spend one hour or longer	As above together with kerbside sites of regular access, car parks, bus stations etc.	Kerbside sites where public would not be expected to have regular access

7.3.1.5 National Policy

The 2019 update to the National Planning Policy Framework (NPPF)[3] describes the policy context in relation to pollutants including air pollutants:

> *"Para 170: Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of […] air […] pollution […]. Development should, wherever possible, help to improve local environmental conditions such as air […] quality […]'*
>
> *'Para 180: Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development."*

Specifically, in terms of development with regards to air quality:

> *"Para 181: Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*

The NPPF is accompanied by web based supporting Planning Practice Guidance (PPG)[4] which includes guiding principles on how planning can take account of the impacts of new development on air quality. In

[3] Secretary of State for Ministry of Housing, Communities and Local Government (February 2019) National Planning Policy Framework.

[4] Secretary of State for Ministry of Housing, Communities and Local Government (November 2019) Planning Practice Guidance.

regard to air quality, the PPG states:

> *"The Department for Environment, Food and Rural Affairs carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with relevant Limit Values. It is important that the potential impact of new development on air quality is taken into account where the national assessment indicates that relevant limits have been exceeded or are near the limit, or where the need for emissions reductions has been identified"*

> *"All development plans can influence air quality in a number of ways, for example through what development is proposed and where, and the provision made for sustainable transport. Consideration of air quality issues at the plan-making stage can ensure a strategic approach to air quality and help secure net improvements in overall air quality where possible".*

The PPG sets out the information that may be required within the context of a supporting air quality assessment, stating that:

> *"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity."*

The policies within the NPPF and accompanying PPG in relation to air pollution are considered within this Air Quality Chapter Addendum.

7.3.1.6 Local Policy

Welwyn Hatfield District Plan

WHC are in the process of preparing a new Local Plan, which has been submitted to the Secretary of State for Communities and Local Government for formal examination. The Local Plan will provide a long-term spatial vision, over the period up to 2032. However, at the time of writing this new Local Plan has yet to be formally adopted following formal examination.

Planning applications are currently decided upon primarily by using the policies of the District Plan originally adopted in 2005. A number of policies have been 'saved' until it is replaced by a Local Development Framework.

The following saved policy content relating to air quality is contained within the 2005 District Plan:

> *"Policy R18 – Air Quality*

> *The Council will have regard to the potential effects of a development on local air quality when determining planning applications. Consideration will be given to both the operational characteristics of the development and to the traffic generated by it. Any development within*

areas designated as Air Quality Management Areas must have regard to guidelines for ensuring air quality is maintained at acceptable levels as set out in the Air Quality Strategy."

Hertfordshire Health and Wellbeing Planning Guidance

The Local Authorities of Hertfordshire, including WHC, have collectively adopted Health and Wellbeing Planning Guidance (May 2017) to aid planning professionals, both local authorities and developers in the delivery of healthy developments and communities by increasing local capacity, knowledge of health and wellbeing and the relationship to spatial planning issues. The document focuses on seven key areas, including air quality. Under the requirements of air quality, the guidance considers that a 'healthy development' should:

- Implement measures to improve air quality;
- Facilitate sustainable modes of transport, use of low emission vehicles e.g. electric vehicles and enable active travel;
- Locate key facilities, services and vulnerable communities away from traffic hotspots; and
- Address mitigation from the outset, setting out a clear approach to exposure and introducing receptors (residents) to an area of poor air quality, with a focus on design-led solutions.

7.3.1.7 Relevant Guidance

DEFRA 'LAQM.TG(16)'

DEFRA Local Air Quality Management Technical Guidance[5] (LAQM.TG(16)) was published for use by local authorities in their LAQM review and assessment work. The document provides key guidance in aspects of air quality assessment, including screening, use of monitoring data, and use of background data that are applicable to all air quality assessments.

EPUK & IAQM 'Land-use planning and development control Planning for Air Quality'

Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have together published guidance[6] to help ensure that air quality is properly accounted for in the development control process. It clarifies when an air quality assessment should be undertaken, what it should contain, and how impacts should be described and assessed including guidelines for assessing the significance of impacts.

The Design Manual for Roads and Bridges

The Design Manual for Roads and Bridges (DMRB) LA 105[7] states receptors, within 200m of a road source, require further assessment of potential impacts.

If there are no properties or relevant Designated Sites near the affected roads, then the impact of the scheme can be considered neutral in terms of local air quality and no further AQA is required.

[5] Defra Local Air Quality Management Technical Guidance (2016).
[6] Environmental Protection UK and Institute of Air Quality Management, 'Land-Use Planning and Development Control: Planning for Air Quality' (v1.2 2017).
[7] Highways England (2019), Design Manual for Roads and Bridges (DMRB), LA 105 Air Quality.

7.3.2 Assessment Methodology

7.3.2.1 Vehicular Pollutants Assessment

The assessment has been undertaken with reference to the following documents:

- Local Air Quality Management Technical Guidance LAQM.TG(16);
- DMRB LA 105 Air Quality; and
- Land-Use Planning and Development Control: Planning for Air Quality (v1.2, 2017) – EPUK and IAQM.

Descriptors for magnitude of impact (percentage change in air quality relative to AQAL) and predicted impact used in this assessment are from the EPUK & IAQM Guidance, as presented in Table 7.4.

Table 7.4 : Operational Phase Impact Significance Matrix

Concentration with the Development	Percentage Change in Air Quality Relative to AQAL (%)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Note:
Changes of 0%, i.e. less than 0.5%, will be described as Negligible.

Detailed air dispersion modelling has been undertaken using the Cambridge Environmental Research Consultants (CERC) ADMS Roads v4.1 air dispersion model, following guidance provided in LAQM.TG(16), to predict annual mean concentrations of NO_2 and PM_{10} for the various scenarios. The risk of exceedence of the short-term AQALs and compliance with 1-hour mean NO_2 and 24-hour mean PM_{10} AQALs has been assessed following LAQM.TG(16) guidance.

The following scenarios have been modelled:

- Verification / Baseline: 2018 baseline year, on the basis that this is the most recent year with complete datasets for traffic flow, diffusion tube monitoring data and meteorological data with which to carry out model verification, in accordance with LAQM.TG.(16);
- Do Minimum (DM): 2036 future opening year, inclusive of committed development flows; and
- Do Something (DS): 2036 opening year of the Proposed Development with associated traffic flows.

Details of the dispersion model set-up, traffic data and verification are provided in Appendix 7.1 to this ES Chapter Addendum.

Air Quality Significance Criteria – Vehicular Pollutants Assessment

The EPUK-IAQM guidance requires a judgment on the significance of the 'effect', this is based upon consideration, as necessary, of the following factors:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the worst case assumptions adopted when undertaking the prediction of impacts; and
- the extent to which the Proposed Development has adopted best practice to eliminate and minimise emissions.

7.3.3 Limitations and Assumptions

The updated traffic data provided by Vectos corresponds to a 2036 development opening year, with complementary 'do-minimum' and 'do-something' scenarios.

It is noted that the latest mapped background concentrations (2017-base) and road vehicle emission factors are not forecast by DEFRA beyond 2030. Therefore, 2030 mapped background concentrations (2017-base) and 2030 road vehicle emission factors from v9.0 of the emissions factor toolkit (EFT) have been presented and applied to the 2036 Proposed Development opening year in lieu of relevant data. These are the latest publicly available tools/dataset for use within this air quality assessment and ES Chapter Addendum.

7.4 Baseline Conditions

7.4.1 Sensitive Receptors

7.4.1.1 Traffic Emissions Assessment Sensitive Receptors

The DMRB method considers any receptor within 200m of a road source to be potentially affected by air quality. Human receptor locations have been characterised with reference to LAQM.TG(16) Box 1.1. According to LAQM.TG(16) exceedences of the AQALs should be assessed in relation to:

> *"the quality of the air at locations which are situated outside of buildings or other natural or man-made structure, above or below ground, and where members of the public are regularly present".*

The receptor locations considered representative of potential exposure within the Air Quality Assessment of road traffic emissions are shown below in Table 7.5, based upon relevant exposure locations outlined in Table 7.3. Receptors have been modelled at a height of 1.5m above ground level to represent exposure (i.e. breathing) height. Where traffic emission receptors are referenced within the report text, they are referred to as R1 – R34. These receptors are consistent with those considered as part of the Air Quality Chapter to the ES, dated 2018. A review of these locations was undertaken as part of this updated assessment, to take account of changes to land use and potential new locations of worst-case exposure. For this ES Addendum, traffic data and change in development trips was provided over a greater spatial extent. Therefore, additional receptors have been considered to represent relevant exposure adjacent to these additional links. Where these receptors are referenced within the report text, they are referred to as R35 – R45.

The sensitive receptors identified in Table 7.5 represent worst-case locations and have been chosen as the closest residences to each road which may be affected by traffic associated with the proposed development.

Reference should be made to Figure 7.2 for an illustration of the considered receptor locations relative to the wider area and modelled links.

Table 7.5 : Operational Phase – Human Road Traffic Emission Sensitive Receptors

ID	Receptor Description	NGR (m)	
		X	Y
R1	Popefield Farm - residential	520073.6	207963.9
R2	Residential property on A1057	520377.4	208077.2
R3	Residential property on Poplars Close	520746.1	208177.3
R4	Residential property on St Albans Road West	520777.9	208189.7
R5	Residential property on Ashbury Close	521163.8	208285
R6	University of Hertfordshire Sports Pitches - short-term exposure only	520409.1	207955.7
R7	Astwick Manor Lodge - residential	520498.9	210098
R8	Astwick Manor - residential	520442.3	209974.5
R9	Residential property on Selwyn Crescent	521231.5	208120
R10	Residential property on Crossbrook 1	521189.4	207912.8
R11	Residential property on Crossbrook 2	521154.1	207777.5
R12	Residential property off Ellenbrook Lane	521124.5	207665.7
R13	King George House - residential	521579.5	208678.5
R14	Residential property on Walsingham Close	521919.8	209077.6
R15	Residential property off Hatfield Avenue	521007.8	210034.5
R16	Residential property off Cornflower Way	521446.2	209768
R17	Residential property off Campion Road 1	521551.8	209698.3
R18	Residential property off Campion Road 2	521614	209663.8
R19	Residential property on West View 1	522093.8	209415.9
R20	Residential property on West View 2	522078.6	209392.4
R21	Residential property on West View 3	522080	209379.3
R22	Residential property off Birchwood Avenue	522074.5	209321.3
R23	Residential property off Wellfield Road	522070.4	209306.1
R24	Residential property on Halford Court 1	521197	208964.4
R25	Residential property on Halford Court 2	521183.8	208940.2
R26	Residential property off Errington Close 1	521092.7	208706.1
R27	Residential property off Errington Close 2	521085.1	208684

ID	Receptor Description	NGR (m)	
		X	Y
R28	Residential property on Albatross Way 1	521060.9	208669.5
R29	Residential property on Albatross Way 2	520952.5	208619.1
R30	Residential property on Albatross Way 3	520878.7	208583.2
R31	University of Hertfordshire - student accommodation off Albatross Way 1	521045.1	208619.8
R32	University of Hertfordshire - student accommodation off Albatross Way 2	520943.6	208570.8
R34	How Dell Primary School	521147.9	209092.8
R35	Residential property off Ryders Avenue / A414 N Orbital Road 1	521071.28	207296.35
R36	Residential property off Ryders Avenue / A414 N Orbital Road 2	521013.26	207223.51
R37	Residential property on Sleapcross Gardens	520197.64	206728.46
R38	Residential property on Sleapshyde Lane	520369.15	206880.06
R39	Residnetial property on Tudor Close / A1001 Roehyde Way 1	521463.2	206932.13
R40	Residential property on Tudor Close / A1001 Roehyde Way 2	521506.62	206779.12
R41	Residential property on B197 Wellfield Road 1	522090.32	209258.43
R42	Residential property on B197 Wellfield Road 2	522176.15	209147.24
R43	Residential property on Birchwood Avenue 1	522131.28	209366.37
R44	Residential property on Birchwood Avenue 2	522315.3	209328
R45	Birchwood Avenue Primary School	522479.82	209367.02

7.4.1.2 Ecological Receptors

A review using the Magic web-based mapping service[8] was undertaken to identify any designated sites of ecological or nature conservation importance required for consideration within the assessment, as follows:

- construction phase assessment – any ecological designation within 50m of the Application Site boundary, or 50m of any road projected to witness construction phase road traffic movements, that could potentially be affected by dust from the construction phases of the proposed development; and
- operational phase assessment – any Ramsar, Special Areas of Conservation (SAC), Special Protection Areas (SPA) or Sites of Special Scientific Interest (SSSI) within 200m of any ‘affected

[8]Natural England, www.magic.gov.uk, accessed June 2020.

road' as part of the scheme, that could be affected by any change in vehicle emissions associated with the proposed development.

A search within 50m of the development boundary / any road projected to witness construction phase road traffic movements, and 200m of any 'affected road' surrounding the Application Site indicated no sensitive ecological receptors.

7.4.2 Baseline Air Quality

7.4.2.1 Local Authority Review and Assessment

As required under Section 82 of the Environment Act (1995) (Part IV), WHC has conducted an ongoing exercise to review and assess air quality within their area of administration. This process has indicated that concentrations of all Air Quality Strategy pollutants were below the relevant AQALs at locations of relevant public exposure, and as such no AQMAs have been declared within the Council's administrative area.

7.4.2.2 Automatic Air Quality Monitoring

The UK Automatic Urban and Rural Network (AURN) is a countrywide network of air quality monitoring stations operated on behalf of DEFRA. Monitoring data for AURN sites is available from the UK Air Information Resource website (UK AIR)[9].

The closest AURN monitor to the development site is the Borehamwood Meadow Park AURN (NGR: x519709, y197243), located approximately 11.5km south south-west of the Application Site. The Borehamwood Meadow Park AURN is classified as an '*urban background*' location, identified as "*an urban location distanced from sources and therefore broadly representative of city-wide background conditions, e.g. urban residential areas*". Due to the distance between the Application Site and the AURN location, similar pollutant concentrations are not anticipated and therefore the AURN site has not been considered within the context of this assessment.

At the time of assessment, WHC undertakes continuous air quality monitoring at 1No. location within the Council's area. This monitor is located at Great North Road / A1000 (NGR: x523293, y209171), located approximately 2.6km east of the Application Site. The Great North Road / A1000 automatic monitor is classified as a 'roadside' location, identified as "*a site sampling typically within one to five metres of the kerb of a busy road (although distance can be up to 15 m from the kerb in some cases)*". The Great North Road / A1000 automatic monitor is located within the centre of Hatfield, adjacent to the rail line, and only monitors annual mean $PM_{2.5}$ concentrations. Due to the difference in surroundings / classification between the Application Site and the Great North Road / A1000 automatic monitor location, similar pollutant concentrations are not anticipated and therefore data from the Great North Road / A1000 automatic monitor has not been considered further within the context of this assessment.

[9] DEFRA, UK Air Information Resource (UK-AIR) website, http://uk-air.defra.gov.uk/, accessed June 2020.

7.4.2.3 Passive Diffusion Tube Monitoring

Passive diffusion tube monitoring is currently undertaken by WHC at a number of locations throughout the Council's area as part of their commitment to LAQM. The diffusion tubes are located in areas which are deemed to require further assessment of NO_2 concentrations.

A summary of recent NO_2 monitoring results is presented within Table 7.6. Exceedences of the annual mean AQAL are highlighted in bold.

Table 7.6: WHC Passive Diffusion Tube Monitoring Results

Monitoring Location	Site Classification	NGR (m)		2018 Data Capture	Annual Mean NO_2 Concentration ($\mu g/m^3$) (A)		
		X	Y		2016	2017	2018
WH7	Roadside (B)	521575	208645	100%	31	30	28
WH14	Kerbside (C)	522013	209707	100%	29	28	21
WH16	Urban Background (D)	521052	208998	75%	26	21	20
WH19	Roadside (B)	522144	209516	91%	**56**	**49**	**44**
WH22	Kerbside (C)	521801	209471	100%	37	**43**	35
WH24	Urban Centre (E)	521164	207740	100%	**44**	**40**	38
WH25	Roadside (B)	522093	209431	100%	**44**	**46**	**40**
WH26	Roadside (B)	522059	209349	75%	37	39	**45**
WH27	Roadside (B)	522060	209289	100%	37	**40**	34

Notes:

(A) Bias corrected.

(B) Roadside sites defined as '*a site sampling typically within one to five metres of the kerb of a busy road*'.

(C) Kerbside sites defined as '*a site sampling within one metre of the kerb of a busy road*'.

(D) Urban Background sites defined as '*An urban location distanced from sources and therefore broadly representative of city-wide background conditions, e.g. urban residential areas*'.

(E) Urban Centre sites defined as '*An urban location representative of typical population exposure in towns or city centres, for example, pedestrian precincts and shopping areas*'.

The data indicates that the annual mean NO_2 AQAL of 40$\mu g/m^3$ has been exceeded at a number of diffusion tube monitoring locations during considered years. However, review of the WHC 2019 Air Quality Annual Status Report indicates that a number of the monitoring locations presented in Table Table 7.6 are not locations of relevant exposure to the annual mean AQAL. Therefore, these monitored concentrations are not necessarily considered 'exceedences' in LAQM terms.

Further assessment is provided within the WHC 2019 Air Quality Annual Status Report to predict the associated annual mean NO_2 concentration at the location of relevant exposure for each of the diffusion tubes were monitored concentrations are >40$\mu g/m^3$. Based upon the distance correction of 2018 monitored concentrations, the results of this further review indicates at distance corrected annual mean NO_2 concentrations at the assessed location of relevant exposure to the WH19, WH25 and WH26 all predict compliance with the annual mean AQAL. In comparison to the WHC 2018 Air Quality Annual Status

Report, the distance corrected annual mean NO_2 concentration at the assessed location of relevant exposure to diffusion tube monitoring location WH25 calculated an exceedence of the annual mean AQAL. The WHC 2018 Air Quality Annual Status Report concluded that this exceedance / monitoring location and location of relevant exposure will be kept under review, and a continuous monitor is to be installed at this location to further understand monitored concentrations. The WHC 2019 Air Quality Annual Status Report provides the following update:

> *"The distance corrected results in this year's report show that none of the diffusion tube monitoring locations have exceeded the limit after distance correction calculations. Whilst this is very positive news, the location in question which is covered by diffusion tubes (WH25, WH26 and WH27 – West View, Hatfield), is only just below the limit value. The highest result is tube reference WH25 which is 37 µgm-^{3}.*
>
> *The result is still very close to the limit value. Diffusion tubes are an ideal screening tool to monitor air quality. However, they are known to have inaccuracies when compared to a real time air quality analyser.*
>
> *In order to obtain more accurate results we will be going ahead (as agreed with DEFRA) to install a roadside nitrogen dioxide analyser in this location (WH25 – West View). We plan to have the new analyser installed and operational by the end 2019."*

At the time of writing / assessment, it is unknown as to whether this automatic monitor was installed.

7.4.2.4 DEFRA Mapped Background Concentrations

Background pollutant concentration data on a 1km x 1km spatial resolution is provided by DEFRA through the UK Air Information Resource (AIR) website and is routinely used to support LAQM and Air Quality Assessments.

In the interim period since the Air Quality Chapter to the ES was provided (dated 2018), DEFRA has published an update to the mapped background concentration data to revise this to a 2017 base year (May 2019 publication)[10].

Mapped background concentrations of NO_2 and PM_{10}, based upon the 2017 base year DEFRA update were downloaded for the grid squares containing the Application Site and the Road Traffic Emissions Assessment Sensitive Receptors presented in Table 7.5.

A methodology is presented within LAQM.TG(16) to remove individual source sectors from the mapped background concentrations presented as part of the AIR, to present those source sectors which are to be explicitly modelled. This approach avoids double counting of potential source contributions i.e. from existing baseline traffic flows included within the detailed dispersion modelling assessment. NOx and PM_{10} proportions from the 'primary A-road road in' and 'motorway in' sectors of the grid square (where relevant), were removed from the 'total' background concentrations downloaded for each respective pollutant from the Air Quality Information Resource. No 'minor roads in' source sector was removed, as

[10] Background mapping data for local authorities – http://uk-air.defra.gov.uk/data/laqm-background-home, accessed June 2020.

a precautionary approach as not all minor roads are expressly modelled. As the relationship between NO_2 and NO_x is not linear, the NO_2 Adjustment for NO_x Sector Removal Tool[11] has been utilised accordingly.

Following NOx source sector removal, background NO_2 concentrations were updated accordingly using the 'NO$_2$ Adjustment for NOx Sector Removal Tool' (v7.0)

Background pollutant concentrations, for 2018 (the verification assessment year) and 2030 (the development opening year, in lieu of 2036 projections), are displayed in Table 7.7 and Table 7.8, respectively.

Table 7.7: 2018 Mapped Background Concentrations

Pollutant	Mapped Background Concentration (µg/m^3)	Sector Total to be Removed (µg/m^3)	Adjusted Background (µg/m^3)
Grid Square x520500, y207500			
NO_2	15.2	-	14.2
NOx	21.3	1.45	19.9
PM_{10}	16.4	0.01	16.4
Grid Square x520500, y210500			
NO_2	12.5	-	12.5
NOx	17.2	0.00	17.2
PM_{10}	16.1	0.00	16.1
Grid Square x520500, y209500			
NO_2	13.4	-	13.4
NOx	18.6	0.00	18.6
PM_{10}	15.2	0.00	15.2
Grid Square x520500, y208500			
NO_2	14.7	-	14.1
NOx	20.6	0.91	19.7
PM_{10}	15.7	0.01	15.7
Grid Square x520500, y206500			
NO_2	16.7	-	14.9
NOx	23.7	2.83	20.9
PM_{10}	16.3	0.02	16.2
Grid Square x521500, y210500			
NO_2	13.6	-	13.6
NOx	18.9	0.00	18.9

[11] DEFRA NO_2 Adjustment for NO_x Sector Removal Tool version 7.0 (2019), available at https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxsector

Pollutant	Mapped Background Concentration ($\mu g/m^3$)	Sector Total to be Removed ($\mu g/m^3$)	Adjusted Background ($\mu g/m^3$)
PM_{10}	16.5	0.00	16.5
	Grid Square x521500, y209500		
NO_2	18.2	-	16.5
NOx	26.5	2.88	23.6
PM_{10}	16.7	0.02	16.7
	Grid Square x521500, y208500		
NO_2	22.3	-	16.9
NOx	33.4	9.07	24.4
PM_{10}	17.3	0.06	17.3
	Grid Square x521500, y207500		
NO_2	20.2	-	15.5
NOx	29.7	7.71	22.0
PM_{10}	17.2	0.05	17.1
	Grid Square x521500, y206500		
NO_2	19.5	-	15.2
NOx	28.4	7.06	21.4
PM_{10}	16.9	0.04	16.8
	Grid Square x522500, y209500		
NO_2	20.4	-	16.8
NOx	30.2	6.04	24.1
PM_{10}	17.1	0.04	17.1

Table 7.8: 2030 Mapped Background Concentrations

Pollutant	Mapped Background Concentration ($\mu g/m^3$)	Sector Total to be Removed ($\mu g/m^3$)	Adjusted Background ($\mu g/m^3$)
	Grid Square x520500, y207500		
NO_2	10.1	-	9.61
NOx	13.6	0.65	12.9
PM_{10}	15.2	0.00	15.2
	Grid Square x520500, y210500		
NO_2	8.59	-	8.59
NOx	11.4	0.00	11.4

Pollutant	Mapped Background Concentration (µg/m³)	Sector Total to be Removed (µg/m³)	Adjusted Background (µg/m³)
PM_{10}	14.9	0.00	14.9
	Grid Square x520500, y209500		
NO_2	9.26	-	9.26
NOx	12.4	0.00	12.4
PM_{10}	14.0	0.00	14.0
	Grid Square x520500, y208500		
NO_2	9.86	-	9.62
NOx	13.3	0.36	12.9
PM_{10}	14.5	0.00	14.5
	Grid Square x520500, y206500		
NO_2	10.8	-	9.90
NOx	14.6	1.28	13.3
PM_{10}	15.0	0.01	15.0
	Grid Square x521500, y210500		
NO_2	9.25	-	9.25
NOx	12.4	0.00	12.4
PM_{10}	15.3	0.00	15.3
	Grid Square x521500, y209500		
NO_2	12.3	-	11.5
NOx	17.0	1.27	15.7
PM_{10}	15.4	0.00	15.4
	Grid Square x521500, y208500		
NO_2	14.3	-	11.7
NOx	20.0	3.88	16.1
PM_{10}	16.0	0.02	16.0
	Grid Square x521500, y207500		
NO_2	12.8	-	10.6
NOx	17.8	3.36	14.4
PM_{10}	15.9	0.01	15.9
	Grid Square x521500, y206500		
NO_2	12.2	-	10.1
NOx	16.8	3.10	13.7
PM_{10}	15.6	0.01	15.6

Pollutant	Mapped Background Concentration (µg/m³)	Sector Total to be Removed (µg/m³)	Adjusted Background (µg/m³)
	Grid Square x522500, y209500		
NO_2	13.2	-	11.4
NOx	18.3	2.65	15.6
PM_{10}	15.8	0.01	15.8

7.4.2.5 Consideration of Applied Background Concentration

A review of baseline air quality monitoring from within the development locale, as described and presented within in the Sections above, has been undertaken in order to consider an appropriate 'background' concentrations for use within the assessment.

Table 7.6 presents an 'urban background' monitoring location (diffusion tube monitoring location: WH16) which could be applied to the modelled dataset to reflect background annual mean NO_2 concentrations when calculating total annual mean NO_2 concentrations for comparison against the AQAL. The monitored 2018 annual mean NO_2 concentration monitored at the WH16 diffusion tube is 20µg/m³. There are no other appropriate 'urban background' / 'background' monitoring locations from within the development locale which could be used as a source of background annual mean NO_2 concentrations.

In comparison, the 2018 DEFRA mapped background annual mean NO_2 concentrations (2017 base year) from the grid squares covering the modelled domain (presented in Table 7.7) ranges from 12.5µg/m³ to 22.3µg/m³ (before source sector removal is undertaken). This demonstrates that a degree of spatial variability in NOx / NO_2 background concentrations exists across the model domain, which could therefore be misrepresented through using the background concentration obtained from a single geographical point alone. It is noted that the spatial extent of the modelling domain is appropriately 2.5km (x) by 8km (y) and covers a range of land use types (i.e. motorways, rural locations etc.) which are all considered to experience varying background concentrations in comparison.

Furthermore, it is noted that it is not possible to undertake source sector removal of those sources already included within the ADMS Road dispersion model (such as 'primary A-road road in' and 'motorway in' sectors components) from a monitored dataset. Therefore, background NOx / NO_2 concentrations used for the purposes of this assessment have been obtained from the DEFRA supplied background maps (2017-base year) presented within Table 7.7 and Table 7.8.

Furthermore, in lieu of any relevant and local PM_{10} monitoring data, background concentrations from the DEFRA supplied background maps (2017-base year) presented within Table 7.7 and Table 7.8 have been applied as part of the assessment.

7.5 Assessment of Effects

7.5.1 Operational Phase Effects

7.5.1.1 Traffic Emissions Assessment

This section presents the potential air quality impacts arising from road traffic vehicle emissions associated with the operational phase of the proposed development in the 2036 complete development opening year scenario. In summary, the assessment has utilised the following inputs:

- 2030 emission factors from v9 of the EFT; and
- 2030 mapped background concentrations sourced from the DEFRA background maps (2017-base year).

Reference should be made to Appendix 7.1 for details of the model inputs / model output treatments to the dispersion modelling assessment.

Reference should be made to Appendix 7.2 for presentation of impacts predicted as part of the 2018 precautionary modelling scenario. Modelling sensitivities have only under been undertaken on annual mean NO_2 concentrations.

Nitrogen Dioxide Annual Mean Modelling Results

Predicted annual mean ground level NO_2 concentrations were assessed against the AQAL of 40μg/m^3, as displayed in Table 7.9. Exceedences of the AQAL are highlighted in bold.

For completeness, predicted annual mean concentrations are additionally presented at NO_2 air quality monitoring locations within the development locale and the dispersion modelling domain (i.e. monitoring locations WH7, WH19, WH22, WH24, WH25, WH26 and WH24). It is noted that the WHC Air Quality Annual Status Report states that none of these diffusion tubes are locations of relevant exposure to the annual mean AQAL. Therefore, no associated impact descriptor is presented at the considered diffusion tubes.

Table 7.9: Summary of Predicted Annual Mean NO_2 Concentrations: Road Vehicle Emissions: 2030 Development Opening Year

Receptor	2036 (μg/m^3) [(A)]		Change (μg/m^3)	Change as a Percentage of the AQAL (%)	Impact
	'Do-minimum'	'Do-something'			
R1	10.2	10.2	+0.01	0.02	Negligible
R2	10.4	10.4	+0.01	0.02	Negligible
R3	10.5	10.5	+0.01	0.02	Negligible
R4	10.8	10.8	+0.02	0.05	Negligible
R5	13.6	13.6	+0.03	0.07	Negligible
R6	9.9	9.9	+0.01	0.03	Negligible
R7	9.4	9.4	+0.03	0.08	Negligible

Receptor	2036 (µg/m³) (A)		Change (µg/m³)	Change as a Percentage of the AQAL (%)	Impact
	'Do-minimum'	'Do-something'			
R8	9.4	9.4	+0.00	0.00	Negligible
R9	14.0	14.1	+0.03	0.08	Negligible
R10	13.5	13.5	+0.03	0.08	Negligible
R11	13.3	13.3	+0.03	0.07	Negligible
R12	13.0	13.0	+0.02	0.05	Negligible
R13	12.9	12.9	+0.01	0.02	Negligible
R14	13.0	13.0	+0.01	0.02	Negligible
R15	9.8	9.8	+0.03	0.07	Negligible
R16	12.0	12.0	+0.02	0.05	Negligible
R17	12.3	12.3	+0.04	0.10	Negligible
R18	12.4	12.4	+0.04	0.10	Negligible
R19	18.8	18.9	+0.03	0.08	Negligible
R20	20.8	20.9	+0.04	0.10	Negligible
R21	20.4	20.4	+0.03	0.08	Negligible
R22	19.0	19.1	+0.02	0.05	Negligible
R23	18.6	18.6	+0.01	0.03	Negligible
R24	12.5	12.5	+0.03	0.07	Negligible
R25	12.5	12.5	+0.03	0.07	Negligible
R26	12.6	12.7	+0.10	0.25	Negligible
R27	12.6	12.8	+0.16	0.40	Negligible
R28	12.5	12.6	+0.16	0.40	Negligible
R29	10.1	10.3	+0.11	0.27	Negligible
R30	10.1	10.2	+0.11	0.27	Negligible
R31	12.4	12.5	+0.09	0.23	Negligible
R32	10.1	10.2	+0.08	0.20	Negligible
R34	11.8	11.8	+0.01	0.03	Negligible
R35	13.5	13.5	+0.03	0.07	Negligible
R36	12.7	12.7	+0.03	0.08	Negligible
R37	11.2	11.2	+0.03	0.07	Negligible
R38	10.8	10.8	+0.01	0.02	Negligible
R39	12.5	12.5	-0.01	-0.02	Negligible
R40	12.6	12.5	-0.01	-0.03	Negligible
R41	15.3	15.3	+0.02	0.05	Negligible
R42	13.5	13.5	+0.03	0.07	Negligible

Receptor	2036 (µg/m^3) (A)		Change (µg/m^3)	Change as a Percentage of the AQAL (%)	Impact
	'Do-minimum'	'Do-something'			
R43	15.9	15.9	+0.02	0.05	Negligible
R44	12.9	12.9	+0.01	0.02	Negligible
R45	12.2	12.3	+0.01	0.02	Negligible
WH19	17.8	17.8	+0.04	0.10	-
WH22	13.7	13.8	+0.10	0.25	-
WH25	21.4	21.4	+0.06	0.15	-
WH26	24.2	24.3	+0.03	0.08	-
WH7	14.2	14.3	+0.02	0.05	-
WH24	15.3	15.3	+0.07	0.18	-
WH27	19.2	19.3	+0.04	0.10	-

Note:
(A) Scenario modelled with 2030 emission factors and 2030 mapped background pollutant concentrations, to reflect the 2036 opening year of the development.

As shown in Table 7.9, there are no predicted exceedences of the annual mean AQAL in either scenario during the 2036 development opening assessment year. It is noted that there are predicted to be a reduction in annual mean NO_2 concentrations in the 'do-something' scenario (compared to the 'do-minimum' scenario) at several receptor locations. Discussion with the transport consultant whom provided the traffic data indicates that in some locations, the development-generated traffic is consequently influencing the distribution of existing traffic on the local road network, and in turn causing an observed, marginal reduction.

The predicted percentage change of annual mean NO_2 concentrations ranges is '<0.5% of the AQAL' at all considered receptor locations. An unmitigated 'negligible' impact is therefore predicted at all receptor locations in accordance with the assessment methodology.

Nitrogen Dioxide 1-hour Mean Modelling Results

The risk of exceeding the 1-hour mean AQAL was assessed according to the guidance in LAQM.TG(16). This Guidance states that:

> *"exceedances of the NO_2 1-hour mean are unlikely to occur where the annual mean is below 60µg/m^3".*

The maximum annual mean NO_2 'do-something' concentration is 24.3µg/m^3 (predicted at the WH26 diffusion tube). Whilst a review of street view imagery indicates that this location is not considered to be comparable to relevant exposure to the 1-hour mean NO_2 AQAL, in accordance with DEFRA guidance the maximum predicted annual mean NO_2 concentration indicates that exceedences of the 1-hour mean NO_2 AQAL are considered 'unlikely' at existing receptors as a result of proposed development trips.

Particulate Matter Annual Mean Modelling Results

Predicted annual mean ground level PM_{10} concentrations were assessed against the $PM_{2.5}$ AQAL of 25µg/m^3, in accordance with EPUK and IAQM guidance, as displayed in Table 7.10.

Table 7.10: Summary of Predicted Annual Mean PM_{10} Concentrations: Road Vehicle Emissions: 2036 Development Opening Year

Receptor	2036 (µg/m^3) [(A)]		Change (µg/m^3)	Change as a Percentage of the AQAL (%)	Impact
	'Do-minimum'	'Do-something'			
R1	15.6	15.6	+0.01	0.03	Negligible
R2	15.1	15.1	+0.01	0.04	Negligible
R3	15.1	15.1	+0.01	0.04	Negligible
R4	15.2	15.2	+0.01	0.05	Negligible
R5	17.2	17.2	+0.02	0.09	Negligible
R6	15.4	15.4	+<0.01	0.01	Negligible
R7	15.0	15.0	+0.02	0.09	Negligible
R8	14.1	14.1	+<0.01	0.01	Negligible
R9	17.3	17.3	+0.02	0.08	Negligible
R10	17.5	17.5	+0.03	0.10	Negligible
R11	17.4	17.4	+0.02	0.09	Negligible
R12	17.3	17.3	+0.02	0.09	Negligible
R13	16.8	16.8	+0.01	0.03	Negligible
R14	16.4	16.4	+0.01	0.03	Negligible
R15	15.6	15.6	+0.02	0.08	Negligible
R16	15.7	15.8	+0.02	0.07	Negligible
R17	15.9	15.9	+0.03	0.10	Negligible
R18	15.9	15.9	+0.03	0.10	Negligible
R19	17.8	17.8	+0.01	0.05	Negligible
R20	18.4	18.4	+0.02	0.07	Negligible
R21	18.3	18.3	+0.01	0.06	Negligible
R22	17.9	17.9	+0.01	0.04	Negligible
R23	17.8	17.8	+0.01	0.04	Negligible
R24	16.5	16.5	+0.02	0.07	Negligible
R25	16.5	16.5	+0.02	0.07	Negligible
R26	16.6	16.6	+0.06	0.26	Negligible
R27	16.6	16.7	+0.11	0.44	Negligible
R28	16.5	16.6	+0.11	0.45	Negligible

Receptor	2036 (µg/m³) (A)		Change (µg/m³)	Change as a Percentage of the AQAL (%)	Impact
	'Do-minimum'	'Do-something'			
R29	14.8	14.9	+0.09	0.36	Negligible
R30	14.8	14.9	+0.09	0.34	Negligible
R31	16.4	16.5	+0.07	0.27	Negligible
R32	14.8	14.9	+0.07	0.27	Negligible
R34	15.6	15.6	+0.01	0.02	Negligible
R35	18.0	18.0	+0.02	0.09	Negligible
R36	17.4	17.4	+0.02	0.07	Negligible
R37	16.0	16.0	+0.01	0.05	Negligible
R38	15.7	15.7	+0.01	0.03	Negligible
R39	16.8	16.8	-0.01	-0.03	Negligible
R40	16.9	16.9	-0.01	-0.03	Negligible
R41	17.1	17.1	+0.01	0.04	Negligible
R42	17.4	17.4	+0.02	0.08	Negligible
R43	17.1	17.1	+0.01	0.03	Negligible
R44	16.8	16.8	+0.01	0.03	Negligible
R45	16.4	16.4	+<0.01	0.02	Negligible

Note:
(A) Scenario modelled with 2030 emission factors and 2030 mapped background pollutant concentrations, to reflect the 2036 opening year of the development.

As shown in Table 7.10, there are no predicted exceedences of the annual mean $PM_{2.5}$ AQAL in either scenario during the 2036 development opening assessment year. It is noted that there is predicted to be a reduction in annual mean PM_{10} concentrations in the 'do-something' scenario (compared to the 'do-minimum' scenario) at several receptor locations. Discussion with the transport consultant whom provided the traffic data indicates that in some locations, the development-generated traffic is consequently influencing the distribution of existing traffic on the local road network, and in turn causing an observed, marginal reduction.

The predicted percentage change of annual mean PM_{10} concentrations is <0.5% of the $PM_{2.5}$ AQAL at all considered receptor locations. An unmitigated 'negligible' impact is therefore predicted at all receptor locations in accordance with the assessment methodology.

Particulate Matter 24-hour Mean Modelling Results

The risk of exceeding the 24-hour mean AQAL was assessed according to the guidance in LAQM.TG(16). This Guidance provides the calculation below to determine compliance;

$$\text{No. 24-hour mean exceedances} = -18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$$

The maximum predicted annual mean PM_{10} concentration of 18.4µg/m^3, as predicted at receptor location R20. Whilst this location is not comparable to relevant exposure to the 24-hour mean PM_{10} AQAL, in accordance with DEFRA guidance this equates to 2-days where 24-hour mean PM_{10} concentrations are greater than 50µg/m^3 (35 24-hour mean concentrations in excess of 50µg/m^3 are permitted). Therefore, the number of exceedences is in compliance with the 24-hour mean AQAL, and exceedences of the 24-hour mean PM_{10} AQAL as a result of proposed development trips is considered unlikely.

7.5.1.2 Significance of Air Quality Impacts

In relation to the proposed development, the unmitigated impact significance associated with the scheme has been predicted in accordance with the stated assessment methodology. The following factors have been taken into account in assessing significance of effects:

- existing receptors:
    - there are no new predicted exceedences of the annual mean NO_2 or PM_{10} (or $PM_{2.5}$) AQALs as a result of the development as part of the 2036 development opening year scenario. The 2018 assessment sensitivity scenario presented in Appendix 7.2 predicts a number of exceedences of the annual mean NO_2 AQAL: however, these do not occur as a result of change in development trips associated with the operation of the proposed development;
    - a negligible impact on annual mean NO_2 concentrations has been predicted at all considered receptor locations as part of the 2036 development opening year scenario;
    - a negligible impact on annual mean PM_{10} concentrations has been predicted at all considered receptor locations, even with change in concentrations as a result of the development assessed against the more exacting $PM_{2.5}$ AQAL;
    - new exceedences of the 1-hour mean NO_2 AQAL are considered unlikely based upon the marginal change in concentrations;
    - exceedences of the 24-hour mean PM_{10} AQAL are considered unlikely, based upon the marginal change in concentrations and absolute concentrations predicted through the dispersion modelling study;
- modelling assumptions:
    - all modelled concentrations have been verified against WHC monitoring data (Appendix 7.1).

A sensitivity assessment of the model input variables (emission factors and background concentrations) has been considered and is presented in Appendix 7.2. However, the overall conclusion over the significance of the effect has been based upon the main body of the assessment and the impact assessment based upon the 2036 development year. Notwithstanding, it is noted that the sensitivity assessment presented within Appendix 7.2 does not predict any exceedences as a result of change in development trips at existing receptor locations across the Application Site locale.

Therefore, on the basis of the above, the overall effect on air quality as a result of the additional development trips on sensitive receptors is considered to be ‘not significant’.

7.5.2 Cumulative Effects

Cumulative effects on air quality resulting from traffic emissions were undertaken and considered all required committed developments. As such, the updated air quality assessment, and results discussed are inherently cumulative in nature.

7.5.2.1 Traffic Emissions

Additional traffic flows from nearby consented developments have been included within the traffic data used within the dispersion modelling scenarios, through the use of the Hertfordshire County Council's (HCC) County Model of Transport (COMET) model, as agreed with the highways authority. Reference should be made to Chapter 12 Transport for further details. As such, the cumulative effects of nearby consented schemes have been taken into consideration during this assessment in terms of traffic emissions.

7.6 MITIGATION

7.6.1 Operational Phase Emissions

An assessment of vehicle emissions associated with the operation of the proposed development predicted the unmitigated impact to be negligible at all considered receptors, resulting in an overall 'not significant' effect on air quality.

Notwithstanding, a Travel Plan is being prepared for the residential and school uses proposed. The Travel Plans for the development states the following mitigation measures which would help to improve air quality in the development locale, to be secured by planning condition. These include:

- Residential travel plan:
  - Appointment of a travel plan coordinator to oversee successful implementation of the Travel Plan;
  - Provision of residential travel packs which include information on public transport, including bus discount vouchers;
  - Provision of a new pedestrian access point to encourage walking;
  - Encouragement of car sharing; and
  - Cycling parking to be provided for each household, with cycle routes displayed to encourage cycling.
- School travel plan:
  - Appointment of a travel plan coordinator to oversee successful implementation of the Travel Plan;
  - Parental engagement to encourage parents to travel to the school by sustainable transport modes;
  - Encouragement of car sharing; and
  - Cycling parking to be provided on-Site for staff and pupils;
  - Cycling training to be provided to increase the uptake and use of cycling; and
  - Information provided to staff and pupils / parents on public transport options.

7.7 RESIDUAL EFFECTS

7.7.1 Operational Phase

7.7.1.1 Traffic Emissions Assessment

The predicted residual effects of traffic emissions arising from the scheme on existing sensitive receptors are predicted to be not significant without the inclusion of mitigation measures.

7.8 SUMMARY OF EFFECTS

Assuming the implementation of relevant mitigation measures, the overall effect of the development in terms of existing sensitive receptors surrounding the Application Site is predicted to be not significant.

7.9 CONCLUSIONS

SLR Consulting has undertaken an Air Quality Assessment to support the planning for a proposed mixed use development on land west of Hatfield.

Additional development trips arising during the operational phase of the scheme are predicted to result in a negligible impact on annual mean NO_2 and PM_{10} concentrations at all human receptor locations. There is no new predicted risk of exceedence of the 1-hour mean NO_2 or 24-hour mean PM_{10} AQALs as a result of the development proposals. As such, the overall effect is considered to be 'not significant'.

In addition, the results of the sensitivity assessment scenarios for NO_2 (Appendix 7.2) does result in the prediction of any exceedences as a result of the change in development trips at existing receptor locations across the Site locale.

As such, it is not considered that air quality represents a material constraint to the development proposals, which conform to the principles of National Planning Policy Framework and accompany Planning Practice Guidance, the Hertfordshire Health and Wellbeing Planning Guidance and saved policies of the Welwyn Hatfield District Plan.

Environmental Statement – Chapter 7: Air Quality Addendum
Appendix 7.1: Dispersion Model Inputs, Verification and Performance

Dispersion Model Inputs

Traffic Emission Factors and Sensitivity Assessment

DEFRA provides an Emission Factor Toolkit (EfT) in order to calculate emissions from a given length of road based on the traffic composition (number of vehicles of each type) and speed data. Emission factors improve with time as new vehicles registered in the UK have to meet progressively tighter European type approval emissions categories, referred to as "Euro" standards. As the proportion of vehicles in the fleet meeting a particular Euro standard increases, the vehicle emissions from the fleet theoretically improve. In order to reflect this, the EfT provides projected emission factors for future years.

Emission factors were determined for each scenario using the latest EfT (v9).

Modelled traffic exhaust concentrations of oxides of nitrogen (NOx) have been subject to verification in accordance with LAQM.TG(16) and annual mean NO_2 concentrations calculated using the latest DEFRA 'NOx-NO_2 Calculator' (v7.1). The traffic mix within the calculator has been set to "All other UK traffic" for a 2030 year (i.e. the complete development opening year, in lieu of specific factors for 2036). Welwyn Hatfield was selected as the local authority.

In summary, the assessment has utilised the following inputs:

- 2030 emission factors from v9.0 of the EFT; and
- 2030 mapped background concentrations sourced from the DEFRA mapping study (2017 base year).

Recent evidence indicates a disparity between the emission factors and ambient monitoring data[12]. To address this uncertainty, an additional modelling scenario has been assessed in which it has been assumed there is no improvement in vehicle emissions from the verified 2018 base year, and no improvement in backgrounds from the 2018 DEFRA mapped background concentrations. Reference should be made to Appendix 7.2 for presentation of the sensitivity modelling scenario. These modelling assumptions and sensitivity on the dispersion modelling inputs are in accordance with principles of the IAQM's Position Statement on Dealing with Uncertainty in Vehicle NOx Emissions within Air Quality Assessments[13].

Meteorological Data

To calculate pollutant concentrations at identified sensitive receptor locations the dispersion model uses sequential hourly meteorological data, including wind direction, wind speed, temperature, cloud cover and stability, which exert significant influence over atmospheric dispersion.

The dispersion modelling has been undertaken using 2018 data from Luton Airport. This Site is located approximately 13km to the north-west of the Proposed Development site. It is also the closest meteorological station that records all of the parameters necessary for dispersion modelling.

[12] Carslaw, et al. (2011). Trends in NOx and NO_2 emissions and ambient measurements in the UK.
[13] http://www.iaqm.co.uk/text/position_statements/vehicle_NOx_emission_factors.pdf - accessed October 2018.

The meteorological dataset used in this assessment was provided by ADM Ltd. A windrose is presented in Figure 7.3.

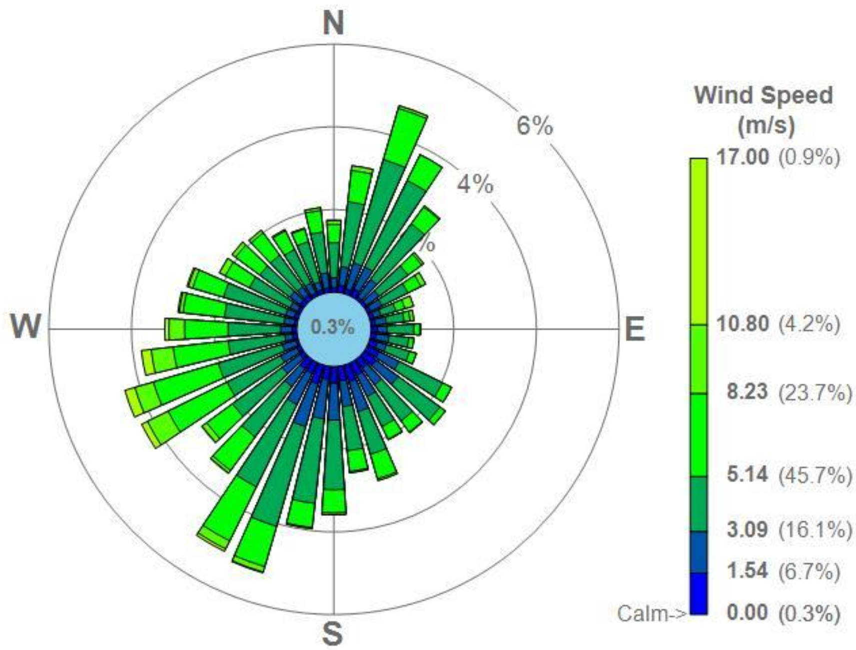

Figure 7.3: Wind Rose for Luton Airport Meteorological Station (2018)

Dispersion Model Input Summary

The modelling input parameters are summarized in Table 7.11.

Table 7.11: Land West of Hatfield AQIA – Summary of Modelling Inputs

Parameter	Description	Input Variable
Surface Roughness	Surface roughness of the modelling domain as a function of land use	A roughness length z0 of 0.5m was used within the assessment area of this dispersion modelling study. This value is for 'open suburbia' and therefore considered appropriate for the surface roughness of the dispersion modelling assessment area
Road Source Emissions	Source of the emission factors used	EFT v.9.0
Emission Year	Modelling year used to factor the traffic emissions	2018 verification year and 2030 development opening year. A further sensitivity scenario was assessed which considered 2018 emission factors for the development opening year (i.e. assuming no further improvement in vehicle NO_X emission factors for future years).
Road Type	Road type within the EFT emission database	Urban (not London) for the majority of links. Links L8 and L9 (correlating to the A1(M)) modelled as 'England (motorway)' – in line with the EFT v9.0 user guide.

Parameter	Description	Input Variable
Elevation of Road	Height of the road link above ground level	Grade – roads are at ground level. See 'Height / Elevation of Modelled Links' section below for further discussion on this.
Diurnal profile	Consideration of temporal emissions within ADMS Roads	A diurnal profile has been included. See 'Diurnal Profile – Temporal Variations' section below for further discussion on this.
Canyons	Consideration of street / road canyons	No road / street canyons have been identified for inclusion within the modelling assessment
Terrain	Consideration of terrain	Complex terrain may have a significant effect on the dispersion of pollutants, due to the disturbance certain topographies cause to the circulation of air within the lower boundary layer. Terrain can account for variations (increase and/or decrease) in pollutant concentrations calculated. The ADMS Roads guidance stipulates that "*Usually terrain effects are only included if the gradient exceeds 1:10* [i.e. 10%]". However, from a review of aerial photography, the area is considered to be generally flat with no terrain variation in excess of 1:10 / 10% present within the modelled study domain. Therefore, terrain has not been considered within the dispersion model.
Special model treatments	Consideration of any additional model treatments	The 'tunnel' module within ADMS Roads has been utilised to reflect the volume emission source from the tunnel portals corresponding to the Hatfield tunnel. See 'Road Tunnel Modelling' section below for further discussion on this.
Road Width	Width of the road link	Road widths measured via use of satellite imagery.
Road Speed	Road speed in km/h	Variable based on posted limit and adjusted to take into account queues and congestion, in accordance with LAQM.TG(16).
Meteorology	Representative hourly sequential meteorological data	Luton Airport 2018
Background	Background pollutant concentration considered during the modelling	DEFRA supplied backgrounds maps (2017 base year) projected to 2030 for 2036 development opening year. A further sensitivity scenario was assessed which considered 2018 DEFRA mapped background concentrations for the development opening year (2018) (i.e. assuming no further improvement in background NO_x/NO_2 concentrations for future years).
Output	Output as gridded or specified points	Specific points
Pollutant Output	Pollutants modelled and averaging time	NO_2 and PM_{10} annual mean, calculated 1-hour mean NO_2 and 24-hour mean PM_{10} in accordance with methodologies prescribed within LAQM.TG(16).

Diurnal Profile – Temporal Variations

A diurnal profile has been included within the ADMS Roads model, in order to account for and consider temporal variation of hourly traffic flow throughout the day and across the week, and be reflected within the resultant predicted concentrations.

In lieu of a specific factor to the Hatfield locale, this diurnal profile has been sourced from the Department for Transport (DfT) Road Traffic Statistics 2018[14], which despite accounting for road traffic patterns across the whole of Great Britain, will to some extent be comparable with those experienced locally. Factors were applied based upon a 5-day weekday average, and factors specific to Saturday and Sunday traffic flows.

Reference should be made to Table 7.12 and Figure 7.4 for details of the applied diurnal profile factors applied within the ADMS Roads dispersion model.

Table 7.12: Land West of Hatfield AQIA – Applied Diurnal Profile Factors

Time of Day (hour ending)	Weekday (5-day average)	Saturday	Sunday
01:00	0.17	0.13	0.11
02:00	0.12	0.15	0.11
03:00	0.10	0.25	0.16
04:00	0.12	0.42	0.26
05:00	0.20	0.67	0.39
06:00	0.49	0.99	0.57
07:00	1.15	1.30	0.93
08:00	1.81	1.56	1.31
09:00	1.82	1.70	1.53
10:00	1.52	1.70	1.61
11:00	1.44	1.62	1.57
12:00	1.48	1.52	1.52
13:00	1.52	1.44	1.51
14:00	1.55	1.42	1.51
15:00	1.64	1.37	1.39
16:00	1.79	1.18	1.21
17:00	1.98	0.91	1.02
18:00	1.96	0.68	0.80
19:00	1.55	0.53	0.58
20:00	1.09	0.46	0.40

[14] Department for Transport statistics, Table TRA0307 Motor vehicle traffic distribution by time of day and day of the week on all roads, Great Britain: 2018.

Time of Day (hour ending)	Weekday (5-day average)	Saturday	Sunday
21:00	0.77	0.37	0.25
22:00	0.58	0.13	0.11
23:00	0.44	0.15	0.11
00:00	0.29	0.25	0.16

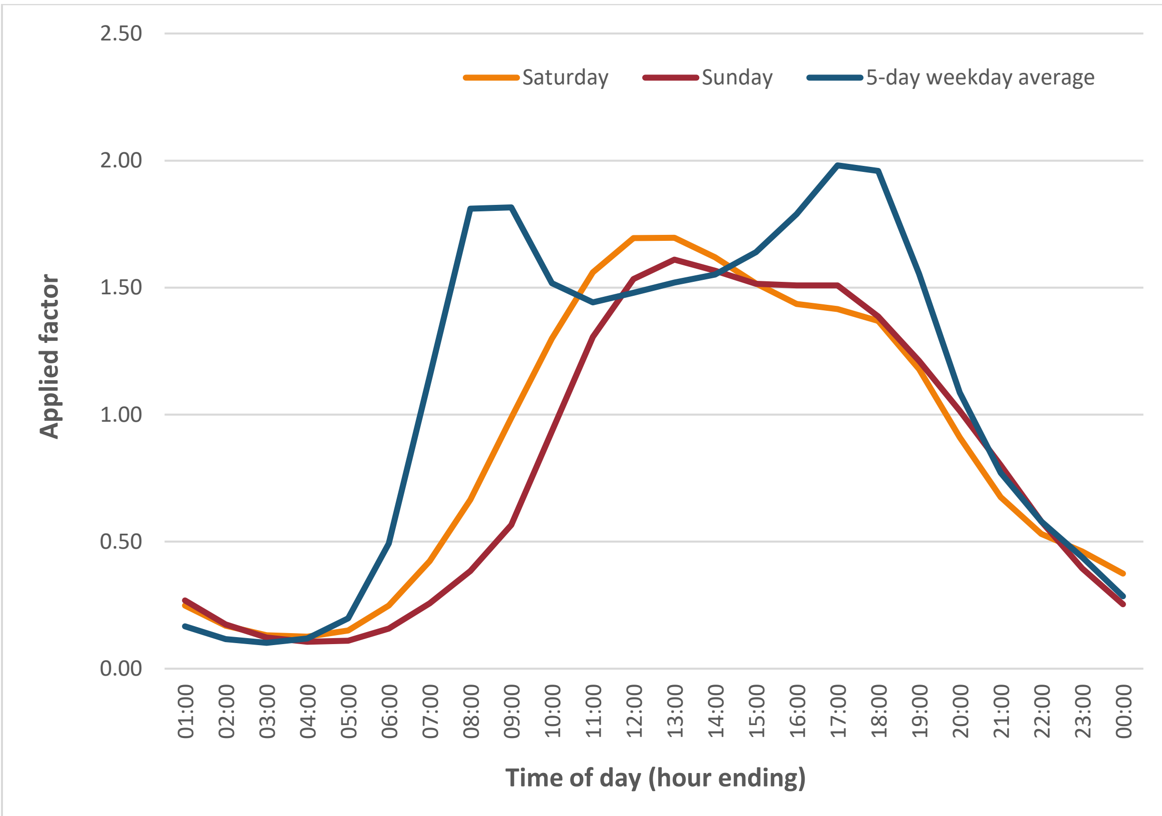

Figure 7.4: Land West of Hatfield AQIA – Applied Diurnal Profile Factors

Height / Elevation of Modelled Links

All road links within the modelled domain have been modelled at grade (i.e. 0m) due to the present limited functionality within ADMS Roads to parametrise roads at a negative elevation. This is considered to form a conservative assessment, and is in accordance the model developer's recommendations.

All receptor locations have subsequently been modelled at a height corresponding to this 'at grade' height.

Road Tunnel Modelling

The 'advanced tunnel' option within ADMS Roads has been utilised, in order to consider and represent the tunnel portals corresponding the Hatfield Tunnel section of the A1(M). It is noted that only tunnel portal emissions have been considered: there are no 'tunnel vents' associated with the Hatfield Tunnel.

Tunnel portal emissions have been modelled corresponding to the one-way directional flow of links L8 and L9, to reflect the north-bound / south-bound direct of vehicular traffic.

Traffic Data

Road traffic data entered into the assessment was obtained from Vectos, transport consultants to the applicant. A summary of the traffic data considered within then assessment is presented in Table 7.13, Table 7.14 and Table 7.15 based upon the Light Duty Vehicles (LDV) Annual Average Daily Traffic (AADT) flow, the Heavy Duty Vehicles (HDV) AADT flow and the modelled vehicle speed, respectively.

Reference should be made to Chapter 12 Transport, for further details on the transport assessment and traffic data considered for the scheme. Reference should be made to Site and surrounding area.

Table 7.13: Traffic Data used within the Dispersion Modelling Assessment – LDV AADT Flows

Link	Road Name	24-hour AADT – LDVs		
		2018 Verification	2036 Do-Minimum	2036 Do-Something
1	A1057	14,047	17,110	17,409
2	Coopers Green Lane (North of Hatfield Avenue)	11,308	13,774	14,431
3	Coopers Green Lane (South of Hatfield Avenue)	11,317	13,786	14,443
4	A1001 (South of Cavendish Way Roundabout)	21,748	26,492	27,718
5	A1001 SB (North of Cavenish Way Roundabout)	10,997	13,395	13,515
6	A1001 NB (North of Cavenish Way Roundabout)	12,087	14,723	14,811
7	Hatfield Avenue	6,852	8,347	9,048
8	A1(M) Northbound (J3-J4)	40,598	49,453	49,453
9	A1(M) Southbound (J4-J3)	42,222	51,430	51,430
10	Mosquito Way NB	9,090	11,072	11,606
11	Mosquito Way SB	9,929	12,094	13,774
12	Albatross Way	1,586	1,932	4,420
13	A414 N Orbital Road (West of A1M J3)	37,077	45,216	46,009
14	Roehyde Way (South of A1M J3)	19,461	23,733	23,377
15	B197 Wellfield Road	18,062	22,027	22,341
16	Birchwood Avenue	9,815	11,970	12,085
17	A1001 Comet Way (South of A1M J4)	14,924	18,200	18,648

Link	Road Name	24-hour AADT – LDVs		
		2018 Verification	2036 Do-Minimum	2036 Do-Something
18	A1(M) south of junction 3	56,454	68,767	68,767
R1	R1 – roundabout with A1001 / Hatfield Avenue / Birchwood Avenue / Wellfield Road	13,722	16,730	16,971
R2	R2 – roundabout with A1001 / St Albans Road West / Cavendish Way	15,597	18,999	19,547
R3	R3 – Roundabout with A1001 / N Orbital Road / A1(M) / Roehyde Way	26,096	31,814	32,368

Table 7.14: Traffic Data used within the Dispersion Modelling Assessment– HDV AADT Flows

Link	Road Name	24-hour AADT – HDVs		
		2018 Verification	2036 Do-Minimum	2036 Do-Something
1	A1057	618	753	753
2	Coopers Green Lane (North of Hatfield Avenue)	217	264	264
3	Coopers Green Lane (South of Hatfield Avenue)	174	211	211
4	A1001 (South of Cavendish Way Roundabout)	2,526	3,077	3,098
5	A1001 SB (North of Cavenish Way Roundabout)	1,277	1,556	1,556
6	A1001 NB (North of Cavenish Way Roundabout)	1,404	1,710	1,710
7	Hatfield Avenue	203	247	247
8	A1(M) Northbound (J3-J4)	6,799	8,282	8,282
9	A1(M) Southbound (J4-J3)	6,430	7,832	7,832
10	Mosquito Way NB	405	493	493
11	Mosquito Way SB	386	470	491
12	Albatross Way	198	241	262
13	A414 N Orbital Road (West of A1M J3)	6,187	7,545	7,566
14	Roehyde Way (South of A1M J3)	2,282	2,783	2,742
15	B197 Wellfield Road	806	983	997

Link	Road Name	24-hour AADT – HDVs		
		2018 Verification	2036 Do-Minimum	2036 Do-Something
16	Birchwood Avenue	434	529	534
17	A1001 Comet Way (South of A1M J4)	1,668	2,035	2,103
18	A1(M) south of junction 3	4,147	5051	5051
R1	R1 – roundabout with A1001 / Hatfield Avenue / Birchwood Avenue / Wellfield Road	1,078	1,314	1,336
R2	R2 – roundabout with A1001 / St Albans Road West / Cavendish Way	1,474	1,795	1,802
R3	R3 – Roundabout with A1001 / N Orbital Road / A1(M) / Roehyde Way	3,665	4,468	4,469

Table 7.15: Traffic Data used within the Dispersion Modelling Assessment– Modelled Speed

Link	Road Name	Vehicle Speed (km/h) (A)		
		2018 Verification	2036 Do-Minimum	2036 Do-Something
1	A1057		64	
2	Coopers Green Lane (North of Hatfield Avenue)		96	
3	Coopers Green Lane (South of Hatfield Avenue)		96	
4	A1001 (South of Cavendish Way Roundabout)		80	
5	A1001 SB (North of Cavenish Way Roundabout)		80	
6	A1001 NB (North of Cavenish Way Roundabout)		80	
7	Hatfield Avenue		48	
8	A1(M) Northbound (J3-J4)		112 (LDV) / 96 (HDV)	
9	A1(M) Southbound (J4-J3)		112 (LDV) / 96 (HDV)	
10	Mosquito Way NB		48	
11	Mosquito Way SB		48	
12	Albatross Way		48	

Link	Road Name	Vehicle Speed (km/h) (A)		
		2018 Verification	2036 Do-Minimum	2036 Do-Something
13	A414 N Orbital Road (West of A1M J3)	112 (LDV) / 96 (HDV)		
14	Roehyde Way (South of A1M J3)	96		
15	B197 Wellfield Road	48		
16	Birchwood Avenue	48		
17	A1001 Comet Way (South of A1M J4)	48		
18	A1(M) south of junction 3	112 (LDV) / 96 (HDV)		
R1	R1 – roundabout with A1001 / Hatfield Avenue / Birchwood Avenue / Wellfield Road	48		
R2	R2 – roundabout with A1001 / St Albans Road West / Cavendish Way	48		
R3	R3 – Roundabout with A1001 / N Orbital Road / A1(M) / Roehyde Way	48		

Note:

(A) Traffic speeds have been adjusted to take into account queues and congestion in accordance with LAQM.TG(16).

It is noted that traffic data presented in Table 7.13, Table 7.14 predicts an additional +793 vehicles per day during the operational phase of the scheme, on Link 13 (A414 N Orbital Road (West of A1M J3)). This link ultimately has the potential to distribute in the direction of the AQMA within St. Albans (St Albans AQMA No. 1). To provide a consideration of vehicle distribution further beyond Link 13, Vectos (transport consultants to the applicant) provided the following comment:

> *"We have then undertaken a further manual assignment exercise using the same methodology and data sources as above to estimate where the traffic using the A414 will be going and the direction it will take. Based on the results of this exercise we have estimated that of the vehicles using the A414 only 126 will be travelling to St Albans per day. The remaining trips will travel around the remainder of St Albans and Hertfordshire (including Dacorum, Hertsmere, Three Rivers and Watford), connect onto either the M1 or M25 (to London and further afield).However of the 126 going to St Albans per day only 27 of those vehicles per day (AADT) will travel into the centre of St Albans at the junction of Chequer St (A5183) and London Road (A1081) where the AQMA is located.*
>
> *Other than the links within the area, we do not think there are any other links within the study area that will see increases of greater than 500 vehicles AADT as beyond the links above the traffic*

will start to distribute round the network on multiple roads and will be going to destinations such as workplaces, shops etc."

Therefore, based upon the above, it is considered that the spatial extent of the Air Quality Assessment includes all relevant road links where change in development trips is above the 'indicative criterion for assessment' defined within EPUK & IAQM guidance (i.e. >500 LDVs / >100HDVs as a 24-hour AADT).

Dispersion Model Verification

Calculation of Correction Factors

The model output of road-NOx (i.e. the component of total NOx coming from road traffic exhaust emissions) has been compared with the 'calculated' road-NOx concentration. For this calculation, the following assessment inputs were used, which are considered to be representative of the development locale:

- DEFRA's NOx to NO2 calculator version 7.1;
- 'Welwyn Hatfield' was selected as the 'Local Authority';
- 2018 NO_2 diffusion tube monitoring locations WH7, WH19, WH22, WH24, WH25, WH26 and WH27 from the WHC monitoring network; and
- 2018 DEFRA mapped background concentrations (2017 base year) for the grid square containing the above diffusion tubes.

Prior to undertaking model verification, model setup parameters and input data were reviewed to maximise the performance of the dispersion model in relation to the real-world conditions.

Calculated (monitored) NOx data versus modelled NOx data is shown in Table 7.16 below with the derived adjustment factor based on a linear regression forced through zero.

Table 7.16: Verification Data 2018, Initial Comparison: All Monitoring Locations

Monitoring Location	Modelled NOx Road Contribution (µg/m³)	Calculated NOx Road Contribution (µg/m³)	Ratio of Modelled : Calculated NOx	Monitored NO_2 Concentration (µg/m³)	Adjusted Modelled NO_2 Concentration (µg/m³)	Difference (%)
WH19	30.07	51.19	1.70	44	35.1	-20.23
WH22	10.45	34.73	3.32	35	23.6	-32.46
WH25	48.20	41.61	0.86	40	43.0	+7.50
WH26	61.37	53.65	0.87	45	48.4	+7.44
WH7	12.41	11.44	0.92	28	28.5	+1.93
WH24	22.21	37.47	1.69	38	31.3	-17.76
WH27	36.68	27.96	0.76	34	38.1	+11.94
		***m*-regression factor**	1.0115			

Refinements have been made to the model performance without "*providing unreasonable data inputs in order to reduce model adjustment factors is not an acceptable approach*" – as stated within LAQM.TG(09), which despite its status (i.e. superseded) the above extract is still considered to be relevant.

In accordance with LAQM.TG(16), the ratio of 'Calculated (Monitored) Road NOx Contribution' to 'Modelled NOx Road Contribution' has been calculated and reviewed. The calculated ratio is a minimum of 1:0.76 (monitoring location WH27) and a maximum of 1:3.32 (monitoring location WH22). It is considered that these ratios illustrate that the dispersion modelling and verification is performing differently across the modelling domain.

LAQM.TG(16) states that:

> "*In order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within 25% of the monitored concentrations as a minimum, preferably within 10%*".

Table 7.16 illustrates that the difference between modelled and calculated road NOx concentrations is within ± 25% at all locations, expect at WH22 (-32.46%), whereby no further improvement of the modelled results could be obtained on this occasion. A factor of 1.0115 could therefore not be used for verification.

At monitoring locations WH25, WH26 and WH27 the model is overpredicting modelled road NOx in comparison to the calculated road NOx. At monitoring locations WH25, WH26 and WH27 (all situated on the roundabout with the A1001 / Birchwood Avenue / Wellfield Road / Hatfield Avenue (herein referred to as 'R1', as presented in Figure 7.2) this is considered to be a function of the way that road elevations / heights have been considered around this roundabout. Based upon guidance provided by CERC, all roads including the A1(M) were modelled at grade (i.e. 0m) irrespective of the height difference between real-world road links, given the present limited functionality within ADMS Roads to parametrise roads at a negative elevation. Furthermore, monitoring location WH19 is similarly positioned adjacent to the A1001 / A1(M), and based upon the 'at grade' nature of these modelled road links it is considered that the model is overperforming in terms of the modelled road NOx concentration in this specific location.

Therefore, it is considered that the model will be performing very differently in the location of the R1 roundabout (and the WH19, WH25, WH26 and WH27 diffusion tubes positioned on this roundabout), and elsewhere within the extent of the considered modelling domain. On this basis, a 'zonal' verification factor has been applied to separately consider a 'roundabout' verification factor and 'non-roundabout' verification factor. The 'roundabout' verification factor has been applied to all receptor locations within 200m of the R1 roundabout / modelled A1(M) north of the Hatfield Tunnel based upon the distance defined within DMRB LA 105[7], within which road traffic emission contributions from specific roads occur. Beyond this 200m separation distance, emission contributions from the R1 roundabout / modelled A1(M) north of the Hatfield Tunnel would reduce. It is noted that receptor locations have been digitised and modelled based upon their relative proximity to the R1 roundabout / modelled A1(M) north of the Hatfield Tunnel (i.e. within approximately 100m) OR at separation distances in excess of 200m. Reference should be made to Figure 7.5 for an illustration of receptors and their proximity to the R1 roundabout / modelled A1(M) north of the Hatfield Tunnel road sources to illustrate this.

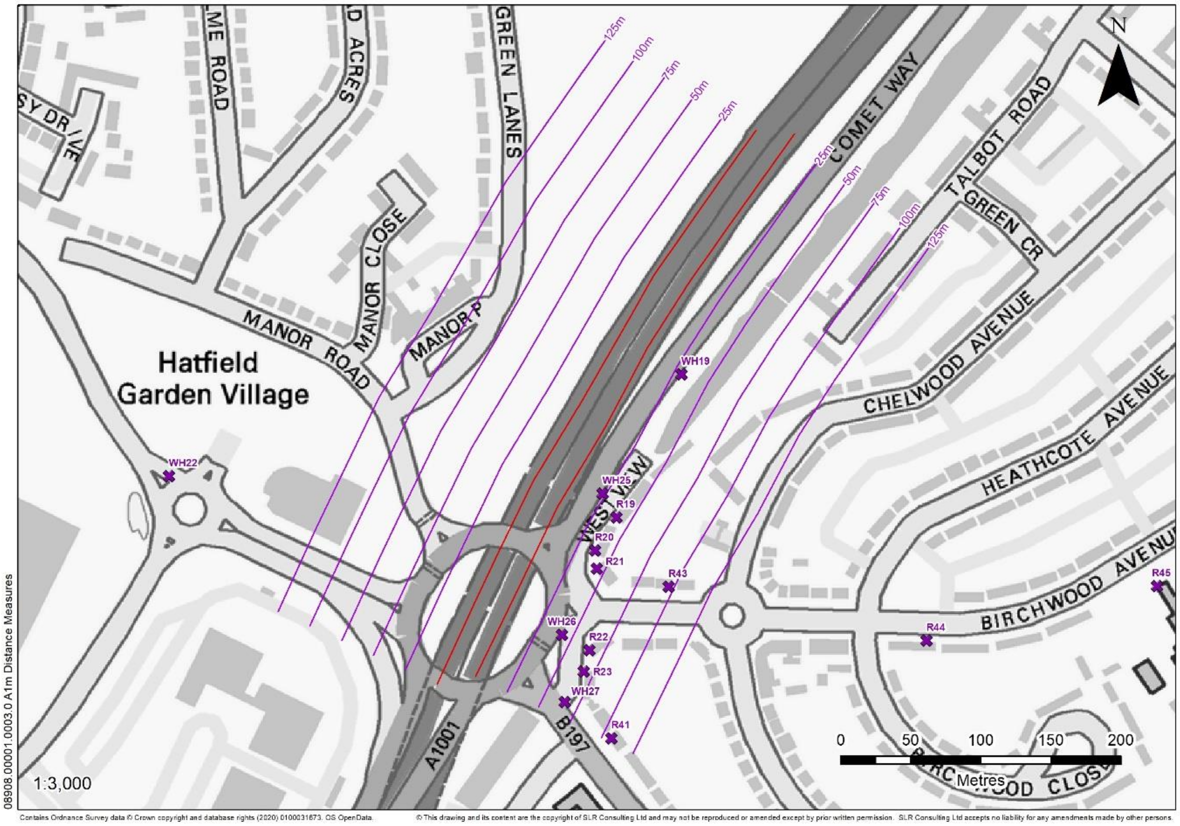

Figure 7.5: Receptor Position Relative to the R1 roundabout / modelled A1(M) north of the Hatfield Tunnel Road Sources

Receptor locations at a separation distance of 200m or greater from the carriageway of the R1 roundabout / modelled A1(M) would be more influenced by emission contributions from other minor road links in the modelling domain (such as B197 Wellfield Road and Birchwood Avenue, for example), with only negligible emission contributions (i.e. <0.01µg/m^3) from the R1 roundabout / modelled A1(M) north of the Hatfield Tunnel sources. Therefore, the 'at grade' / 0m elevation of the R1 roundabout / modelled A1(M) north of the Hatfield Tunnel road sources does not ultimately impact upon or skew absolute modelled concentrations at 'non-roundabout' receptor locations.

At all other receptor locations (i.e. receptor locations >200m from the R1 roundabout / modelled A1(M) north of the Hatfield Tunnel, a 'non-roundabout' verification factor has been applied and considered based upon the average ratio of modelled:calculated road NOx from those relevant locations.

The inclusion of diffusion tubes as part of the 'roundabout' and 'non-roundabout' verification factors, is as follows:

- Roundabout: diffusion tubes WH19, WH25, WH26 and WH27; and
- Non-roundabout: diffusion tubes WH7, WH22 and WH24.

Calculation of Correction Factors – 'Roundabout' Diffusion Tubes

Re-calculated NOx data versus modelled NOx data is shown in Table 7.17 below, based upon the consideration of 'roundabout' diffusion tubes (i.e. WH19, WH25, WH26 and WH27) with the applied primary adjustment factors. The final 'roundabout' verification results are graphed in Figure 7.6.

Table 7.17: Verification Data 2018, Secondary Step: 'Roundabout' Verification

Monitoring Location	Modelled NOx Road Contribution (µg/m³)	Calculated NOx Road Contribution (µg/m³)	Ratio of Modelled : Calculated NOx	Monitored NO_2 Concentration (µg/m³)	Adjusted Modelled NO_2 Concentration (µg/m³)	Difference (%)
WH19	30.07	51.2	1.70	44	34.2	-22.32
WH25	48.20	41.6	0.86	40	41.6	+4.05
WH26	61.37	53.7	0.87	45	46.7	+3.76
WH27	36.68	28.0	0.76	34	37.0	+8.71
		***m*-regression factor**	0.9429			

It is noted that Table 7.17 presents an average *m*-regression factor of less than 1 (0.9429) based upon the consideration of 'roundabout' diffusion tubes (i.e. WH19, WH25, WH26 and WH27). This average relationship is a minimum of 1:0.76 (monitoring location WH27) and a maximum of 1:1.70 (monitoring location WH19). Should this average factor be applied to the modelled road NOx concentration dataset, this would ultimately reduce the verified road NOx in comparison to modelled road NOx and result in the calculation of lower absolute annual mean NO_2 concentrations. Therefore, as a conservative approach a factor of 1 has been applied to all 'roundabout' receptors. Modelled PM_{10} concentrations at 'roundabout' receptors have further been verified using a factor of 1, following the recommendations of LAQM.TG(16) guidance. Those receptor locations / monitoring locations where the 'roundabout' verification factor has been applied, are as follows:

- Receptor locations: R19, R20, R21, R22, R23, R41 and R43 (as presented within Table 7.5 and Figure 7.5); and
- Diffusion tube monitoring locations: WH19, WH25, WH26 and WH27 (as presented within Table 7.6 and Figure 7.5).

LAQM.TG(16) states "*In order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within 25% of the monitored concentrations as a minimum, preferably within 10%*". Table 7.17 illustrates that the difference between modelled and calculated road NOx concentrations is within ±10% at three monitoring locations and ±25% at one monitoring location. On this basis, it is considered that all 'roundabout' diffusion tubes are appropriate to remain in the zonal verification study.

As stated in LAQM.TG(16), a graph of modelled versus calculated road NOx contributions has been prepared (for the 'roundabout' verification factor) including a trend line which presents the following requirements:

"The equation of the trend line should be in the format of

y = mx (intercept at 0)

y is monitored road contribution NOx and

x is modelled road contribution NOx

m is the regression correction factor to apply to the modelled road contribution NOx."

Reference should be made to Figure 7.6 for the relevant graph and trend line.

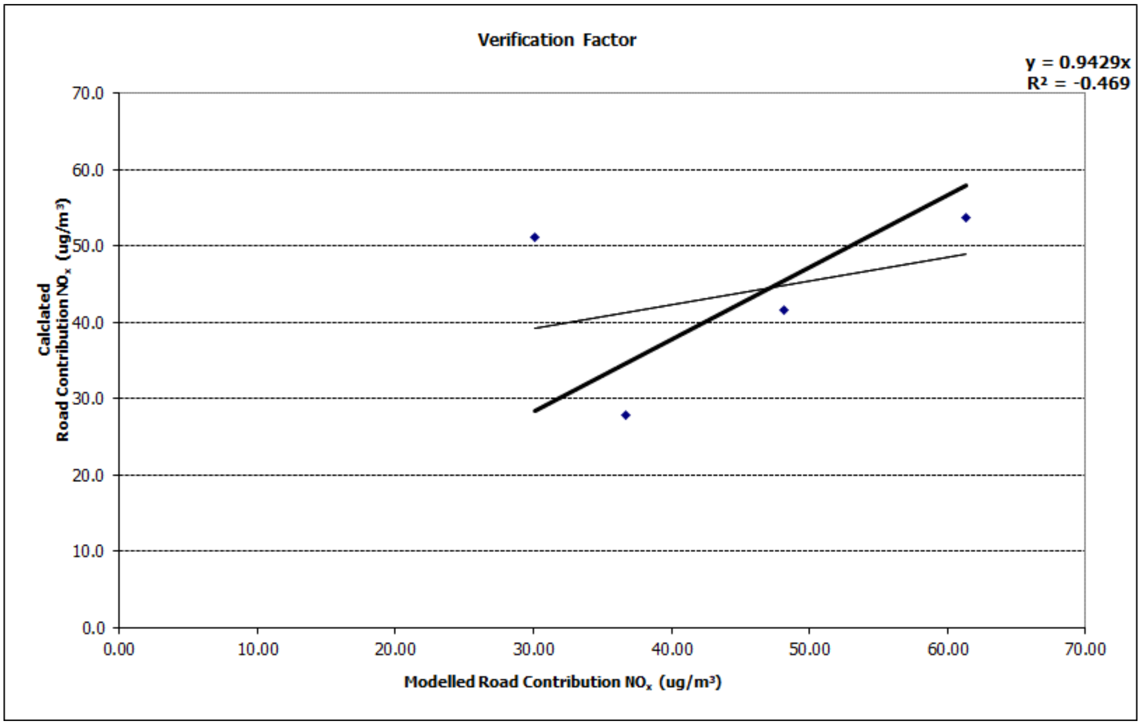

Figure 7.6: Final Verification and Adjustment: 'Roundabout' Verification

As presented in in Table 7.17 and Figure 7.6, modelled NOx concentrations at 'roundabout' locations (as identified) have therefore been verified using a factor of 1.0.

Calculation of Correction Factors – 'Non-roundabout' Diffusion Tubes

Re-calculated NOx data versus modelled NOx data is shown in Table 7.18 below, based upon the consideration of 'non-roundabout' diffusion tubes (i.e. WH7, WH22 and WH24) with the applied primary adjustment factors. The final 'non-roundabout' verification results are graphed in Figure 7.7.

Table 7.18: Verification Data 2018, Final Comparison: 'Non-roundabout' Verification – 1.7674

Monitoring Location	Modelled NOx Road Contribution (µg/m³)	Calculated NOx Road Contribution (µg/m³)	Ratio of Modelled : Calculated NOx	Monitored NO_2 Concentration (µg/m³)	Adjusted Modelled NO_2 Concentration (µg/m³)	Difference (%)
WH22	10.45	34.73	3.32	35	27.5	-21.43
WH7	12.41	11.44	0.92	28	33.0	+17.75
WH24	22.21	37.47	1.69	38	38.8	+2.03
		***m*-regression factor**	1.7674			

In accordance with LAQM.TG(16), the ratio of 'Calculated Road Contribution' to 'Modelled NOx Road Contribution' has been calculated and reviewed, based upon the 'non-roundabout' verification locations. This average relationship is a minimum of 1:0.92 (monitoring location WH7) and a maximum of 1:3.32 (monitoring location WH22).

LAQM.TG(16) states "*In order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within 25% of the monitored concentrations as a minimum, preferably within 10%*". Table 7.18 illustrates that the difference between modelled and calculated road NOx concentrations is within ±10% at one monitoring location and ±25% at two monitoring locations. On this basis, it is considered that all 'non-roundabout' diffusion tubes are appropriate to remain in the zonal verification study.

As stated in LAQM.TG(16), a graph of modelled versus calculated road NOx contributions has been prepared (for the 'non-roundabout' verification factor) including a trend line which presents the following requirements:

> *"The equation of the trend line should be in the format of*
>
> *y = mx (intercept at 0)*
>
> *y is monitored road contribution NOx and*
>
> *x is modelled road contribution NOx*
>
> *m is the regression correction factor to apply to the modelled road contribution NOx."*

Reference should be made to Figure 7.7 for the relevant graph and trend line.

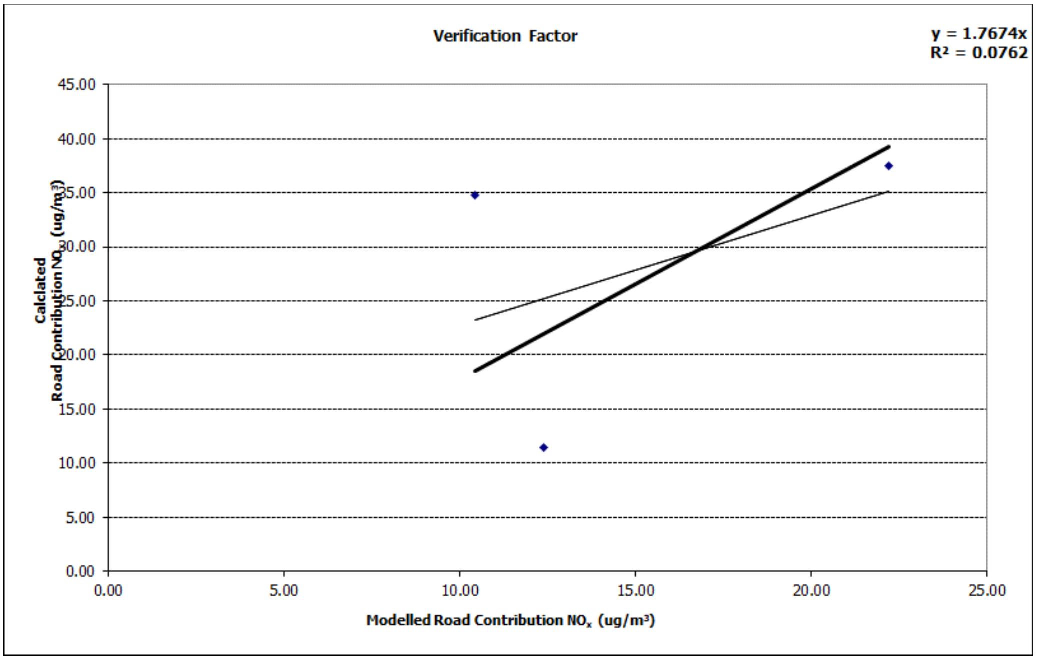

Figure 7.7: Final Verification and Adjustment: 'Non-roundabout' Verification

As presented in in Table 7.18 and Figure 7.7, modelled NOx concentrations at 'non-roundabout' locations (as identified) have therefore been verified using a factor of 1.7674.

PM_{10} Verification

Given the absence of PM_{10} monitoring in the development locale, modelled PM_{10} concentrations have been verified in accordance with the above methodology i.e. as consistent with NOx, using a factor of 1.7674 and 1.0 for 'non-roundabout' and 'roundabout' locations (as identified), respectively, following the recommendations within LAQM.TG(16).

Model Performance

An evaluation of model performance has been undertaken to establish confidence levels in model results. LAQM.TG(16) identifies a number of statistical procedures that are appropriate to evaluate model performance and assess uncertainty. The statistical parameters used in this assessment are:

- Root mean square error (RMSE); and
- Fractional bias (FB).

A brief for explanation of each statistic is provided in Table 7.19 and Table 7.20 based upon consideration of 'roundabout' and 'non-roundabout' verification, respectively, and further details can be found in LAQM.TG(16).

Table 7.19: Dispersion Model Performance Checks – 'Roundabout' Verification

Parameter	Comments	Value
Root Mean Square Error	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared If the RMSE values are higher than ±25% of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. For example, if the model predictions are for the annual mean NO_2 AQAL of 40µg/m^3, if an RMSE of 10µg/m^3 or above is determined for a model, the local authority would be advised to revisit the model parameters and model verification. Ideally an RMSE within 10% of the AQAL would be derived, which equates to 4µg/m^3 for the annual mean NO_2 AQAL.	5.26µg/m^3 (i.e. 13.15% of the NO_2 annual mean AQAL)
Fractional Bias	It is used to identify if the model shows a systematic tendency to over or under predict. FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.	+0.022

As indicated in Table 7.19, the RMSE value for the 'roundabout' verification is calculated to be 5.26µg/m^3 / 13.15% of the NO_2 annual mean AQAL therefore within ±25% of the NO_2 annual mean AQAL based upon the average factor *m*-regression factor derived from 'roundabout' verification monitoring locations: WH19, WH25, WH26 and WH27. It is noted that LAQM.TG(16) states:

> *"Para 7.542:*
>
> *If the RMSE values are higher than ±25% of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. […] Ideally an RMSE within 10% of the air quality objective would be derived, which equates to 4µg/m^3 for the annual average NO_2 objective."*

On this basis, LAQM.TG(16) does not require for the RMSE to be within 10% of the applied objective.

Furthermore, the FB is calculated to be +0.022 and within the required +2 and -2 range.

Therefore, model performance and uncertainty is considered to be satisfactory and monitoring locations WH19, WH25, WH26 and WH27have been retained within the 'roundabout' verification study.

Table 7.20: Dispersion Model Performance Checks – 'Non-roundabout' Verification

Parameter	Comments	Value
Root Mean Square Error	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared	5.21µg/m^3 (i.e. 13.03% of the NO_2 annual mean AQAL)

Parameter	Comments	Value
	If the RMSE values are higher than ±25% of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. For example, if the model predictions are for the annual mean NO_2 AQAL of 40µg/m^3, if an RMSE of 10µg/m^3 or above is determined for a model, the local authority would be advised to revisit the model parameters and model verification. Ideally an RMSE within 10% of the AQAL would be derived, which equates to 4µg/m^3 for the annual mean NO_2 AQAL.	
Fractional Bias	It is used to identify if the model shows a systematic tendency to over or under predict. FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.	+0.018

As indicated in Table 7.20, the RMSE value for the 'non-roundabout' verification is calculated to be 5.21µg/m^3 / 13.03% of the NO_2 annual mean AQAL therefore within ±25% of the NO_2 annual mean AQAL based upon the average factor *m*-regression factor derived from 'non-roundabout' verification monitoring locations: WH22, WH7 and WH24.

Furthermore, the FB is calculated to be +0.018 and within the required +2 and -2 range.

Therefore, model performance and uncertainty is considered to be satisfactory and monitoring locations WH22, WH7 and WH24 have been retained within the 'non-roundabout' verification study.

Environmental Statement – Chapter 7: Air Quality Addendum
Appendix 7.2: Vehicular Pollutant Assessment Sensitivity

Further Assessment – Modelling Sensitivities

In order to provide further assessment and sensitivities on the assessment inputs, an additional scenario has been considered based as described above which considers:

- 2018 background concentrations from the DEFRA supplied background maps (2017 base year); and
- NOx emission factors obtained from EFT v9.0 for 2018.

The results of this sensitivity modelling are presented in the following subsections. No sensitivity analysis has been undertaken with respect to modelled annual mean PM_{10} concentrations.

Nitrogen Dioxide Annual Mean Modelling Results: 2018 Assessment Sensitivity

Predicted annual mean ground level NO_2 concentrations were assessed against the AQAL of 40µg/m^3, as displayed in Table 7.21. Exceedences of the AQAL are highlighted in bold.

For completeness, predicted annual mean concentrations are additionally presented at NO_2 air quality monitoring locations within the development locale and the dispersion modelling domain (i.e. monitoring locations WH7, WH19, WH22, WH24, WH25, WH26 and WH24). It is noted that the WHC Air Quality Annual Status Report states that none of these diffusion tubes are locations of relevant exposure to the annual mean AQAL. Therefore, no associated impact descriptor is presented at the considered diffusion tubes.

Table 7.21: Summary of Predicted Annual Mean NO_2 Concentrations: 2018 Assessment Sensitivity

Receptor	2036 (µg/m^3) [(A)]		Change (µg/m^3)	Change as a Percentage of the AQAL (%)	Impact
	'Do-minimum'	'Do-something'			
R1	16.9	17.0	+0.04	0.10	Negligible
R2	17.7	17.8	+0.05	0.13	Negligible
R3	18.4	18.5	+0.06	0.15	Negligible
R4	19.9	20.0	+0.08	0.20	Negligible
R5	25.7	25.8	+0.12	0.30	Negligible
R6	15.6	15.6	+0.01	0.02	Negligible
R7	16.0	16.2	+0.14	0.35	Negligible
R8	14.1	14.1	+0.02	0.05	Negligible
R9	28.0	28.0	+0.09	0.23	Negligible
R10	29.0	29.2	+0.12	0.30	Negligible
R11	28.2	28.3	+0.11	0.27	Negligible
R12	27.1	27.2	+0.12	0.30	Negligible
R13	22.8	22.8	+0.04	0.10	Negligible
R14	24.0	24.1	+0.03	0.08	Negligible
R15	16.3	16.4	+0.14	0.35	Negligible

Receptor	2036 (µg/m³) (A)		Change (µg/m³)	Change as a Percentage of the AQAL (%)	Impact
	'Do-minimum'	'Do-something'			
R16	19.1	19.2	+0.10	0.25	Negligible
R17	20.5	20.6	+0.16	0.40	Negligible
R18	20.8	21.0	+0.16	0.40	Negligible
R19	36.2	36.3	+0.09	0.22	Negligible
R20	**41.0**	**41.1**	+0.10	0.25	Negligible
R21	39.8	39.9	+0.08	0.20	Negligible
R22	36.5	36.6	+0.06	0.15	Negligible
R23	35.4	35.5	+0.06	0.15	Negligible
R24	20.6	20.7	+0.10	0.25	Negligible
R25	20.6	20.7	+0.11	0.27	Negligible
R26	21.4	21.9	+0.41	1.03	Negligible
R27	21.5	22.2	+0.72	1.80	Negligible
R28	20.7	21.4	+0.66	1.65	Negligible
R29	16.8	17.3	+0.49	1.23	Negligible
R30	16.5	17.0	+0.47	1.18	Negligible
R31	20.2	20.6	+0.39	0.97	Negligible
R32	16.7	17.1	+0.38	0.95	Negligible
R34	18.1	18.2	+0.03	0.08	Negligible
R35	30.0	30.2	+0.14	0.35	Negligible
R36	26.3	26.4	+0.11	0.27	Negligible
R37	21.7	21.7	+0.09	0.23	Negligible
R38	19.5	19.6	+0.05	0.13	Negligible
R39	26.3	26.3	-0.04	-0.10	Negligible
R40	26.5	26.5	-0.05	-0.13	Negligible
R41	27.3	27.3	+0.06	0.15	Negligible
R42	26.8	26.9	+0.11	0.28	Negligible
R43	28.8	28.8	+0.05	0.13	Negligible
R44	23.8	23.9	+0.04	0.10	Negligible
R45	20.9	20.9	+0.02	0.05	Negligible
WH19	33.8	33.9	+0.11	0.27	-
WH22	27.4	27.8	+0.40	1.00	-
WH25	**42.6**	**42.7**	+0.16	0.40	-
WH26	**48.4**	**48.5**	+0.08	0.20	-

Receptor	2036 ($\mu g/m^3$) (A)		Change ($\mu g/m^3$)	Change as a Percentage of the AQAL (%)	Impact
	'Do-minimum'	'Do-something'			
WH7	29.6	29.6	+0.07	0.18	-
WH24	37.2	37.4	+0.27	0.68	-
WH27	37.1	37.2	+0.11	0.27	-

Note:

(A) Scenario modelled with 2018 emission factors and 2018 background concentrations, to reflect the 2036 opening year of the development.

As shown in Table 7.21 there are three predicted exceedences of the annual mean AQAL in both the 'do-minimum' and 'do-something' scenarios during the 2018 assessment sensitivity scenario. These exceedences occur at receptor location R20 and diffusion tube locations WH25 and WH26. It is noted that the exceedences occur in both the do-minimum' and 'do-something' scenarios and not as a result of change in development trips associated with the proposed development. Furthermore, it is noted that at the closest receptor locations of relevant annual mean exposure relative to WH25 and WH26 diffusion tubes (i.e. receptors R19 and R22, respectively), there are no predicted exceedences of the annual mean AQAL in either scenario.

It is noted that there are predicted to be a reduction in annual mean NO_2 concentrations in the 'do-something' scenario (compared to the 'do-minimum' scenario) at several receptor locations. Discussion with the transport consultant whom provided the traffic data indicates that in some locations, the development-generated traffic is consequently influencing the distribution of existing traffic on the local road network, and in turn causing an observed, marginal reduction.

The predicted percentage change of annual mean NO_2 concentrations ranges from between '2 – 5% of the AQAL' (as predicted at receptors R27 and R28), '1% of the AQAL' (as predicted at receptors R26 and R29 – R32) to '<0.5% of the AQAL' (as predicted at all other receptors). An unmitigated 'negligible' impact on annual mean NO_2 concentrations remains to be predicted at receptor locations as part of the 2018 sensitivity assessment, despite the overly conservative sensitivity assessment approach.

Nitrogen Dioxide 1-hour Mean Modelling Results: 2018 Assessment Sensitivity

The risk of exceeding the 1-hour mean AQAL was assessed according to the guidance in LAQM.TG(16). This Guidance states that:

> *"exceedances of the NO_2 1-hour mean are unlikely to occur where the annual mean is below 60µg/m^3".*

The maximum annual mean NO_2 'do-something' concentration is 48.5µg/m^3 (predicted at diffusion tube H26). Whilst this location is not comparable to relevant exposure to the 1-hour mean NO_2 AQAL, in accordance with DEFRA guidance the maximum predicted annual mean NO_2 concentration indicates that exceedences of the 1-hour mean NO_2 AQAL are considered 'unlikely' at existing receptors as a result of proposed development trips.

Analysis of Assessment Sensitivities

Sensitivity modelling has been undertaken which utilises 2018 emission factors (EFT v9) and 2018 background concentrations (May 2019 DEFRA release, 2017 base year) to reflect the 2036 development opening year. This scenario predicts a number of exceedences of the annual mean NO_2 AQAL. These exceedences are predicted to occur in both the 'do-minimum' and 'do-something' scenarios. Exceedences do not occur as a result of change in development trips.

The unmitigated impact is predicted to be 'negligible' at all receptor locations in accordance with the assessment methodology.

It is noted that this precautionary assessment assumes that road traffic emission factors and background concentrations in the 2036 development opening year will remain relative to 2018 (verification year) levels. Furthermore, the precautionary assessment assumes that road traffic flows predicted in the 2036 development opening year will occur in 2018.

DEFRA projections and the basis for future year road traffic emission factor reductions embedded within the EFT v9.0 are based upon a number of assumptions, including the following:

- Updated basic fleet assumptions for 2017-2030 in line with DfT, NAEI and TfL projections; and
- Updated Euro class compositions for 2017-2030 in line with DfT, NAEI, and TfL data (inclusive of Euro 6 subcategories);

These assumptions and forecasts are in accordance with the release of new car sales data, which represents a stronger empirical dataset than previous forecasts.

It is considered that the 2018 modelling predictions presented within this sensitivity assessment are worst-case reflections to provide confidence in the modelling predictions, and do not reflect likely impacts from additional development trips in the development opening year – particularly given the 18-year difference between the predicted complete development opening year (2036) and the sensitivity assessment scenario year (2018). Actual impacts in the development opening year are likely to be lower than those predicted given the projected road traffic exhaust emission factor improvements, as indicated by the impact assessment scenario and modelled concentrations in the main body of the Air Quality Chapter.

DEFRA mapped background concentrations (2017-base) and their future year projections are based on a number of assumptions which include the following:

- all assumptions underlying the latest (2017) NOx emission projections for road transport, as detailed above;
- updated road transport forecasts for Great Britain from the DfT;
- updated assumptions on diesel car penetration rates provided by the DfT; and
- updated vehicle sales projections for cars and Light Goods Vehicles (LGV) based on information provided by the DfT.

In relation to trends in air pollutant concentrations within WHC's area, including those of NO_2, a review of the WHC 2019 Air Quality Annual Status Report indicates a general downward trend in monitored annual mean NO_2 concentrations (particularly those of a 'background' classification) over the period 2012 to 2017. Furthermore, a current and short-term period trend is noted indicating than 2018 annual mean concentrations are lower than those in 2017.

On this basis, and given the witnessed reduction trend in annual mean NO_2 concentration within the WHC network, the precautionary approach of using 2018 mapped background concentrations to reflect the 2036 development opening year is considered likely to overestimate background concentrations in 2036. On this basis, compliance with the annual mean AQAL is considered to be indicated by the impact assessment scenario and modelled concentrations in the main body of the Air Quality Chapter.