Report for:

JSA Planning Limited

Residential Development at Grundon Waste Management Site, Higham Way, Banbury

Air Quality Assessment

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Author	[redacted] Thomas Wescott Junior Air Quality Consultant
Approved By	[redacted] Graham Parry Managing Director
Report For	JSA Planning Limited, Tavistock House, Waltham Road, Maidenhead, Berkshire, SL6 3NH
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1. INTRODUCTION

ACCON UK Limited (ACCON) have been commissioned by JSA Planning Limited to carry out an air quality assessment to support a planning application for a proposed residential development on the site of Grundon Waste Management, Higham Way, Banbury. The proposed development will consist of approximately 200 residential dwellings.

The proposed development location will have Higham Road as its main access to the north-west, along with Merton Street, Bridge Street and Middleton Road to the north. The proposed development is located within Cherwell District Council (CDC) and is not within an air quality management area (AQMA).

This assessment has been completed in order to determine whether the proposed development achieves compliance against the National Air Quality Objectives (NAQOs), along with National and Local Planning Policy. This assessment has been undertaken in accordance with the Department for Environment, Food and Rural Affairs' (DEFRA) current Technical Guidance on Local Air Quality Management (LAQM.TG16.)[1] and covers the effects of local air quality on the development.

The report assesses the overall pollutant concentrations of nitrogen dioxide (NO_2) and particulates (PM_{10} and $PM_{2.5}$) at the proposed development site and at nearby surrounding sensitive receptors. A glossary of terms is detailed in **Appendix 1** and the location of the site is shown in **Section 3.1**. Development plans for the site with development receptor locations can be found in **Appendix 5.** Maps identifying nearby sensitive receptor locations, modelled to assess impacts of additional traffic emissions associated with the operation of the development, can be found in **Appendix 4.** It is estimated that the proposed development will be completed and occupied by 2021.

The potential air quality constraints on development and impacts of the development have been assessed on the basis of the findings of detailed dispersion modelling using Breeze Roads GIS Pro Version 5.1.8, which has been undertaken in the context of relevant NAQOs, emission limit values and relevant guidance.

[1] Local Air Quality Management Technical Guidance 2016. Defra

Email: enquiry@accon-uk.com ● www.accon-uk.com ● 0118 971 0000
Unit B, Fronds Park, Frouds Lane, Aldermaston, Reading, RG7 4LH

2. AIR POLLUTION POLICY CONTEXT

2.1. Introduction

In the UK at the present time, emissions from road transport account for a substantial proportion of national air pollutant emissions. Road transport currently contributes almost 22% of national carbon dioxide emissions[2]. Whilst the UK is set to meet its international commitments on carbon dioxide emission reductions, the transport sector carbon dioxide emissions are continuing to grow.

The number of licensed vehicles in Great Britain in 2016 was 37.1 million, an increase of 41% from 1994[3], with 83.1% of these being cars. Between 1994 and 2014, there was a substantial increase in the amount of diesel cars on the road from 7.4% to 36.2%. Of the 2,274,550 new car registrations in 2015, 51.3% of the vehicles were diesel, 45.7% were petrol with 3% used alternative fuels[4].

It is evident that continued growth in private car ownership and usage will continue to result in a further deterioration of air quality in urban areas and increasing emissions of greenhouse gases. Whilst current technological improvements extended the reduction in emissions to approximately 2010, additional measures are now required in order to prevent re-growth of emissions, both to meet ambient air quality targets in urban areas and to offer an alternative to the car for urban journeys. Consequently, where new development can be located in relatively close proximity to public transport and local services, a contribution to the UK's target of reducing emissions will have been made.

2.2. Legislation

In 1997, the United Kingdom National Air Quality Strategy (NAQS)[5] was published and this document, set out an analysis of the magnitude and potential health and environmental problems associated with air pollutant emissions, particularly those emanating from road traffic.

The strategy proposed a schedule of air quality objectives, which were to be met for various pollutants in the years up to 2005. In setting these objectives, due account was taken of health and socio-economic cost-benefit factors, together with consideration of the practical and pragmatic aspects of whether targets would be achievable. Whilst it was identified in the Strategy that the objectives for benzene, butadiene, lead and carbon monoxide could be achieved as a result of improvement measures already put in place, complying with targets for NO_2 and PM_{10} would be more difficult. In considering what additional measures would have to be introduced to counter these apparent shortfalls, the Government voiced the following thought: "*changes in planning and transport policies (are needed) which would reduce the need to travel and reliance on the car*". With regard to the necessity for encouraging a shift away from private car usage, the Strategy commented, in terms of the new package approach to transport funding, "*As a general rule, traffic demand* management *and restraint measures should be included and this, together with proposals to promote and enhance other modes of transport, should aim to achieve modal shifts away from the private car*".

[2] Environmental Protection UK. (2010 Update, Published 2017). Car Pollution. Available from www.environmental-protection.org.uk
[3] Department for Transport. (2016). Provisional Road Traffic Estimates, Great Britain: October 2015 - September 2016 Summary
[4] Society of Motor Manufacturers and Traders (2016). Car Registrations October 2016 Overview. Available from www.smmt.co.uk
[5] Defra. The National Air Quality Strategy 1997 (1997).

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The White Paper on Integrated Transport (July 1998) proposed a range of measures at both national and local level to address issues of congestion and environmental effects. During the consultation process in 1997, the environmental issue most frequently cited by responses was air quality and it is therefore clear that this problem is uppermost in the mind of the public. The implementation of measures to relieve congestion in urban areas, by means of improvements in provision of public transport and encouragement of a modal shift, will also benefit urban air quality.

A review of the UK Air Quality Strategy was undertaken in 1998 and a consultation document was published in January 1999, outlining proposals for amending the Strategy. In August 1999, in response to the consultation, the Government then published an Air Quality Strategy for England, Scotland, Wales and Northern Ireland. The Air Quality Regulations (England) 2000 enacted in April 2000, and the Air Quality (England) (Amendment) Regulations 2002 gave legal force to the air quality standards set out in the Strategy. A new strategy was released in July 2007 with various amendments to the air quality objectives. The proposals, in brief, consisted of recommendations to adopt the provisions of the EU Air Quality Daughter Directives.

Schedule 2 of the Air Quality Standards Regulations 2010[6] implements a limit value for $PM_{2.5}$ to be achieved by 2015, although they are yet to come into force and only apply to England. The Air Quality Standards (AQS) included in the Air Quality Standards Regulations 2010 are set out in **Appendix 2**.

The ‘standards’ are set as concentrations below which health effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of a particular pollutant.

The ‘objectives’ set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of the costs, benefits, feasibility and practicality of achieving the standards. The objectives are prescribed within The Air Quality (England) Regulations 2000 (Stationery Office, 2000) and The Air Quality (England) (Amendment) Regulations 2002 (Stationery Office, 2002) (termed the ‘Regulations’). Air Quality Objectives included in the Regulations and current legislation (CAFE Directive) which are relevant to the current study (NO_2 and PM_{10}) are outlined in **Appendix 2**.

The Air Quality Objectives only apply where members of the public are likely to be regularly present for the averaging time of the objective (i.e. where people will be exposed to pollutants). The annual mean objectives apply to all locations where members of the public might be regularly exposed; these include building façades of residential properties[7], schools, hospitals and care homes. The 24-hour mean objective applies to all locations where the annual mean objective would apply, together with hotels and gardens of residential properties. The 1-hour mean objective also applies at these locations as well as at any outdoor location where a member of the public might reasonably be expected to stay for 1-hour or more, such as shopping streets, parks and sports grounds, as well as bus stations and railway stations that are not fully enclosed.

Measurements across the UK have shown that the 1-hour mean NO_2 objective is unlikely to be exceeded unless the annual mean NO_2 concentration is greater than 60µg/m^3 [8]. Thus exceedances of

[6] HMSO, (2010). The Air Quality Standards Regulations 2010. Statutory Instrument 1001.
[7] Such locations should represent parts of the garden where relevant public exposure is likely, for example where there are seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied.

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60µg/m^3 as an annual mean NO_2 concentration are used as an indicator of potential exceedances of the 1-hour mean NO_2 objective.

Similarly, studies have also established a relationship between the annual mean PM_{10} concentration and number of exceedances of the 24-hour mean objective: those areas where the annual mean concentrations are greater than 32µg/m^3 were demonstrated to be at risk of exceeding the 24-hour mean objective. Thus exceedances of 32µg/m^3 as an annual mean PM_{10} concentration are used as an indicator of potential exceedances of the 24-hour mean PM_{10} objective.

2.3. Planning Policy

2.3.1. National Planning Policy Framework

The new National Planning Policy Framework (NPPF)[9] was released in March 2012 and replaced the Planning Policy Guidance which previously covered planning and pollution control and new development in England. The purpose of the planning system is to contribute to the achievement of sustainable development. There are three dimensions to sustainable development: economic, social and environmental. The environmental role is to contribute to protecting and enhancing our natural, built and historic environment; and as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate to adapt to climate change including moving to a low carbon economy.

One of the core planning principles is to contribute to conserving and enhancing the natural environment and reducing pollution. Allocations of land for development should prefer land of lesser value, where consistent with other policies in the Framework. The planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability.

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

A draft NPPF[10] was submitted in March 2018 for consultation, with an aim to supersede the March 2012 NPPF. Changes related to air quality policy are included in Paragraph 181, which states:

> *"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*

[8] Defra, 2007. Analysis of the Relationship Between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, 2003. Laxen and Mariner.
[9] Department for Communities and Local Government, National Planning Policy Framework 2012
[10] Ministry of Housing, Communities and Local Government, National Planning Policy Framework (Draft Text for Consultation) 2018

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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"

2.3.2. National Planning Practice Guidance

Whether or not 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 generate air quality impacts in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife).

When deciding whether air quality is relevant to a planning application, considerations could include whether the development would:

- Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads.
- Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.
- Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations.

Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact. It is important therefore that local planning authorities work with applicants to consider appropriate mitigation so as to ensure the new development is appropriate for its location and unacceptable risks are prevented. Planning conditions and obligations can be used to secure mitigation where the relevant tests are met.

Examples of mitigation include:

- The design and layout of development to increase separation distances from sources of air pollution;
- Using green infrastructure, in particular trees, to absorb dust and other pollutants;
- Means of ventilation;
- Promoting infrastructure to promote modes of transport with low impact on air quality;
- Controlling dust and emissions from construction, operation and demolition; and
- Contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development.

2.3.3. Cherwell District Council Local Plan

The Cherwell Local Plan[11], which incorporates the Core Strategy was adopted in July 2015 and re-adopted in December 2016. The plan sets out how the district *"will grow and change in the period*

[11] Cherwell District Council, Cherwell Local Plan, July 2015

up to 2031" and how it will *"set out the long term spatial vision for the District and contains policies to help deliver that vision"*.

The plan does not have a specific policy on air quality but discusses air quality in its policy on Protection and Enhancement of Biodiversity and the Natural Environment ESD 10), where it states, *"Air Quality assessments will also be required for development proposals that would be likely to have a significantly adverse impact on biodiversity by generating an increase in air pollution"*.

The plan also discusses air quality as a public health issue, in its policy for Building Sustainable Communities (B.2 Theme Two), where it states, *"new housing needs to be provided in such a way that it minimises environmental impact, including through the elimination and control of pollution and the effective and efficient use of natural resources".*

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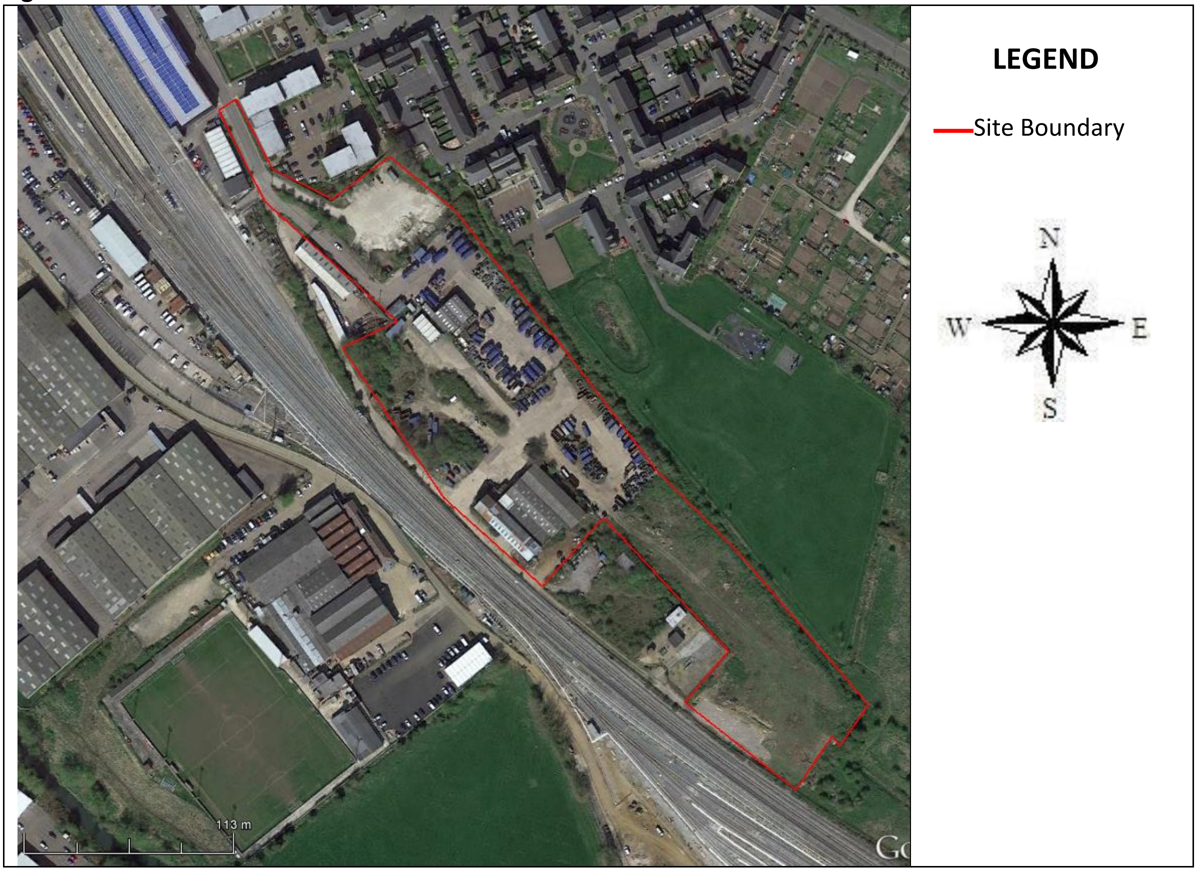
3. SITE DESCRIPTION AND BASELINE CONDITIONS

3.1. Site Description

The northern site boundary is accessed via Higham Way to the north-west and is currently occupied by a Grundon Waste Management Site. Merton Street, Middleton Road and Bridge Street are north of the site and Banbury Station and Cherwell Street are north-west. There are a significant number of existing residential properties along many of the surrounding roads.

The location and red line boundary is detailed below in **Figure 3.1**.

Figure 3.1: Site Location Plan



3.2. Air Quality Review and Assessment

As previously indicated, Local Authorities have been required to carry out a review of local air quality within their boundaries to assess areas that may fail to achieve the limit values. Where these objectives are unlikely to be achieved, local authorities must designate these areas as AQMA's and prepare a written action plan to achieve the AQS's.

The review of air quality takes on several prescribed stages, of which each stage is reported. CDC's Air Quality Annual Status Report 2017[12] provides the most recent air quality monitoring results for the District (2016). Details of the monitoring data used for model verification purposes is provided in **Section 3.3.**

[12] Cherwell District Council, 2017 Air Quality Annual Status Report

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3.3. Local Air Quality Monitoring

CDC has a large network of air quality monitoring sites. The monitoring sites chosen for verification of the air quality modelling were two diffusion tubes within 1.5 kilometres of the site, one at Cherwell Street and another at Stroud Close.

The 2016 annual mean NO_2 concentrations for the monitoring sites are shown in **Table 3.1** below. The annual mean NO_2 NAQO is not exceeded at either of the monitoring sites.

Table 3.1: Local Monitoring Data Suitable for Model Verification

Location	Distance to nearest Kerb (m)	Grid Reference		2016 Annual Mean NO_2 (µg/m^3)	2016 Data Capture (%)
		X	Y		
Cherwell Street	1	445932	240499	37.7	100
Stroud Close 1	N/A	446334	241676	28.1	100

3.4. Identification of Relevant Receptors

To assess the potential air quality constraints on the development site, sensitive receptor locations were identified at key locations on the façades of the proposed buildings (DR). As the development will contain buildings with parking undercrofts all DRs have been modelled at first floor and second floor elevations (4.5m and 7.5m respectively). Although many of the buildings contain more floors than this, it was only deemed necessary to model the first and second floors as pollutant concentrations decrease with height, therefore higher floors would have lower pollutant concentrations.

To determine if there is likely to be any impact from the development on surrounding sensitive receptors, existing receptors (ER) have been identified in the local surrounding area. These were modelled at either ground floor, first floor or basement elevations depending on the lowest floor with sensitive receptors on. The heights used in the modelling were 1.5m, 4.5m and 0m (representative of basement location) respectively. **Appendices 4** and **5** identify the DR and ER locations.

3.5. Background Concentration of Air Pollutants

Background concentrations of air pollutants for the modelling were obtained from the 2015 pollutant concentration maps which were updated by DEFRA in November 2017. These updated maps are based on monitoring and meteorological data for 2015. **Table 3.2** identifies the pollutant concentrations at the diffusion tubes and the proposed development site. The estimated background concentrations for annual mean NO_2 and PM_{10} used in the assessment are below the annual mean objective limit of 40µg/m^3 in 2016 and 2021.

Table 3.2: Background Concentrations of Pollutants

Location and Year	NO_x µg/m^3	NO_2 µg/m^3	PM_{10} µg/m^3	$PM_{2.5}$ µg/m^3
Cherwell Street (2016) (445,500, 240,500)	22.0	15.7	16.1	11.6
Stroud Close 1 (2016) (446,500, 241,500)	24.9	17.5	16.5	11.7
Site and Existing Receptors (2021) (446,500, 240,500)	19.0	13.7	15.5	11.1

Note: The ratio between PM_{10} and $PM_{2.5}$ on site in 2021 is 0.71.

4. METHODOLOGY AND ASSESSMENT CRITERIA

4.1. Methodology

In the UK, DEFRA provides guidance on the most appropriate methods to estimate pollutant concentrations for use in Local Air Quality Management (LAQM). DEFRA regularly updates its Technical Guidance, with the latest LAQM Technical Guidance (TG16) published in April 2016. The methodology in LAQM.TG16. directs air quality professionals to a number of tools published by DEFRA to predict and manage air quality. For example, it is necessary to use the updated NO_x to NO_2 calculator to derive NO_2 concentrations from the NO_x outputs from Breeze Roads modelling. This is because NO_2 concentrations within the model are predicted using the CALINE4 NO_x to NO_2 conversion methodology, which should not be used within the model as current evidence shows that the proportion of primary NO_2 in vehicle exhausts has increased since the model was developed, which would affect the relationship between NO_x and NO_2 at roadside locations.

In order to determine the extent to which air quality issues will affect the development of the site, the study has considered the following:

- Any air quality measurements carried out in the area near the proposed development; and
- The most recent Air Quality Review and Assessment Reports from Cherwell District Council.

4.2. Breeze Roads Modelling of Pollutant Concentrations

Dispersion modelling has been undertaken using Breeze Roads to determine air quality concentrations across the site. Breeze Roads is an air dispersion modelling software suite that predicts air quality impacts of carbon monoxide (CO), nitrogen dioxide, particulate matter (PM), and other inert pollutant concentrations from moving and idling motor vehicles at or alongside roadways and roadway intersections.

Breeze Roads can be used in conjunction with the MOBILE5, EMFAC emission models or other emissions data, to demonstrate compliance with the UK's National Air Quality Strategy. Breeze Roads predicts air pollutant concentrations near highways and arterial streets due to emissions from motor vehicles operating under free-flow conditions and idling vehicles. In addition, 1-hour and running 8-hour averages of CO or 24-hour and annual block averages of PM_{10} can be calculated.

4.3. Model Set-up Parameters

The most recent Emissions Factor Toolkit (EFT, version 8.0, November 2017) issued by DEFRA was used to derive emissions factors (in grams per kilometre) for vehicle movement along roads incorporated into the model. This version of the EFT includes updates to COPERT NOx and PM_{10} emissions factors for road traffic which are taken from the European Environment Agency EEA COPERT 5 emissions calculation tool, including new EURO 6 subcategories.

There have also been updates to the vehicle fleet and age information. Version 8.0 was produced by DEFRA in response to changes in 'real world' vehicle emissions. As such, it has been assumed that the EFT produces reliable emission factors which are suitable for dispersion modelling as it is the most up-to-date tool provided by DEFRA. 2016 Meteorological data from Church Lawford has been used in the modelling.

Email: enquiry@accon-uk.com ● www.accon-uk.com ● 0118 971 0000
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4.4. Local Air Quality Management Technical Guidance (2016) Recommendations

The Local Air Quality Management Technical Guidance (TG.16) has made recommendations of where the AQS should and should not be applied, as summarised in **Table 4.1**.

As it is not always possible to be prescriptive in this matter, Local Authorities may apply local knowledge and judgement when considering the application of the AQS. The examples given in **Table 4.1** are not intended to be a comprehensive list.

Table 4.1: Examples of Where AQS Should Be Applied

Averaging Period	AQS Should Apply	AQS Should Not Apply
Annual Mean	All locations where members of the public might be regularly exposed. Building facades of: • Residential properties • Schools • Hospitals • Care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. • Hotels, unless people live there as their permanent residence. • Residential gardens • Kerbside sites or any other location where public exposure is expected to be short term.
24-hour and 8-hour mean	All locations where the annual mean objective would apply. • Hotels • Residential gardens	Kerbside sites or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives apply. • Kerbside sites (e.g. pavements of busy shopping streets) • Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might spend one hour or more. • Any outdoor locations where members of the public might spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-min mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	

4.5. Applying the AQS to this Development

As this planning application includes residential properties the AQS calendar year limit value will apply to these properties. The 24-hour and 1-hour mean objectives will also be considered.

4.6. Assessment Criteria

A detailed assessment was considered appropriate for this proposed development with model results being verified against local monitoring data. This was carried out using the detailed dispersion model Breeze Roads.

For the purposes of this assessment, the limit values assigned to individual pollutants as set out in the Air Quality Standards Regulations 2010 form the basis of the air quality assessment. The limit

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values are based on an assessment of the effects of each pollutant on public health. Therefore, they are a good indicator in assessing whether, under normal circumstances, the air quality in the vicinity of a development is likely to be detrimental to human health.

4.7. Operation Phase

The main pollutants of concern are generally considered to be NO_2 and PM_{10} for road traffic. The Breeze Roads methodology has been used for this assessment to predict the constraints on development and also to predict the impacts of any additional traffic generated from the development on surrounding sensitive receptors.

For the assessment, the following scenarios were considered:

- 2016 Model Verification;
- 2021 Opening Year Without Development; and
- 2021 Opening Year With Development.

4.8. Traffic Data

The Breeze Roads prediction model requires the user to provide various input data, including the Annual Average Hourly Traffic (AAHT) flow, the number of heavy duty vehicles (HDVs), the distance of the road centreline from the receptors and vehicle speeds.

The traffic information is detailed in **Table 4.2** and **Table 4.3** below for the verification and assessment scenarios. For the verification scenario traffic flow and vehicle split data were obtained from the Department for Transport (DfT). Vehicle speeds were estimated based on local speed limits and traffic conditions and were reduced near junctions and crossings to replicate queuing traffic.

The DfT currently provides traffic data for 2016.

Table 4.2: 2016 Traffic Flow Data for Verification

Monitoring Site	Road Section	AAHT	Speed (km/h)	HDV%
Cherwell Street	Cherwell Street, junction with Lower Cherwell Street	763	20	4.4
	Cherwell Street, Between junctions with Lower Cherwell Street and George Street	763	25	4.4
	Cherwell Street, junction with George Street	763	12	4.4
Stroud Close 1	Hennef Way, approach of junction with A4260	1,809	22	4.1
	Hennef Way freeflowing	1,809	80	4.1
	Hennef Way, junction with Ermont Way and Wildmere Way	1,809	15	4.1

Note: This is a non-exhaustive summary of the road sections modelled and includes the sections that are likely to contribute the greatest emissions to the development receptors.

Table 4.3 identifies the estimated 2021 AAHT traffic flows for roads near to the proposed development (for use in the constraints and impacts modelling). 2015 traffic flows were obtained

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from a transport assessment[13] of the Grundon Waste Management Site and surrounding roads. These traffic flows were in AM and PM peak hour format so were converted to AADT (then subsequently AAHT) by multiplying their mean value by a factor of 12. They were then scaled to 2020 flows using a Cherwell specific traffic growth factor of 1.14, obtained from Tempro. The traffic flows for the without development scenario included all currently measured traffic flows plus additional flow expected from other nearby proposed developments. The with development scenario included additional flows predicted from this proposed development as well. As the transport assessment did not include traffic split data, HDV% was approximated based on nearby DfT data and on the types of building use surrounding the roads.

Table 4.3: 2021 Opening Year Traffic Flow Data

Model scenarios	Road Section	AAHT	Speed (km/h)	HDV (%)
Opening Year Without Development	Concorde Avenue	1,475	48	4.4
	Concorde Avenue and Cherwell Street, junction with Bridge Street	1,700	12	4.4
	Cherwell Street, southern section	2,003	25	4.4
	Bridge Street, west of Concorde Avenue and Cherwell Street	262	40	3.0
	Bridge Street junction with Cherwell Street	788	15	3.0
	Bridge Street between Cherwell Street and Station access Road	1,238	30	3.0
	Bridge Street, junctions with Merton Street and Waterloo Drive	862	18	3.0
	Waterloo Drive, junction with Bridge Street and Middleton Road	160	25	1.0
	Middleton Road, between Waterloo Drive and Duke Street	734	25	3.0
	Middleton Road, junction with Duke Street	734	18	3.0
	Merton Street, junction with Bridge Street	379	20	2.0
	Merton Street, junction with Higham Way	379	25	2.0
	Merton Street, eastern section	168	30	2.0
	Higham Way, junction with Merton Street	188	30	3.0
	Higham Way, southern section	188	48	3.0
Opening Year With	Concorde Avenue	1,483	48	4.4

[13] Grontmij (part of Sweco), Transport Assessment – Grundon Waste Management Depot, 2015

Model scenarios	Road Section	AAHT	Speed (km/h)	HDV (%)
Development	Concorde Avenue and Cherwell Street, junction with Bridge Street	1,715	12	4.4
	Cherwell Street, southern section	2,022	25	4.4
	Bridge Street, west of Concorde Avenue and Cherwell Street	287	40	3.0
	Bridge Street junction with Cherwell Street	826	15	3.0
	Bridge Street between Cherwell Street and Station access Road	1,290	30	3.0
	Bridge Street, junctions with Merton Street and Waterloo Drive	883	18	3.0
	Waterloo Drive, junction with Bridge Street and Middleton Road	161	25	1.0
	Middleton Road, between Waterloo Drive and Duke Street	741	25	3.0
	Middleton Road, junction with Duke Street	741	18	3.0
	Merton Street, junction with Bridge Street	417	20	2.0
	Merton Street, junction with Higham Way	417	25	2.0
	Merton Street, eastern section	170	30	2.0
	Higham Way, junction with Merton Street	227	30	1.0
	Higham Way, southern section	227	48	1.0
	Development Primary Road	39	40	1.0

Note: This is a non-exhaustive summary of the road sections modelled and includes the sections that are most likely to contribute the greatest emissions of pollutants to the development receptors. Also note (orange) that the HDV% on Higham Way has been reduced with the development in place, as the Grundon Waste management site will no longer be present.

4.9. Validation and Verification of the Model

Model validation undertaken by the software developer will not have been carried out in the vicinity of the site being considered in this assessment. As a result, it is necessary to perform a comparison of the modelled results with local monitoring data at suitable locations. This verification process aims to minimise model uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results. The verification was carried out in accordance with LAQM.TG16. Suitable monitoring data for the purpose of verification is available for concentrations of NO_2 and PM_{10} at the monitoring positions detailed in **Section 3.3**.

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The verification exercise resulted in an average difference for the NO_x contribution between the modelled and monitored NO_x roads of -73.09, which indicates that the model is significantly under predicting. When the monitored and modelled results are compared as recommended in LAQM.TG16 the road NO_X adjustment factor is **3.779** (as identified in **Table 4.4**). This factor was applied to all modelled NO_x results prior to calculating modelled NO_2 using the NO_x to NO_2 calculator. In the absence of appropriate PM_{10} monitoring within close proximity to the site, the NO_x adjustment factor has also been applied to the PM_{10} modelled concentrations, in accordance with the guidance provided in LAQM.TG16.

Table 4.4: NO_2 Annual Mean Verification for 2016

Monitoring Position	Monitored		Modelled		% Difference (NO_2 Total) Before Adjustment	% Difference (NO_2 Total) After Adjustment	Road NO_X Factor
	Road NO_2 µg/m³	Road NO_X[14] µg/m³	Road NO_2 µg/m³	Road NO_X µg/m³			
Cherwell Street	22.0	45.4	7.2	13.8	-39.3	7.9	3.779
Stroud Close 1	10.6	20.9	2.6	4.9	-28.7	-4.1	

Typically, with smaller datasets the root mean square error (RMSE) is the important statistic and the verification process resulted in an RMSE close to the ideal value of 0 µg/m³. Therefore, there is a high level of confidence in the verification process.

Table 4.5: Summary of the Statistics Used to Assess Model Uncertainty

Statistical Parameter	Value	Description
Correlation Coefficient	1.000	Used to measure the linear relationship between predicted and observed data. The ideal value (an absolute relationship) is 1.
Root Mean Square Error (RMSE)	2.3	RMSE defines the average error/uncertainty of the model verification and is in the same units as the model outputs (µg/m³). Values should be <10µg/m³ or ideally <4µg/m³ where concentrations are near the AQO. The ideal value is 0µg/m³.
Fractional Bias	0.0	Identifies if the model shows a systematic tendency to over/under predict concentrations. The ideal value is 0 and range between +/- 2. Negative values suggest an over prediction whilst positive values suggest under prediction.

4.10. Assessment of $PM_{2.5}$

The 2007 Air Quality Strategy introduced a new exposure reduction regime for $PM_{2.5}$, tiny particles associated with respiratory and cardio-vascular illness and mortality which have no known safe limit for human exposure. The new regime will attempt to reduce the exposure of all urban dwellers, alongside the existing method of reducing hotspots of PM exposure. $PM_{2.5}$ typically makes up two thirds of PM_{10} emissions and concentrations. However, objectives for $PM_{2.5}$ (as shown in **Table 4.6**) are not currently incorporated into Local Air Quality Management regulations, therefore there is no statutory obligation to review and assess air quality against them.

[14] Obtained from NO_X to NO_2 Calculator Spreadsheet available from www.laqm.Defra.gov.uk

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Table 4.6: National Exposure Reduction Target, Target Value and Limit Value for $PM_{2.5}$

Time Period	Objective/Obligation	To be achieved by
Annual mean	Target value of 25µg/m^3	2010
Annual mean	Limit value of 25µg/m^3	2015
Annual mean	Stage 2 indicative limit value of 20µg/m^3	2020
3 year Average Exposure Indicator (AEI)[a]	Exposure reduction target relative to the AEI depending on the 2010 value of the 3 year AEI (ranging from a 0% to a 20% reduction)	2020
3 year Average Exposure Indicator (AEI)[a]	Exposure concentration obligation of 20µg/m^3 (of vegetation)	2015

[a] The 3 year running mean of AEI is calculated from the $PM_{2.5}$ concentration averaged across all urban background monitoring locations in the UK e.g. the AEI for 2010 is the mean concentration measured over 2008, 2009 and 2010.

Presently, Breeze Roads does not predict the concentration of $PM_{2.5}$ as part of the methodology therefore the future concentration of $PM_{2.5}$ will be calculated using the typical ratio between the background concentrations of PM_{10} and $PM_{2.5}$ for the opening year of development. This predicted concentration will then be compared against the annual mean Objective Limit value of 25µg/m^3.

5. IMPACTS AND CONSTRAINTS OF AIR QUALITY

5.1. Air Quality Impact of Development Traffic - Acceptability Criteria

It is common in the UK to use the Environmental Protection UK's (EPUK) Guidance[15] on Air Quality Assessments for Planning Applications to assess the impact of a development. This advises that an air quality assessment will be required where the development is anticipated to give rise to significant changes in air quality. There will also be a need to assess air quality implications of a development where a significant change in relevant exposure is anticipated. A full air quality assessment should normally be undertaken where proposals give rise to significant changes in either volumes, typically a change in annual average daily traffic (AADT) or peak traffic flows of +/-5% or +/-10%, depending on local circumstances, or in vehicle speed (or both), usually on a road with more than 10,000 AADT (5,000 if narrow and congested). It also advises of the need for an assessment where the proposals will:

- Generate or increase congestion;
- Alter the traffic composition on local roads;
- Include significant new car parking;
- Significantly affect nitrogen deposition on sensitive habitats;
- Introduce new exposure close to existing sources of air pollutants;
- Include biomass boilers or biomass-fuelled CHP plant;
- Include centralised boilers of CHP;
- Give rise to potentially significant impacts during construction; or
- Include a large, long-term construction site.

5.2. Air Quality Impacts

In January 2017, Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) updated their guidance on "Land-Use Planning and Development Control: Planning for Air Quality". The guidance provides a methodology for determining the impacts of increased pollutant concentrations at sensitive receptor locations resulting from emission sources such as the generation of traffic from development sites.

To characterise the impacts of the proposed development on local air quality, predictions of air pollutant concentrations have been made for an operational year of 2021 using the Breeze Roads dispersion model.

[15] Environmental Protection UK and IAQM (2017) – Land-Use Planning and Development Control: Planning for Air Quality

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Table 5.1: Impacts of Pollutant Concentrations as a result of the Development

Long Term Average Concentration in Assessment Year	% Change in Concentration relative to the Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial
The AQAL is the Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level'				

5.3. Air Quality Impact of Development Traffic - Assessment

The proposed development will include approximately 200 residential dwellings. The transport consultants have modelled an additional 929 AADT vehicles attributed to this on the proposed development's primary road and Higham Way with a smaller percentage of this on the other surrounding roads. Sensitive receptors were modelled at the façades of existing properties on Bridge Street, Middleton Road, Merton Street and Higham Way (as shown in **Appendix 4**) and the modelled predicted NO_2 and particulate matter at these existing receptors can found in **Tables 5.2 & 5.4**.

5.4. Predicted Constraints on Development

In order to characterise the air quality at the proposed development, predictions of air pollutant concentrations have been carried out for an occupation year of 2021 using the Breeze Roads dispersion model and UK emission factors. The results of the predictions which include the road NO_X adjustment factor (**Table 4.4**) can be seen in **Tables 5.3** and **5.5**.

5.5. 2021 Pollutant Concentrations

5.5.1. 2021 Annual Mean NO_2 Concentrations

Table 5.2 identifies the modelled NO_2 concentrations in 2021 both with the development completed and fully occupied and without the development. The greatest change in pollutant concentrations is 0.6µg/m^3 at ER15, and the pollutant concentrations will remain below the AQO, therefore the impact is negligible.

Table 5.2: Modelled 2021 NO_2 Concentrations – Existing Receptors

Receptor	Floor	Air Quality Objective (µg/m^3)	Without Development Total NO_2 (µg/m^3)	With Development Total NO_2 (µg/m^3)	Change in Concentration	Impact Descriptor
ER1	First	40	32.5	32.9	0.4	Negligible
ER2	First	40	24.9	25.2	0.3	Negligible
ER3	First	40	36.4	36.8	0.4	Negligible
ER4	First	40	31.0	31.4	0.4	Negligible
ER5	Ground	40	27.3	27.6	0.3	Negligible

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Receptor	Floor	Air Quality Objective (μg/m³)	Without Development Total NO_2 (μg/m³)	With Development Total NO_2 (μg/m³)	Change in Concentration	Impact Descriptor
ER6	Ground	40	27.0	27.3	0.3	Negligible
ER7	Ground	40	21.2	21.5	0.3	Negligible
ER8	First	40	22.4	22.6	0.2	Negligible
ER9	First	40	23.1	23.4	0.3	Negligible
ER10	First	40	24.5	24.8	0.3	Negligible
ER11	Ground	40	29.4	29.8	0.4	Negligible
ER12	Ground	40	21.9	22.0	0.1	Negligible
ER13	First	40	21.0	21.4	0.4	Negligible
ER14	Ground	40	21.5	22.0	0.5	Negligible
ER15	Basement	40	21.0	21.6	0.6	Negligible
ER16	Ground	40	18.6	19.0	0.4	Negligible
ER17	Ground	40	18.1	18.4	0.3	Negligible

5.5.2. NO_2 1-hour Exposure Assessment

According to guidance, there is only a risk that the NO_2 1-hour objective (200μg/m³) could be exceeded at local sensitive receptors if the annual mean NO_2 concentration is greater than 60μg/m³. At the existing receptors, the worst case annual mean predicted concentration is 36.8μg/m³ (ER3) – therefore hourly exceedances would not be expected.

Table 5.3 outlines the modelled NO_2 concentrations in 2021. Annual mean NO_2 concentrations range from 14.1μg/m³ at DR16 to 14.7μg/m³ at DR1 and DR9. There are not predicted to be any exceedances of the AQO in 2021 on the proposed development site.

Table 5.3: Modelled 2021 NO_2 Concentrations – Development Receptors

Receptor	Floor	Air Quality Objective (μg/m³)	NO_2 Road Contribution (μg/m³)	Total NO_2 (μg/m³)
DR1	First	40	1.0	14.7
DR2		40	0.9	14.6
DR3		40	0.8	14.5
DR4		40	0.6	14.3
DR5		40	0.6	14.3
DR6		40	0.7	14.4
DR7		40	0.6	14.3
DR8		40	0.5	14.2

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Receptor	Floor	Air Quality Objective (µg/m³)	NO_2 Road Contribution (µg/m³)	Total NO_2 (µg/m³)
DR9	Second	40	1.0	14.7
DR10		40	0.8	14.5
DR11		40	0.7	14.4
DR12		40	0.6	14.3
DR13		40	0.6	14.3
DR14		40	0.5	14.3
DR15		40	0.5	14.2
DR16		40	0.4	14.1

5.5.3. Air Quality Constraints - NO_2 1-hour Exposure Assessment

According to guidance, there is only a risk that the NO_2 1-hour objective (200µg/m³) could be exceeded on the development site if the annual mean NO_2 concentration is greater than 60µg/m³. At the development site, the worst case annual mean predicted concentration is 14.7µg/m³ (DR1 & DR9). Therefore, hourly exceedances would not be expected.

5.5.4. 2020 Annual Mean Particulate Matter Concentrations

Table 5.4 identifies the modelled PM_{10} and $PM_{2.5}$ concentrations in 2021 both with and without the development completed and fully occupied. The highest predicted annual mean PM_{10} concentration without the development is 19.2µg/m³ (ER3) and with the development is 19.4µg/m³ (ER3). The highest predicted annual mean $PM_{2.5}$ concentration without the development is 13.7µg/m³ (ER3) and with the development is 13.8µg/m³ (ER3). The highest change in PM_{10} concentration is 0.1µg/m³**.**

Table 5.4: Modelled 2021 PM_{10} and $PM_{2.5}$ Concentrations – Existing Receptors

Receptor	Total PM_{10} Without Development µg/m³ (Days >50 µg/m³)	Total PM_{10} With Development µg/m³ (Days >50 µg/m³) [16]	Change in PM_{10}	Total $PM_{2.5}$ Without Development µg/m³	Total $PM_{2.5}$ With Development µg/m³	Change in $PM_{2.5}$
ER1	18.4 (2)	18.4 (2)	0.0	13.1	13.2	0.1
ER2	17.2 (1)	17.3 (1)	0.1	12.3	12.3	0.0
ER3	19.2 (3)	19.4 (3)	0.3	13.7	13.8	0.1
ER4	18.6 (2)	18.7 (2)	0.1	13.3	13.4	0.1
ER5	17.8 (1)	17.8 (1)	0.0	12.7	12.7	0.0
ER6	17.7 (1)	17.8 (1)	0.1	12.6	12.7	0.1
ER7	16.7 (1)	16.8 (1)	0.1	12.0	12.0	0.0

[16] Not to be exceeded more than 35 times a year.

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ER8	16.9 (1)	17.0 (1)	0.1	12.1	12.1	0.0
ER9	17.0 (1)	17.1 (1)	0.1	12.2	12.2	0.0
ER10	17.3 (1)	17.3 (1)	0.0	12.4	12.4	0.0
ER11	18.1 (1)	18.2 (2)	0.1	12.9	13.0	0.1
ER12	16.9 (1)	16.9 (1)	0.0	12.0	12.1	0.1
ER13	16.7 (1)	16.8 (1)	0.1	12.0	12.0	0.0
ER14	16.9 (1)	17.0 (1)	0.1	12.0	12.1	0.1
ER15	16.8 (1)	16.9 (1)	0.1	12.0	12.1	0.1
ER16	16.4 (0)	16.4 (0)	0.0	11.7	11.7	0.0
ER17	16.4 (0)	16.4 (0)	0.0	11.7	11.7	0.0

5.5.5. Air Quality Constraints – 2020 Annual Mean Particulate Matter Concentrations

Table 5.5 outlines the modelled PM_{10} concentrations in 2021. Modelled PM_{10} concentrations range from 15.6µg/m^3 at multiple receptors to 15.7µg/m^3 at multiple receptors.

Modelled $PM_{2.5}$ concentrations are 11.2µg/m^3 at all receptors.

Table 5.5: Modelled 2021 PM_{10} and $PM_{2.5}$ Concentrations – Development Receptors

Receptor	Floor	PM_{10} Air Quality Objective (µg/m^3)	Total PM_{10} µg/m^3 (Days >50 µg/m^3) [17]	$PM_{2.5}$ Air Quality Objective (µg/m^3)	Total $PM_{2.5}$ µg/m^3
DR1	First	40	15.7 (0)	25	11.2
DR2		40	15.7 (0)	25	11.2
DR3		40	15.7 (0)	25	11.2
DR4		40	15.6 (0)	25	11.2
DR5		40	15.6 (0)	25	11.2
DR6		40	15.6 (0)	25	11.2
DR7		40	15.6 (0)	25	11.2
DR8		40	15.6 (0)	25	11.2
DR9	Second	40	15.7 (0)	25	11.2
DR10		40	15.7 (0)	25	11.2
DR11		40	15.6 (0)	25	11.2
DR12		40	15.6 (0)	25	11.2
DR13		40	15.6 (0)	25	11.2
DR14		40	15.6 (0)	25	11.2

[17] Not to be exceeded more than 35 times a year.

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DR15		40	15.6 (0)	25	11.2
DR16		40	15.6 (0)	25	11.2

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6. MITIGATION

6.1. Operation Phase

As identified by the constraints assessment, there are no exceedances of the NAQO's for NO_2, PM_{10} or $PM_{2.5}$ at any of the proposed development receptors for the projected completion year of 2021. The highest modelled NO_2 concentration and PM_{10} concentration at sensitive development receptors are 14.7µg/m^3 and 15.7µg/m^3 respectively which are significantly below the annual mean NO_2 and PM_{10} objective values of 40µg/m^3.

Therefore, it is not deemed necessary to include any mitigation measures for the proposed development.

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7. RESIDUAL EFFECTS

7.1. Operation Impacts on Local Air Quality

As identified by the impact assessment, there are no exceedances of the NAQO's for NO_2, PM_{10} or $PM_{2.5}$ at any of the existing sensitive receptors.

The highest expected increase in NO_2 concentrations at an existing receptor with the development in place is 0.6µg/m^3, which results in an NO_2 pollutant concentration of 21.6µg/m^3 (ER15).

The highest expected increase in PM_{10} concentrations at an existing receptor with the development in place is 0.3µg/m^3 which results in a PM_{10} pollutant concentration of 19.4µg/m^3 (ER3).

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8. CONCLUSIONS

During the operation phase, the Breeze Roads modelling predicts that there will be no exceedances of the nitrogen dioxide or particulate matter objectives at the sensitive development receptors on the proposed development site.

The modelling also predicts that there will be negligible increases in nitrogen dioxide and particulate matter at existing sensitive receptors as a result of the proposed development and that pollutant concentrations will remain significantly below the air quality objective levels. Therefore, no mitigation is required.

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APPENDICES

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Appendix 1: Glossary of Terms

AADT	Annual Average Daily Traffic
AAHT	Annual Average Hourly Traffic
AQMA	Air Quality Management Area -An area that a local authority has designated for action, based upon predicted exceedances of Air Quality Objectives.
AQS/ NAQOs	Air Quality Standard/ National Air Quality Objectives - The concentrations of pollutants in the atmosphere, which can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive sub groups.
AURN	Automatic Urban and Rural Network Air Quality Monitoring Site.
Calendar Year	The average of the concentrations measured for each pollutant for one year. In the case of the AQS this is for a calendar year.
Concentration	The amount of a (polluting) substance in a volume (of air), typically expressed as a mass of pollutant per unit volume of air (for example, micrograms per cubic metre, $\mu g/m^3$) or a volume of gaseous pollutant per unit volume of air (parts per million, ppm).
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emissions Factor Toolkit
Exceedance	A period of time where the concentration of a pollutant is greater than the appropriate Air Quality Objective.
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicle
LAQM	Local Air Quality Management
Nitrogen Oxides	Nitric oxide (NO) is mainly derived from road transport emissions and other combustion processes such as the electricity supply industry. NO is not considered to be harmful to health. However, once released to the atmosphere, NO is usually very rapidly oxidised to nitrogen dioxide (NO_2), which is harmful to health. NO_2 and NO are both oxides of nitrogen and together are referred to as nitrogen oxides (NO_x).
PM_{10}/$PM_{2.5}$	Fine Particles are composed of a wide range of materials arising from a variety of sources including combustion sources (mainly road traffic), and coarse particles, suspended soils and dust from construction work. Particles are measured in a number of different size fractions according to their mean aerodynamic diameter. Most monitoring is currently focused on PM_{10} (less than 10 microns in aero-dynamic diameter), but the finer fractions such as $PM_{2.5}$ (less than 2.5 microns in aero-dynamic diameter) is becoming of increasing interest in terms of health effects.
$\mu g/m^3$	Micrograms per cubic metre of air - A measure of concentration in terms of mass per unit volume. A concentration of $1\mu g/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollution.

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Appendix 2: Air Quality Standards

Pollutant	Averaging Period	Limit Value	Margin of Tolerance
Benzene	Calendar Year	5µg/m^3	
Carbon Monoxide	Maximum daily running 8 Hour Mean	10mg/m^3	
Lead	Calendar Year	0.5µg/m^3	100%
Nitrogen Dioxide	One Hour	200µg/m^3 Not to be exceeded more than 18 times per year	
	Calendar Year	40µg/m^3	
Particulates (PM_{10})	One day	50µg/m^3 Not to be exceeded more than 35 times per year	50%
	Calendar Year	40µg/m^3	20%
Particulates ($PM_{2.5}$)	Calendar Year	25µg/m^3	20%
Sulphur Dioxide	One Hour	350µg/m^3 Not to be exceeded more than 24 times per calendar year	150µg/m^3
	One Day	150µg/m^3 Not to be exceeded more than 3 times per calendar year	

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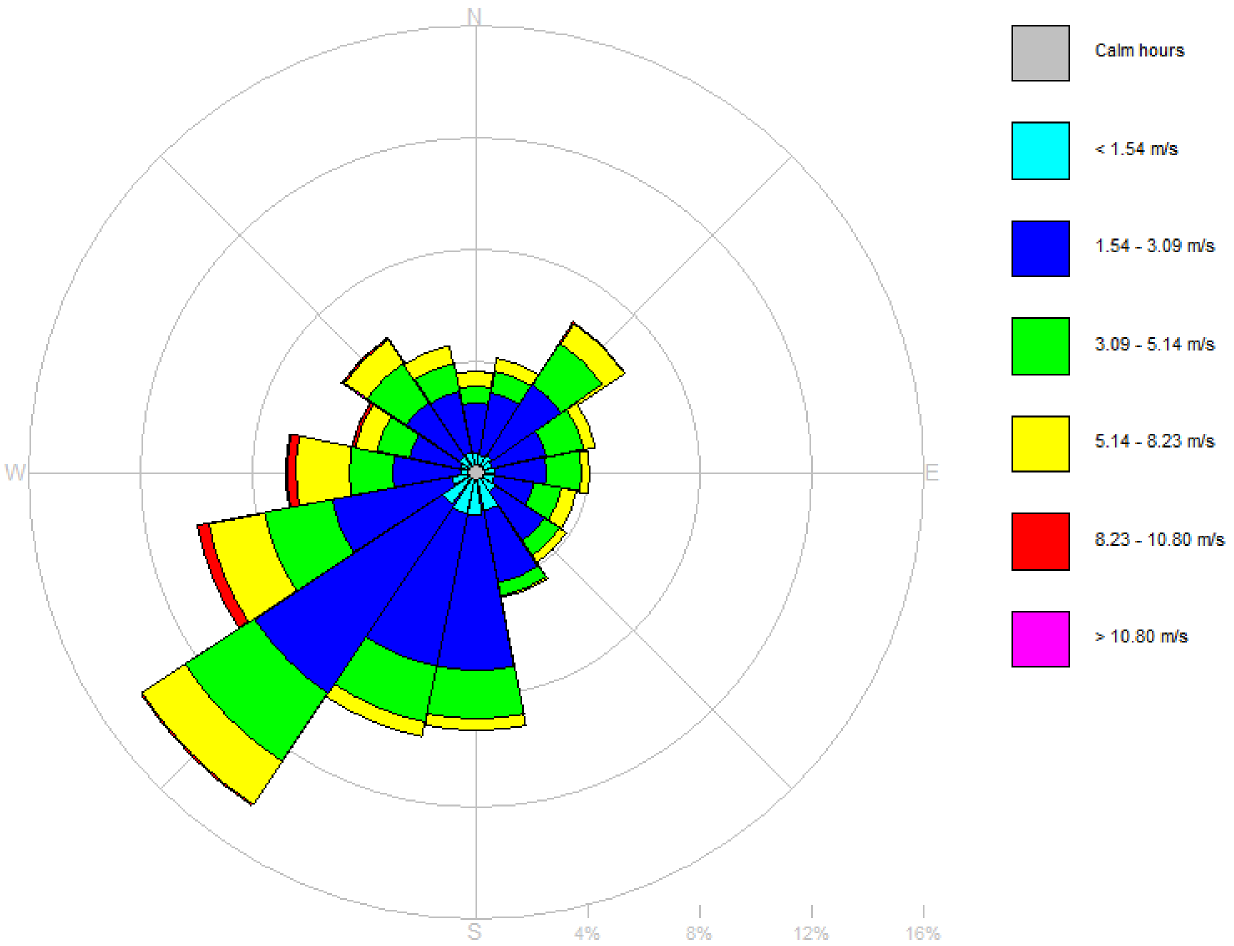
Appendix 3: 2016 Church Lawford Wind Rose



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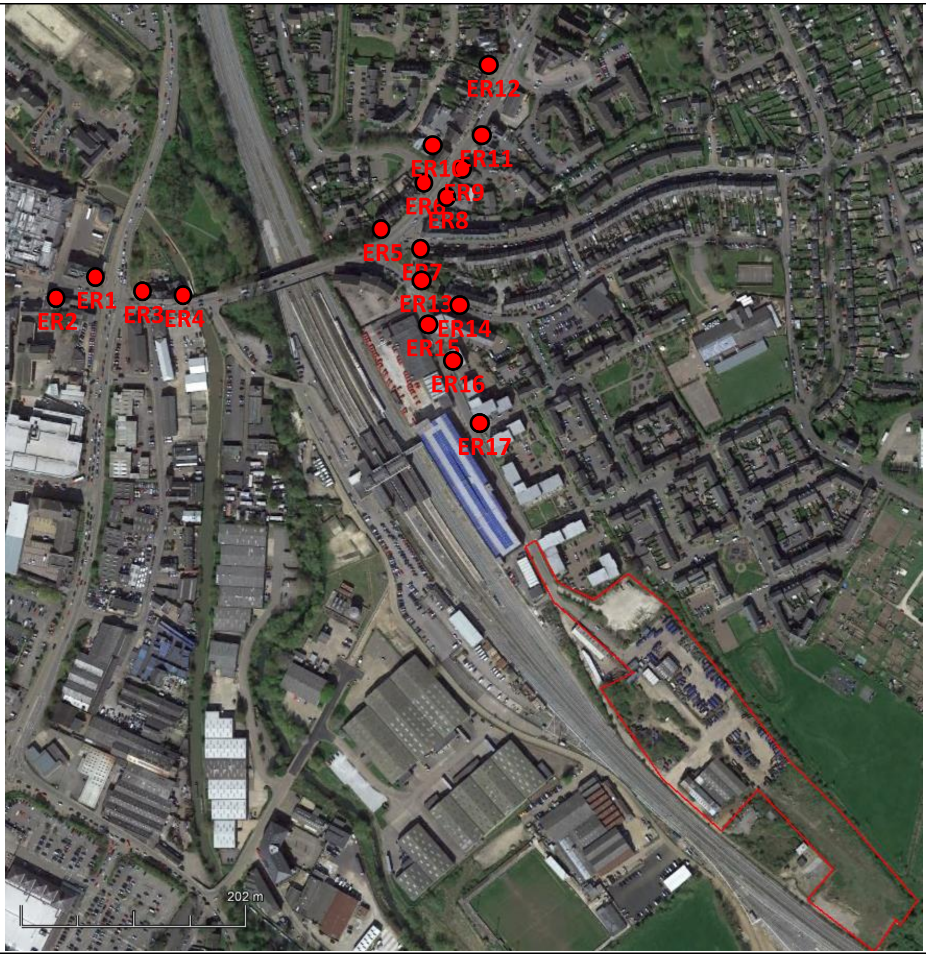
Appendix 4: Proposed Development Nearby Existing Receptor Locations



LEGEND

- Existing Receptor Location
- ER1 Existing Receptor Number
- Site Boundary

Client: JSA Planning Limited		Proposed Development Nearby Existing Receptors	Design:	TW	15.06.2018
			Drawn:	TW	15.06.2018
Rev: A	Description: FINAL	Rev: A	Checked:	GP	18.06.2018
			Approved:	GP	18.06.2018

Appendix 4

Scale: On Map

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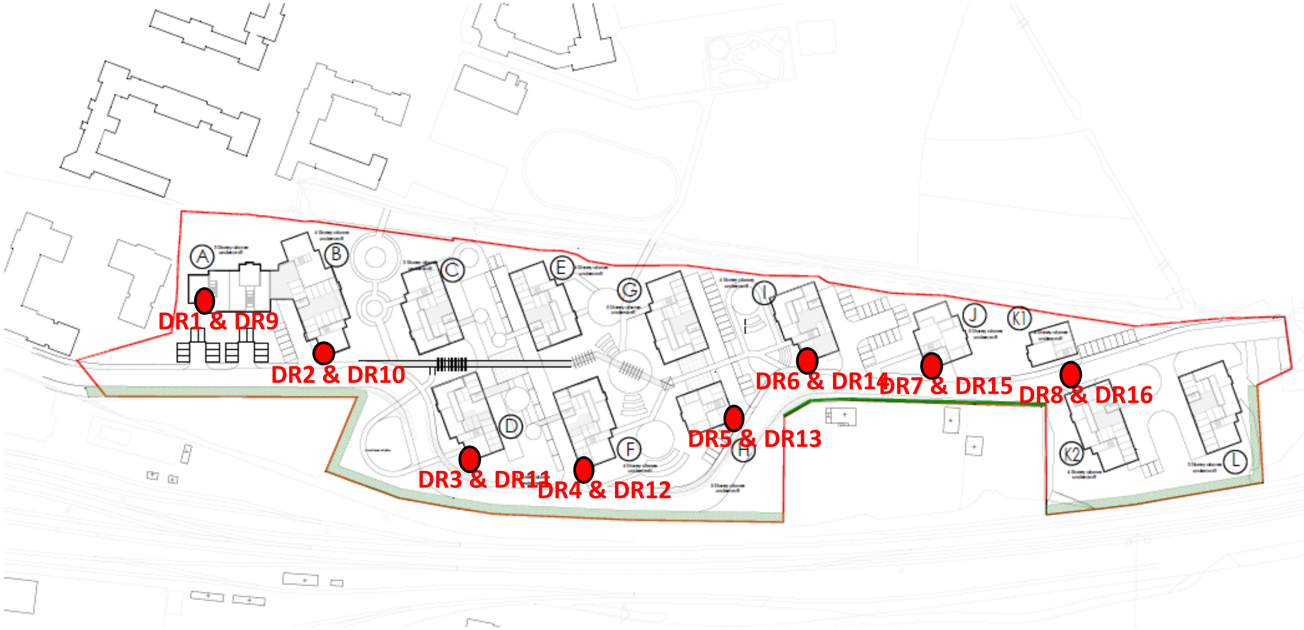
Appendix 5: Proposed Development Receptor Locations



Proposed Site Plan

LEGEND

- Development Receptor Location
- DR1 — Development Receptor Number
- Site Boundary

Client: JSA Planning Limited	Description: Proposed Development Receptors	Design:	TW	31.08.2018	accon UK ENVIRONMENTAL CONSULTANTS
		Drawn:	TW	31.08.2018	
Rev: A / Description: FINAL	Rev: A	Checked:	CP	31.08.2018	*Appendix 5*
		Approved:	GP	31.08.2018	Scale: 1:500

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Unit B, Fronds Park, Frouds Lane, Aldermaston, Reading, RG7 4LH

Email: enquiry@accon-uk.com

Reading Office:
Unit B, Fronds Park,
Frouds Lane, Aldermaston,
Reading, RG7 4LH
Tel: 0118 971 0000   Fax: 0118 971 2272

Brighton Office:
Citibase, 95 Ditchling Road,
Brighton, East Sussex, BN1 4ST
Tel: 01273 573 814

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