BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

ENVIRONMENT

Barratt Homes & David Wilson Homes

Land South of Halifax Road, Penistone

Air Quality Assessment

LDP2246

Barratt Homes & David Wilson Homes

Land South of Halifax Road, Penistone

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Notice

EXECUTIVE SUMMARY

BWB Consulting was appointed by the client to undertake an air quality assessment for a proposed residential development at land south of Halifax Road, Penistone.

The proposed development Site is located within the administrative area of Barnsley Metropolitan Borough Council. The proposed development Site is not located within, or in the vicinity of an existing Air Quality Management Area.

A qualitative construction phase dust assessment was undertaken in accordance with Institute of Air Quality Management guidance and measures were recommended for inclusion in a Dust Management Plan to minimise emissions during construction activities. With the implementation of these mitigation measures the impact of construction phase dust emissions was considered to be 'not significant' in accordance with IAQM guidance.

A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified existing receptor locations. Road traffic emissions were modelled using the dispersion model ADMS-Roads and concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) were predicted at identified sensitive receptor locations. The modelling assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance. The development was not predicted to result in any new exceedances of the relevant air quality objectives and the impact of the development on local air quality was predicted to be 'negligible' in accordance with IAQM and EPUK guidance.

Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were also predicted across the proposed development Site and the suitability of the Site for the proposed residential use considered with regard to air quality. Pollutant concentrations were predicted to be below the relevant air quality objectives and the Site was therefore considered suitable for the proposed use.

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1. INTRODUCTION

Appointment & Background

1.1 BWB Consulting was appointed the client to undertake an air quality assessment for a proposed residential development at land south of Halifax Road in Penistone ('the Site').

1.2 The assessment considers construction phase dust impacts and operational phase road traffic emissions. A qualitative construction phase dust assessment was undertaken in accordance with relevant guidance. A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified receptor locations. In addition, pollutant concentrations were predicted across the proposed development Site.

1.3 This report is necessarily technical in nature, so to assist the reader, a glossary of air quality terminology can be found in **Appendix A.**

Site Setting

1.4 The Site is located to the south of Halifax Road and west of Well House Lane and is located within the administrative area of Barnsley Metropolitan Borough Council (BMBC). **Figure 1.1** details the location of the proposed development. The Site currently comprises open land.

1.5 The Site is bounded to the north by Halifax Road with open land beyond. To the east of the Site is open land and a railway line. To the south east of the Site is Well House Lane and existing residential dwellings. To the south is a wooded area with existing residential dwellings and the A628 Barnsley Road beyond and to the west is open land and a wooded area with residential dwellings and the B6462 Huddersfield Road beyond.

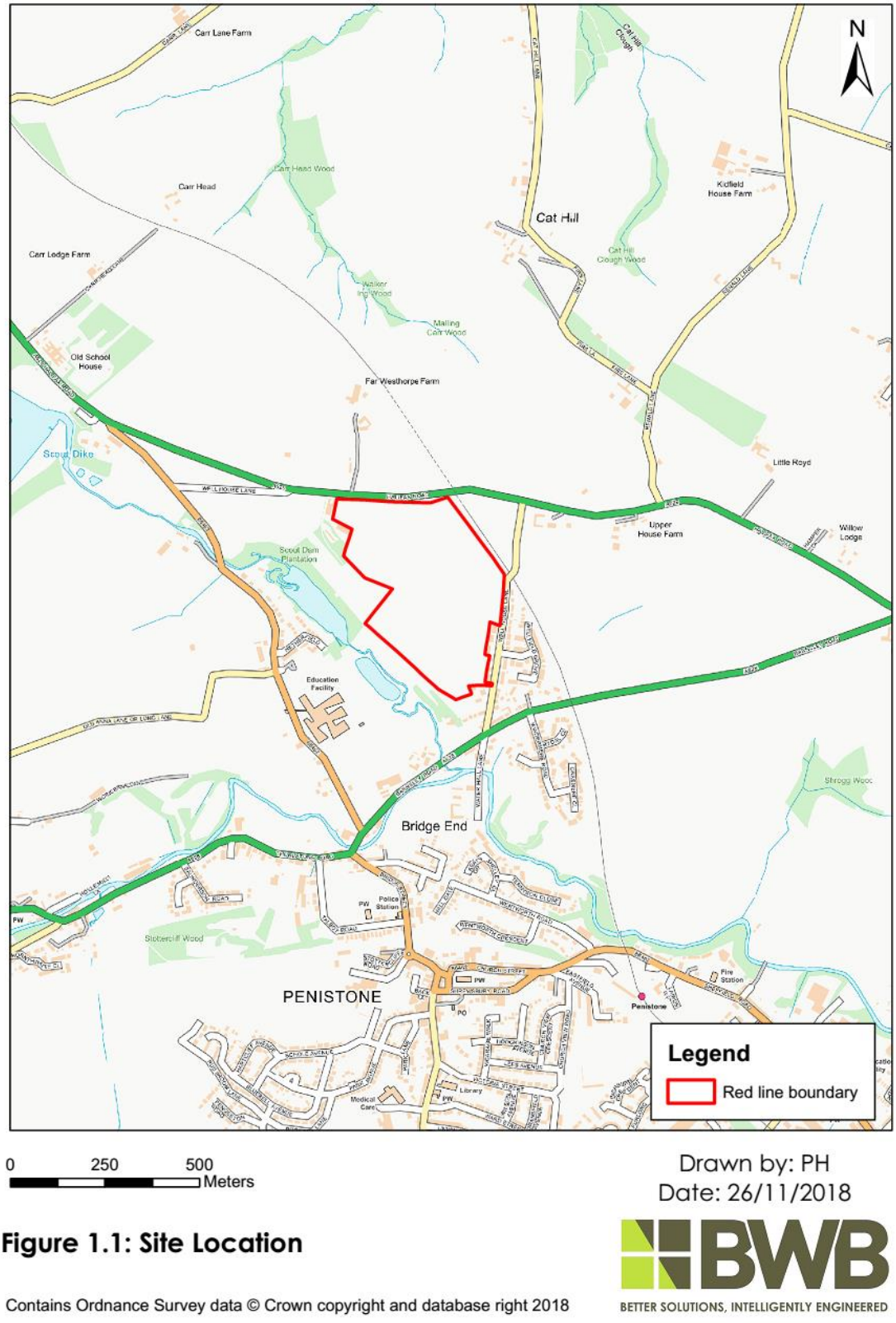
1.6 Principal air pollution sources in the vicinity of the development are likely to comprise road traffic emissions from the existing road network.

Proposed Development

1.7 The proposed development comprises 459 residential dwellings, associated highways and access works and landscaping.

1.8 The proposed development masterplan is detailed in **Appendix B**.

Figure 1.1: Site Location



Drawn by: PH
Date: 26/11/2018

Figure 1.1: Site Location

BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

2. LEGISLATION AND PLANNING POLICY

National Legislation and Planning Policy

The UK Air Quality Strategy

2.1 European Union (EU) legislation forms the basis of air quality policy and legislation in the UK. The EU 2008 ambient Air Quality Directive[1] sets limits for ambient concentrations of air pollutants including nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). The air quality standards and objectives are prescribed through the Air Quality (England) Regulations 2000[2], as amended, for the purpose of the Local Air Quality Management Framework.

2.2 The UK Government are required under the Environment Act 1995[3] to produce a national Air Quality Strategy (AQS). The AQS was first published in 1997[4] and was most recently reviewed and updated in 2007[5]. The AQS provides an overview of the Government's ambient air quality policy and sets out the air quality standards and objectives to be achieved and measures to improve air quality.

2.3 Part IV of the Environment Act[3] requires local authorities in the UK to review local air quality within their administrative area and, if relevant air quality standards and objectives are likely to be exceeded, designate Air Quality Management Areas (AQMAs). Following the designation of an AQMA, local authorities are required to publish an Air Quality Action Plan (AQAP) detailing measures to be taken to improve local air quality and work towards meeting the relevant air quality standards and objectives.

National Planning Policy Framework

2.4 The National Planning Policy Framework (NPPF)[6] was published in July 2018 and sets out the Government's planning policies for England and how these are expected to be applied.

2.5 With regard to assessing cumulative effects the NPPF[6] states:

> *"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.*
>
> *[…]"*

[1] European Parliament (2008) Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe
[2] HMSO (2000) Statutory Instrument 2000 No. 928, The Air Quality (England) Regulations 2000 (as amended), London: HMSO
[3] HMSO (1995) The Environment Act 1995, London: TSO
[4] Department of the Environment (DoE) (1997) The UK National Air Quality Strategy, London: HMSO
[5] Department of the Environment, Food and Rural Affairs (Defra) (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, London: HMSO
[6] Ministry of Housing, Communities & Local Government (2018) National Planning Policy Framework, HMSO London

The NPPF[6] recognises air quality within Section 15: Conserving and enhancing the natural environment, and states that:

"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 soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

[…]

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.

[…]

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.Planning Practice Guidance".

2.6 The Planning Practice Guidance (PPG) for air quality[7] was updated in 2014 and provides guiding principles on how the planning process can take account of the impacts of new development on air quality.

2.7 The PPG[7] sets out the role of Local Plans with regard to air quality and when air quality could be relevant to a planning decision stating that:

"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 impact in an area where air quality

[7] Department for Communities and Local Government (2014) Planning Practice Guidance 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. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate Heavy Goods Vehicle flows over a period of a year or more.*

- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area.*

- *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.*

- *Affect biodiversity. In particular, this is likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites."*

2.8 The PPG provides guidance regarding what should be included within an air quality assessment. Examples of potential air quality mitigation measures are also provided.

Local Planning Policy

2.9 Barnsley MBC is currently producing a Local Plan which will replace the Core Strategy[8] and the Unitary Development Plan. Once adopted, the Local Plan, together with the

[8] Barnsley Metropolitan Borough Council (2011) Local Development Framework, Core Strategy

Joint Waste Plan prepared with Doncaster and Rotherham and adopted in March 2012, will be the Statutory Development Plan.

2.10 This will consider the future use of all land within the borough and establishes policies and proposals up to the year 2033. Until the Local Plan is formally adopted the current Statutory Development Plan will remain in place. The current Statutory Development Plan includes the Core Strategy, which includes policies relevant to air quality:

"OBJECTIVE 2: To improve access, movement and connectivity with sustainable travel by:

[…]

- reducing transport emissions of green house gases in order to tackle climate change and minimising other pollutants to improve air quality".

"CSP 28 Reducing the Impact of Road Travel

- developing and implementing robust, evidence based air quality action plans to improve air quality
- […]

[…]

We will also continue to work to minimise the impact of air pollution on human health both within the AQMA's and in the borough generally. To this end we are currently updating our Air Quality Action Plan (initially published in 2004) to accommodate measures to improve air quality in the additional AQMA's that have been declared since 2004.

[…]"

"CSP 41 Development in Air Quality Management Areas

Development in air quality management areas will be expected to demonstrate that it will not have a harmful effect on the health or living conditions of any future users of the development in terms of air quality (including residents, employees, visitors and customers), or that any such harmful effects can be mitigated against. We will only allow residential development in air quality management areas, where the developer provides an assessment that shows living conditions will be acceptable for future residents. We will only allow development in air quality management areas which could cause more air pollution, where the developer provides an assessment that shows there will not be a significantly harmful effect on air quality."

2.11 The above policies were taken into consideration throughout the undertaking of the assessment.

3. METHODOLOGY

Consultation with Barnsley Metropolitan Borough Council

3.1 Consultation was undertaken with the Regulatory Services Department at BMBC, in which the proposed assessment methodology was provided and agreed via email[9].

3.2 The agreed assessment methodology is detailed below:

- Construction Phase – A construction phase assessment was undertaken and relevant measures to mitigate construction phase dust emissions were recommended. The assessment was undertaken in accordance with guidance provided by the Institute of Air Quality Management (IAQM)[10].
- Operational Phase – A detailed operational phase road traffic emissions assessment was undertaken to consider the impact of development-generated traffic on local air quality and predict pollutant concentrations at the proposed development site. The dispersion model ADMS-Roads was used to model concentrations of oxides of nitrogen (NOx) and particulate matter (PM_{10} and $PM_{2.5}$) at identified existing receptor locations for both without and with development scenarios. The change in pollutant concentrations as a result of development-generated traffic was then calculated. The assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance (LAQM.TG16)[11]. Pollutant concentrations were also predicted across the proposed development Site to consider the suitability of the Site for the proposed use with regard to air quality. Full details of the methodology used in the assessment as agreed with BMBC is provided in paragraph 3.11 of this report. Mitigation measures for the operational phase were recommended in accordance with the Barnsley good practice guidance[12].

Construction Phase Assessment

3.3 An assessment of the potential impacts arising from the construction of the proposed development was undertaken in accordance with IAQM Guidance[10]. The full assessment methodology is not reproduced within this report but a summary of the assessment steps are provided below:

- Step 1 – screen the requirement for a more detailed assessment. No assessment is required if there are no receptors within a certain distance of the works;
- Step 2 – assess the risk of dust impacts separately for each of the four activities considered (demolition, earthworks, construction and trackout).
  - Step 2A – determine the potential dust emission magnitude for each of the four activities;
  - Step 2B – determine the sensitivity of the area;

[9] Consultation request emails issued to Barnsley Regulatory Services Department on 26/11/2018 via email, response received 28/11/2018.
[10] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London
[11] Defra (2018) Local Air Quality Management Technical Guidance (LAQM.TG16), London: Defra
[12] Barnsley MBC (October 2018)Air Quality and Emissions Good Practice Planning Guidance

- Step 2C – determine the risk of dust impacts by combining the findings of steps 2A and 2B.
- Step 3 – determine the site-specific mitigation for each of the four activities; and
- Step 4 – examine the residual effects and determine significance.

Road Traffic Emissions – Air Dispersion Modelling

3.4 The air dispersion model ADMS-Roads, version 4.1.1.0 was utilised in the assessment to predict concentrations of NOx, PM_{10} and $PM_{2.5}$ at existing and proposed receptor locations.

3.5 The assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance and Institute of Air Quality Management and Environmental Protection UK guidance[13].

Assessment Scenarios and Traffic Data

3.6 The following scenarios were considered in the air dispersion modelling:

- Scenario 1: 2017 Base Year;
- Scenario 2: 2024 Opening Year without development; and
- Scenario 3: 2024 Opening Year with development.

3.7 Traffic data were obtained from Optima Highways, the Transport Consultants for the project. 24-hour Annual Average Daily Traffic Data (AADT) and Heavy Duty Vehicle (HDV) proportions were provided for the following roads for use in the assessment:

- A629 Halifax Road / High Lee Road;
- A628 Barnsley Road/ Thurlstone Road;
- B6462 Bridge Street; and
- Well House Lane.

3.8 In addition traffic data for the A616 Stockbridge Bypass north were obtained from the Department for Transport[14] for use in the verification of the ADMS-Roads model.

3.9 Consideration was given to the speeds at which vehicles are likely to travel within the study area. Free-flowing traffic conditions were modelled at speeds provided by the Transport Consultants. Queuing sections, including the junctions of Well House Lane with the A628 and A629 were modelled in accordance with Defra guidance[11].

3.10 Traffic data used in the air dispersion modelling are provided in **Appendix C.**

[13] Institute of Air Quality Management and Environmental Protection UK (2017) Land-Use Planning & Development Control: Planning for Air Quality, v1.2, London
[14] Department for Transport, traffic counts website https://roadtraffic.dft.gov.uk/ [accessed July 2018]

ADMS-Roads Model Inputs

3.11 The following model inputs were utilised in the assessment:

- Emission Factors – emission factors were utilised from the Defra Emission Factor Toolkit[15], version 8.0.1, for the years of assessment (2017 and 2024).
- Conversion of oxides of nitrogen – concentrations of NOx were predicted using the ADMS-Roads dispersion model. These concentrations were converted to nitrogen dioxide (NO_2) using the Defra NOx to NO_2 calculator[16], version 6.1.
- Meteorological Data – hourly sequential meteorological data for the base year of assessment (2017) were obtained for the Emley Moor recording station. This is the closest, most representation recording station to the proposed development site. The wind rose for 2017 is provided in **Appendix D**.
- Surface roughness – a surface roughness of 0.5m was utilised in the dispersion model. This is representative of the suburban conditions of the study area.
- Monin-Obukhov length (MO) – a MO of 30 was utilised in the dispersion model. This is representative of the suburban conditions of the study area.
- Background pollutant concentrations – background concentrations of NO_2, PM_{10} and $PM_{2.5}$ for the study area were obtained from the pollutant concentrations maps[17] provided by Defra as a 1km x 1km grid of the UK, for the years of assessment (2017 and 2024).
- Model verification – model verification was undertaken using 2017 monitoring data available for the study area. Full details of the verification procedure are provided in **Appendix E.**
- Calculation of short term PM_{10} concentrations – the following calculation, as detailed in Defra guidance[11], was utilised to calculate the number of exceedance of the 24-hour mean PM_{10} air quality objective:

  Number of 24-Hour Mean Exceedance = -18.5 + 0.00145 * Annual Mean^3 + (206 / Annual Mean)

- The IAQM released a position statement in July 2018[18] regarding dealing with the uncertainty in vehicle NOx emissions within air quality assessments. This recommends that sensitivity analyses be undertaken and professional judgement be applied to consider the scenario where NOx emissions do not reduce as rapidly as shown by the EFT. As such a sensitivity analysis was undertaken and emission factors, NOx to NO_2 calculator inputs and background concentrations were kept at base year (2017) levels. Details of the sensitivity analysis are provided in **Appendix F**.

[15] Defra (2018) Emission Factor Toolkit [https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html]
[16] Defra (2018) NOx to NO_2 Calculator [https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc]
[17] Defra (2018) background pollutant concentration maps [https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015]
[18] Institute of Air Quality Management (2018) Position Statement: Dealing with Uncertainty in Vehicle NOx Emissions within Air Quality Assessments, Version 1.1

Assessment Criteria

3.12 Predicted pollutant concentrations were compared to the relevant air quality objectives. The current relevant air quality standards and objectives are detailed in **Table 3.1.**

Table 3.1: Air Quality Standards and Objectives (England)

Pollutant	Averaging Period	Air Quality Objective (µg.m^{-3})	Date to Achieve by
NO_2	Annual Mean	40	31 December 2005
	1-hour mean not to be exceeded more than 18 times per year	200	31 December 2005
PM_{10}	Annual Mean	40	31 December 2004
	24-hour mean not to be exceeded more than 35 times per year	50	31 December 2004
$PM_{2.5}$	Annual mean target (15% cut in annual mean (urban background exposure)	25	2010 - 2020

3.13 Guidance is provided by the Institute of Air Quality Management and Environmental Protection UK[13] to determine the significance of the impact of development-generated road traffic emissions on local air quality. The impact descriptors at receptor locations are detailed in **Table 3.2.** These impact descriptors consider the predicted magnitude of change in pollutant concentrations and the concentration in relation to the relevant air quality objectives.

Table 3.2: Impact Descriptors for Individual Receptors

Long Term Average Concentration at Receptor in Assessment Year	% Change in Concentration Relative to 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

Note: Figures rounded up to the nearest whole number, therefore any value less than 1% after rounding (effectively less than 0.5%) will be described as negligible.

4. BASELINE CONDITIONS

Local Air Quality Management

4.1 The proposed development is not located within, or in close proximity to, an AQMA designation.

Local Air Quality Monitoring

Nitrogen Dioxide

4.2 BMBC undertakes monitoring within its administrative boundary using a network of automatic monitoring locations and diffusion tubes. The closest monitoring location to the proposed development site is located at Midhopestones, 4.4km to the south of the Site on the A616. Bias adjusted NO_2 monitoring results, for this location are detailed in **Table 4.1.**

Table 4.1: BMBC NO_2 Monitoring Data in 2013 – 2017

Location	Grid Reference		Site Type[19]	Monitored Annual Average Concentration ($\mu g.m^{-3}$)				
				2013	2014	2015	2016	2017
1 – Midhopestones Eastbound	423621	399817	Roadside	35.4	35.0	38.6	37.1	35.9

4.3 Monitored concentrations in 2013 to 2017 were below the annual mean air quality objective for NO_2 of 40$\mu g.m^{-3}$ at DT1.

Particulate Matter (PM_{10})

4.4 No monitoring of PM_{10} is undertaken by BMBC within the study area. Modelled road contributions of PM_{10} were adjusted using the adjustment factor derived for NOx, in accordance with Defra guidance[11].

Particulate Matter ($PM_{2.5}$)

4.5 No monitoring of $PM_{2.5}$ is undertaken by BMBC within the study area. Modelled road contributions of $PM_{2.5}$ were adjusted using the adjustment factor derived for NOx, in accordance with Defra guidance[11].

Background Pollutant Concentrations

4.6 No background air quality monitoring is undertaken by BMBC within the study area.

[19] Site Types: R = Roadside, UB =- Urban Background, UT = Urban Traffic

4.7 Background pollutant concentrations were therefore obtained from the latest Defra background concentration maps[17], which are provided for the UK as a 1km x 1km grid network. The latest maps are based on 2015 monitoring and meteorological data. Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ were obtained for the grid squares covering the study area for the years of assessment (2017 and 2024). The background concentrations used in the assessment are detailed in **Table 4.3.**

Table 4.3: Background Pollutant Concentrations used in the Assessment

Pollutant	Grid Square	Receptors	Concentration (µg.m^{-3})	
			2017	2024
NO_2	424500, 404500	R1-R5, R17-R18, R23-R24, All Proposed Receptors	8.7	6.5
PM_{10}			10.8	10.4
$PM_{2.5}$			7.0	6.7
NO_2	424500, 403500	R6-R14, R22	9.4	7.1
PM_{10}			10.0	9.7
$PM_{2.5}$			6.7	6.4
NO_2	423500, 404500	R15-R16	8.0	6.1
PM_{10}			10.7	10.3
$PM_{2.5}$			7.0	6.7
NO_2	425500, 404500	R19-R21	9.2	7.0
PM_{10}			11.2	10.9
$PM_{2.5}$			7.3	7.0
NO_2	423500,399500	BMBC DT 1	8.2	6.2
PM_{10}			10.5	10.1
$PM_{2.5}$			7.1	6.7

4.8 2017 and 2024 background concentrations are below the relevant annual mean air quality objectives for NO_2, PM_{10} and $PM_{2.5}$.

5. CONSTRUCTION PHASE ASSESSMENT

5.1 The construction phase of the proposed development will involve a number of activities which have the potential to impact on local air quality. These include emissions of dust generated through demolition, excavation, construction, earthworks and trackout activities, exhaust pollutant emissions from construction traffic on the local highways network, and exhaust emissions from non-road mobile machinery (NRMM) within the construction site itself.

5.2 The location of sensitive receptors in relation to construction activities will affect the potential for such construction activities to cause dust soiling, nuisance and local air quality impacts. Meteorological conditions and the use of control measures will also contribute to the effects experienced.

Step 1: Screen the Need for a Detailed Assessment

5.3 Step 1 of the IAQM guidance[10] involves a screening assessment to consider whether a more detailed construction phase dust assessment is required.

5.4 In accordance with the guidance, a detailed assessment is required if:

- Human receptors are located within 350m of the boundary of the site or 50m of routes used by construction vehicles on the public highways, up to 500m from the site entrances; or
- Ecological receptors are located within 50m of the boundary of the site or 50m of routes used by construction vehicles on the public highways, up to 500m from the site entrances.

5.5 From a review of the Multi Agency Geographic Information for the Countryside (MAGIC) website[20], no ecological designations were identified within the above distances and therefore ecological impacts were not considered further. However human receptors are located within 350m of the Site boundary, with the closest of these receptors located off Well House Lane. A construction phase assessment was therefore undertaken.

Step 2: Assess the Risk of Dust Impacts

Step 2A: Define the Potential Dust Emission Magnitude

5.6 The dust emission magnitudes for the construction activities were defined using the criteria detailed in the IAQM guidance[10]. These criteria and the dust emission magnitude defined for the proposed development are detailed in **Table 5.1**. It is assumed that no demolition will be required and therefore this was not considered further.

[20] Defra, Multi Agency Geographic Information for the Countryside (MAGIC) [http://magic.defra.gov.uk/]

Table 5.1: Dust Emission Magnitude Criteria and Definition

Activity	IAQM Dust Emission Magnitude	IAQM Dust Emission Magnitude Criteria	Project Defined Dust Emission Magnitude
Earthworks	Large	Total site area >10,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes.	Large: Total site area more than 10,000m^2.
	Medium	Total site area 2,500m^2 – 10,000m^2, moderately dusty soil type (e.g. silt), 5 - 10 heavy earth moving vehicles active at any one time, formation of bunds 4m - 8m in height, total material moved 20,000 tonnes – 100,000 tonnes.	
	Small	Total site area <2,500m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <20,000 tonnes, earthworks during wetter months.	
Construction	Large	Total building volume >100,000m^3, on site concrete batching, sandblasting.	Large: Construction volume is anticipated to be more than 100,000m^3.
	Medium	Total building volume 25,000m^3 – 100,000m^3, potentially dusty construction material (e.g. concrete), on site concrete batching.	
	Small	Total building volume <25,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).	
Trackout	Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m.	Medium: 10 – 50 HDVs anticipated per day
	Medium	10 - 50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m.	
	Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50m.	

Step 2B: Define the Sensitivity of the Area

5.7 The sensitivity of the study area takes into account the specific receptors in the vicinity of the Site, the proximity and number of those receptors, the local background concentration of PM_{10} and site-specific factors. The assessment requires the determination of the sensitivity of the area for the purposes of dust soiling and human health impacts and these are presented in **Table 5.2**.

Table 5.2: Determination of the Sensitivity of the Area

Potential Impact	Justification	Sensitivity		
		Earthworks	Construction	Trackout
Dust Soiling	There are 10 – 100 highly sensitive receptors within 20m of the proposed development.	High	High	High
Human Health	There are 10 – 100 highly sensitive receptors within 20m of the proposed development. The 2017 background concentration of PM_{10} is less than 24µg.m^{-3}.	Low	Low	Low

Step 2C: Define the Risk of Impacts

5.8 The dust emission magnitude determined in Step 2A is then combined with the sensitivity of the area determined in Step 2B to define the risk of dust impacts with no mitigation applied. The results of this assessment are detailed in **Table 5.3.**

Table 5.3: Summary Dust Risk Table to Define Site Specific Risk

Activity	Step 2A: Dust Emission Magnitude	Step 2B: Sensitivity of the Area	Step 2C: Risk of Dust Impacts
Dust Soiling Effects on People and Property			
Earthworks	Large	High	High Risk
Construction	Large	High	High Risk
Trackout	Medium	High	Medium Risk
Human Health Impacts			
Earthworks	Large	Low	Low Risk
Construction	Large	Low	Low Risk
Trackout	Medium	Low	Low Risk

Step 3: Site-Specific Mitigation

5.9 The risk of dust impacts defined in Step 2C is used to determine the measures required to mitigate construction phase dust impacts. The mitigation measures are detailed in **Section 7** of this report.

Step 4: Determine Significant Effects

5.10 In accordance with IAQM guidance[10], with the implementation of the mitigation measures detailed in **Section 7**, the residual impacts from the construction phase are considered to be 'not significant'.

6. OPERATIONAL PHASE ROAD TRAFFIC EMISSIONS ASSESSMENT

Existing Receptor Locations

6.1 Existing receptor locations were identified within close proximity of the road links detailed in paragraph 3.7 and considered in the operational phase road traffic emissions assessment. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at the identified existing receptor locations for the assessment scenarios detailed in paragraph 3.6. Where possible the closest receptors to those road links were considered, as these receptors are likely to experience the greatest change in pollutant concentrations as a result of the proposed development. Receptors heights were modelled at 1.5m.

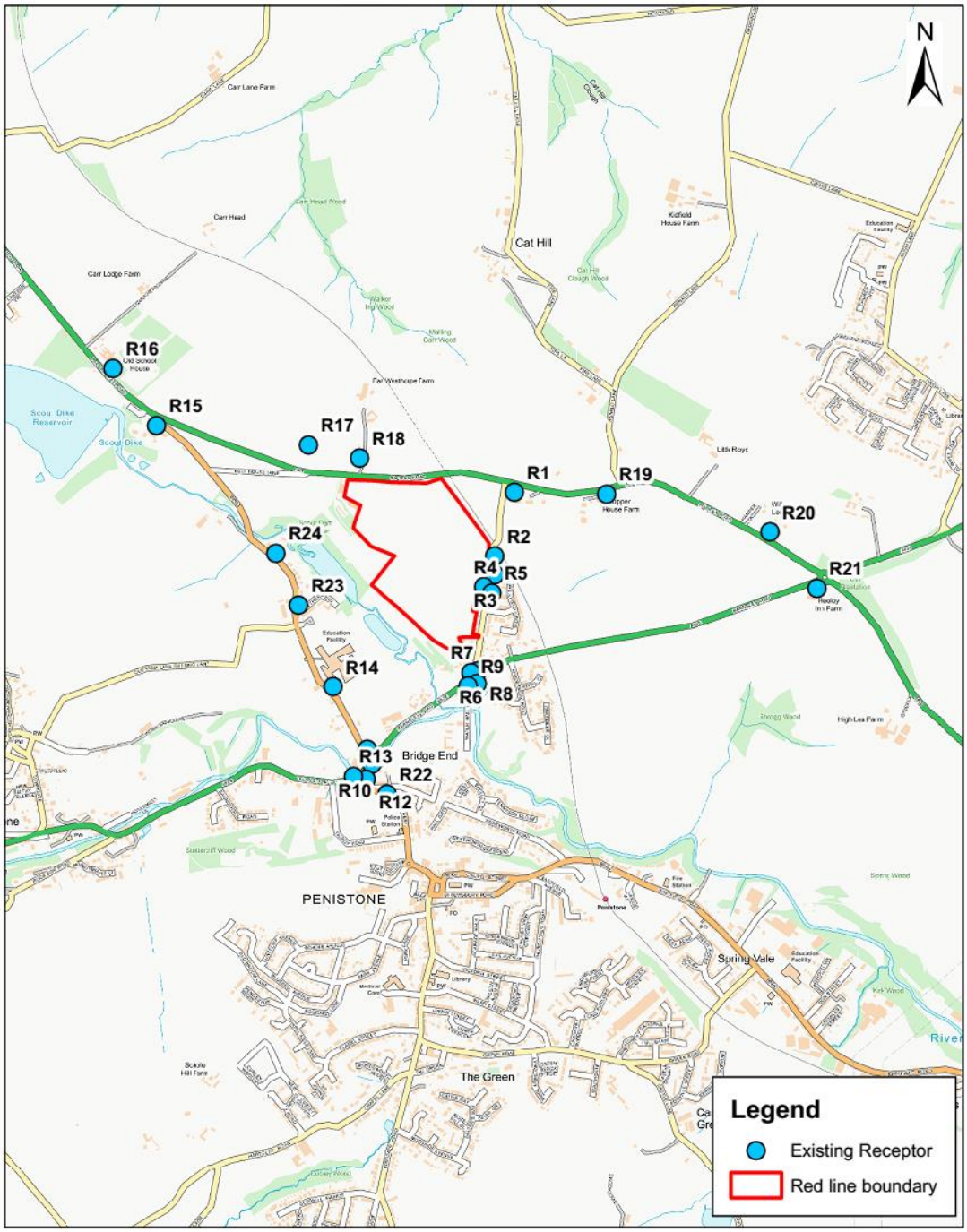
6.2 The existing receptor locations are detailed in **Table 6.1** and **Figure 6.1.**

Table 6.1: Existing Sensitive Receptor Locations

Receptor	Grid Reference		Details
	X	Y	
R1	424836	404544	Residential receptor at junction of Halifax Road and Well House Lane
R2	424774	404345	Residential receptor on Well House Lane
R3	424774	404286	Residential receptor on Well House Lane
R4	424740	404249	Residential receptor on Well House Lane
R5	424765	404229	Residential receptor on Well House Lane
R6	424722	403985	Residential receptor on Well House Lane
R7	424700	403980	Residential receptor at junction of Well House Lane and Barnsley Road
R8	424719	403946	Residential receptor at junction of Well House Lane and Barnsley Road
R9	424691	403938	Residential receptor at junction of Well House Lane and Barnsley Road
R10	424389	403693	Residential receptor at junction of Barnsley Road and Huddersfield Road
R11	424375	403740	Residential receptor at junction of Barnsley Road and Huddersfield Road
R12	424372	403646	Residential receptor at junction of Thurlstone Road and Bridge Street
R13	424332	403655	Residential receptor at junction of Thurlstone Road and Bridge Street
R14	424268	403936	School on Huddersfield Road

Receptor	Grid Reference		Details
	X	Y	
R15	423715	404753	Residential receptor on Huddersfield Road
R16	423579	404932	Children's outdoor activity centre on Halifax Road
R17	424191	404692	Residential receptor on Halifax Road
R18	424351	404651	Residential receptor on Halifax Road
R19	425125	404538	Residential receptor on Halifax Road
R20	425636	404420	Residential receptor on Halifax Road
R21	425783	404243	Residential receptor adjacent to roundabout
R22	424437	403600	Residential receptor on Bridge Street
R23	424836	404544	Residential receptor on Huddersfield Road
R24	424774	404345	Residential receptor on Huddersfield Road

Figure 6.1: Existing Receptor Locations



Drawn by: PH
Date: 26/11/2018

Figure 6.1: Modelled Existing Receptors

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Proposed Receptor Locations

6.3 Pollutant concentrations were predicted across the proposed development Site to consider exposure of future residents of the proposed development to air quality. Proposed receptor locations were selected to represent the worst-case exposure locations of future residents i.e. at the redline boundary closest to existing road sources. Pollutant concentrations were predicted at the proposed development site for Scenario 3: 2017 Opening Year with development at those locations detailed in **Table 6.2** and shown in **Figure 6.2**.

Table 6.2: Proposed Sensitive Receptor Locations

Proposed Receptor	Grid Reference	
	X	Y
PR1	424738	404287
PR2	424748	404306
PR3	424742	404376
PR4	424616	404560
PR5	424536	404559
PR6	424400	404573
PR7	424378	404560
PR8	424311	404563
PR9	424664	404078
PR10	424703	404153

Figure 6.2: Proposed Receptor Locations

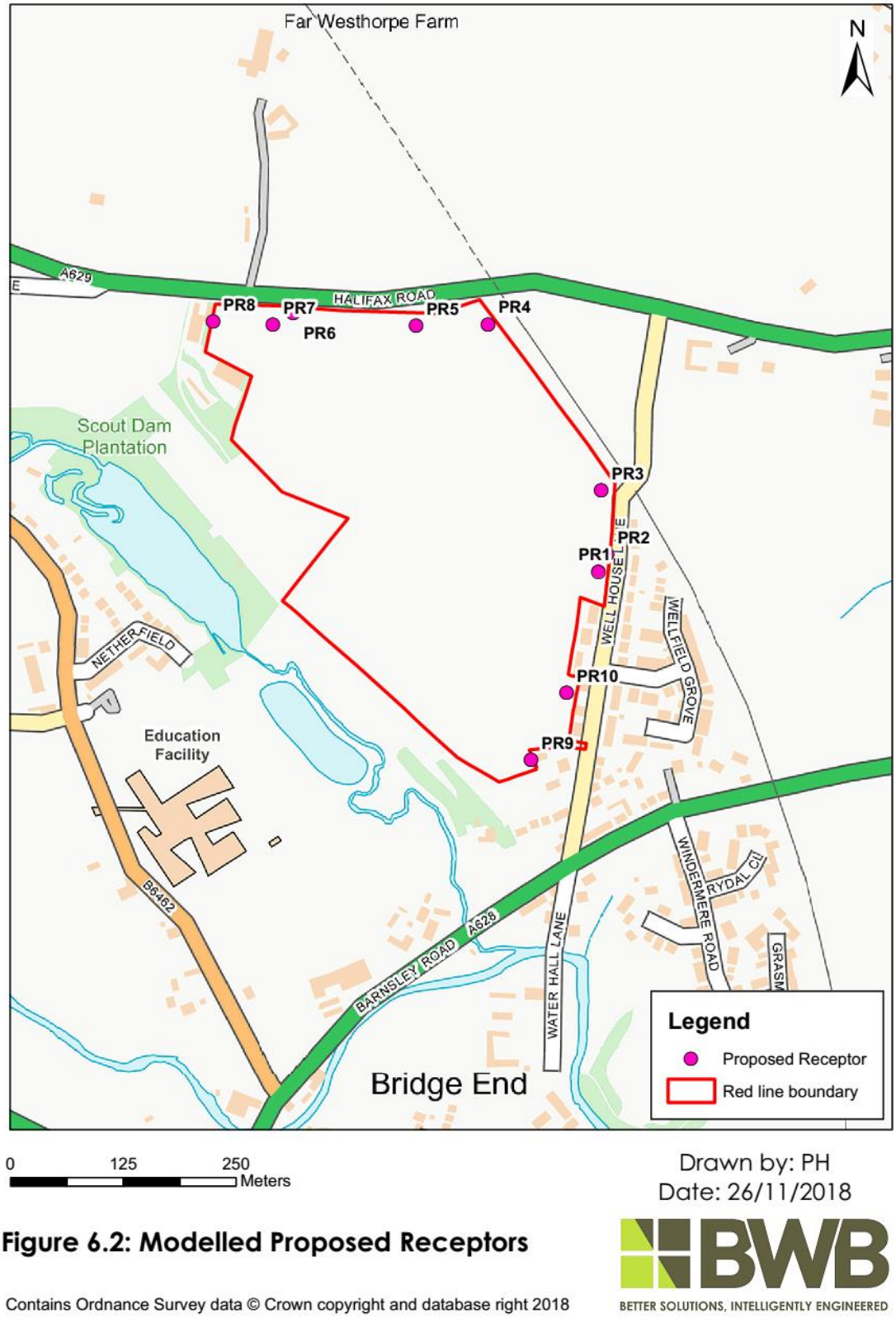

Figure 6.2: Modelled Proposed Receptors

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Baseline Assessment

6.4 Pollutant concentrations were predicted at the identified existing sensitive receptor locations using the dispersion model ADMS-Roads. Predicted pollutant concentrations for Scenario 1: 2017 Base Year and Scenario 2: 2024 Opening Year without development are detailed in **Table 6.3.**

Table 6.3: Predicted Annual Mean Pollutant Concentrations for Scenario 1: 2017 Base Year and Scenario 2: 2024 Opening Year Without Development at Existing Receptor Locations

Receptor	Scenario 1: 2017 Base Year ($\mu g.m^{-3}$)			Scenario 2: 2024 Opening Year Without Development ($\mu g.m^{-3}$)		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	16.7	12.2	7.9	11.5	11.9	7.5
R2	14.0	11.7	7.6	9.9	11.4	7.2
R3	13.4	11.6	7.5	9.5	11.2	7.2
R4	11.8	11.3	7.4	8.5	11.0	7.0
R5	13.3	11.5	7.5	9.5	11.2	7.2
R6	24.4	12.6	8.2	16.6	12.4	7.9
R7	19.6	11.8	7.8	13.6	11.5	7.4
R8	23.0	12.5	8.2	15.8	12.2	7.8
R9	27.8	13.5	8.8	19.0	13.3	8.4
R10	33.2	14.4	9.3	22.5	14.2	8.9
R11	23.8	12.6	8.2	16.2	12.3	7.8
R12	38.8	15.3	9.8	26.0	15.1	9.4
R13	28.1	13.2	8.6	18.9	13.0	8.2
R14	16.6	11.2	7.4	11.6	10.9	7.1
R15	14.2	11.7	7.6	9.9	11.4	7.3
R16	17.7	12.5	8.0	12.2	12.2	7.7

Receptor	Scenario 1: 2017 Base Year (µg.m^{-3})			Scenario 2: 2024 Opening Year Without Development (µg.m^{-3})		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R17	12.4	11.4	7.4	8.9	11.1	7.1
R18	13.2	11.6	7.5	9.3	11.3	7.2
R19	21.1	13.4	8.6	14.2	13.2	8.2
R20	20.5	13.3	8.6	13.9	13.0	8.2
R21	21.9	13.6	8.7	14.9	13.3	8.3
R22	35.3	14.8	9.5	23.6	14.6	9.1
R23	17.8	12.3	8.0	12.1	12.0	7.6
R24	17.3	12.2	7.9	11.9	11.9	7.5

6.5 The baseline assessment for Scenario 1 and Scenario 2 indicates that predicted concentrations of PM_{10} and $PM_{2.5}$ are below the respective annual mean air quality objectives at receptors considered. Concentrations of NO_2 are not predicted to exceed the annual mean air quality objective at any of the identified receptors in either scenario.

6.6 With regard to short term air quality objectives for NO_2 and PM_{10}, the predicted annual mean NO_2 concentrations are less than 60µg.m^{-3} and therefore in accordance with Defra guidance[11] it may be assumed that exceedance of the 1-hour mean objective are unlikely. The calculation detailed in paragraph 3.11 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

Impact Assessment

6.7 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at identified existing receptor locations for Scenario 3: 2024 Opening Year with development, to consider the impact of development-generated vehicles on local air quality.

6.8 Predicted pollutant concentrations are detailed in **Tables 6.4**, **6.5** and **6.6** for NO_2, PM_{10} and $PM_{2.5}$ respectively together with Scenario 2: 2024 Opening Year without development concentrations for comparison purposes. The predicted change in pollutant concentrations resulting from development-generated traffic, and the associated impact are also provided.

Table 6.4: Predicted Annual Mean NO_2 Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted NO_2 Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2024 Without Development	Scenario 3: 2024 With Development	Change	
R1	11.5	11.9	+0.3	Negligible
R2	9.9	10.3	+0.3	Negligible
R3	9.5	10.2	+0.6	Negligible
R4	8.5	8.8	+0.3	Negligible
R5	9.5	10.0	+0.5	Negligible
R6	16.6	17.3	+0.6	Negligible
R7	13.6	13.9	+0.4	Negligible
R8	15.8	16.1	+0.3	Negligible
R9	19.0	19.3	+0.3	Negligible
R10	22.5	22.8	+0.3	Negligible
R11	16.2	16.3	+0.1	Negligible
R12	26.0	26.3	+0.3	Negligible
R13	18.9	19.1	+0.2	Negligible
R14	11.6	11.6	+0.0	Negligible
R15	9.9	9.9	+0.0	Negligible
R16	12.2	12.2	+0.1	Negligible
R17	8.9	8.9	+0.0	Negligible
R18	9.3	9.4	+0.1	Negligible
R19	14.2	14.7	+0.5	Negligible
R20	13.9	14.3	+0.5	Negligible

Receptor	Predicted NO_2 Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2024 Without Development	Scenario 3: 2024 With Development	Change	
R21	14.9	15.2	+0.3	Negligible
R22	23.6	23.8	+0.2	Negligible
R23	12.1	12.2	+0.0	Negligible
R24	11.9	11.9	+0.0	Negligible

Please note: discrepancies in predicted changes are a result of rounding calculations

Table 6.5: Predicted Annual Mean PM_{10} Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted PM_{10} Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2024 Without Development	Scenario 3: 2024 With Development	Change	
R1	11.9	12.0	+0.1	Negligible
R2	11.4	11.4	+0.1	Negligible
R3	11.2	11.4	+0.1	Negligible
R4	11.0	11.0	+0.1	Negligible
R5	11.2	11.4	+0.1	Negligible
R6	12.4	12.6	+0.2	Negligible
R7	11.5	11.6	+0.1	Negligible
R8	12.2	12.3	+0.1	Negligible
R9	13.3	13.4	+0.1	Negligible
R10	14.2	14.3	+0.1	Negligible
R11	12.3	12.3	0.0	Negligible
R12	15.1	15.2	+0.1	Negligible

Receptor	Predicted PM_{10} Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2024 Without Development	Scenario 3: 2024 With Development	Change	
R13	13.0	13.0	+0.1	Negligible
R14	10.9	10.9	0.0	Negligible
R15	11.4	11.5	0.0	Negligible
R16	12.2	12.2	0.0	Negligible
R17	11.1	11.1	0.0	Negligible
R18	11.3	11.3	0.0	Negligible
R19	13.2	13.3	+0.2	Negligible
R20	13.0	13.2	+0.2	Negligible
R21	13.3	13.4	+0.1	Negligible
R22	14.6	14.7	+0.1	Negligible
R23	12.0	12.0	0.0	Negligible
R24	11.9	11.9	0.0	Negligible

Please note: discrepancies in predicted changes are a result of rounding calculations

Table 6.6: Predicted Annual Mean $PM_{2.5}$ Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted $PM_{2.5}$ Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2024 Without Development	Scenario 3: 2024 With Development	Change	
R1	7.5	7.6	+0.1	Negligible
R2	7.2	7.3	0.0	Negligible
R3	7.2	7.2	+0.1	Negligible
R4	7.0	7.1	0.0	Negligible
R5	7.2	7.2	+0.1	Negligible

Receptor	Predicted $PM_{2.5}$ Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2024 Without Development	Scenario 3: 2024 With Development	Change	
R6	7.9	8.0	+0.1	Negligible
R7	7.4	7.4	+0.1	Negligible
R8	7.8	7.8	0.0	Negligible
R9	8.4	8.4	+0.1	Negligible
R10	8.9	8.9	+0.1	Negligible
R11	7.8	7.8	0.0	Negligible
R12	9.4	9.4	0.0	Negligible
R13	8.2	8.2	0.0	Negligible
R14	7.1	7.1	0.0	Negligible
R15	7.3	7.3	0.0	Negligible
R16	7.7	7.7	0.0	Negligible
R17	7.1	7.1	0.0	Negligible
R18	7.2	7.2	0.0	Negligible
R19	8.2	8.3	+0.1	Negligible
R20	8.2	8.3	+0.1	Negligible
R21	8.3	8.4	0.0	Negligible
R22	9.1	9.1	0.0	Negligible
R23	7.6	7.6	0.0	Negligible
R24	7.5	7.5	0.0	Negligible

Please note: discrepancies in predicted changes are a result of rounding calculations

6.9 The predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for Scenario 2: 2024 Opening Year without development and Scenario 3: 2024 Opening Year with development are below the relevant annual mean air quality objectives for all of the modelled receptors.

6.10 The proposed development does not lead to any additional exceedances of the annual mean air quality objectives.

6.11 Predicted changes in NO_2, PM_{10} and $PM_{2.5}$ concentrations are less than 0.5% of the relevant annual mean air quality objectives and therefore considered to be negligible in accordance with IAQM and EPUK guidance[13].

6.12 With regard to short term air quality objectives for NO_2 and PM_{10}, the predicted annual mean NO_2 concentrations are less than 60µg.m^{-3} and therefore in accordance with Defra guidance[11] it may be assumed that exceedances of the 1-hour mean objective are unlikely. The calculation detailed in paragraph 3.11 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

Impact Significance Summary

6.13 Relevant guidance and legislation and professional judgement was utilised to determine the significance of the air quality assessment. The air quality assessment was undertaken and supervised by full members of the Institute of Air Quality Management. A summary of the impact significance and justification of this are provided below.

6.14 The impact of the proposed development on air quality is considered to be 'negligible':

- Consideration was given to local planning policy[8] and the development proposals are considered to be in accordance with this policy with regard to air quality.
- Existing concentrations of NO_2, PM_{10} and $PM_{2.5}$ in the study area are predicted to be below the relevant air quality objectives.
- The air quality assessment undertaken utilised robust model inputs including slowing traffic sections at junctions, appropriate meteorological data , surface roughness and cumulative traffic flows.
- The impact of development-generated road traffic on local air quality is defined as negligible in accordance with IAQM and EPUK guidance[13].
- In addition, a sensitivity analysis was undertaken and provided in **Appendix F** considering the conservative scenario of NOx concentrations not decreasing from baseline levels in line with projected emission factors. The findings of this sensitivity analysis also predict the impact of development-generated road traffic on local air quality as ' negligible' in accordance with IAQM and EPUK guidance[13].

Site Suitability Assessment

6.15 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at the proposed residential dwellings within the development site for Scenario 3: 2024 Opening Year with development. Predicted pollutant concentrations are detailed in **Table 6.7**.

Table 6.7: Predicted Annual Mean NO_2, PM_{10} and $PM_{2.5}$ Concentrations at Proposed Receptor Locations

Receptor	Scenario 3: 2024 Opening Year with development (µg.m^{-3})		
	NO_2	PM_{10}	$PM_{2.5}$
PR1	8.3	10.9	7.0
PR2	8.7	11.0	7.0
PR3	8.2	10.9	7.0
PR4	10.2	11.5	7.3
PR5	10.7	11.7	7.4
PR6	12.6	12.3	7.7
PR7	10.3	11.6	7.3
PR8	10.1	11.5	7.3
PR9	8.1	10.9	7.0
PR10	8.1	10.9	7.0

6.16 The predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for Scenario 3: 2024 Opening Year with development, indicate that pollutant concentrations at the proposed residential development will be below the respective air quality objectives in 2024 with the development in place.

6.17 With regard to short term air quality objectives for NO_2 and PM_{10}, the predicted annual mean NO_2 concentrations are less than 60µg.m^{-3} and therefore in accordance with Defra guidance[11] it may be assumed that exceedance of the 1-hour mean objective are unlikely. The calculation detailed in paragraph 3.11 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

7. MITIGATION

Construction Phase Assessment

Step 3: Site-specific Mitigation

7.1 The risk of dust impacts, defined in Step 2C of the assessment, are used to determine the mitigation measures required to minimise the emission of dust during construction phase activities. The IAQM guidance[10] provides details of highly recommended and desirable mitigation measures which are commensurate with the risk of dust impacts defined in Step 2C for construction, earthworks and track out activities. Where the mitigation measures are general in nature, the highest risk category was applied in accordance with the guidance[10]. The highest risk category identified was 'High Risk' and the recommended mitigation taken from the IAQM guidance[10] is detailed in **Table 7.1** and **Table 7.2**.

Table 7.1: Mitigation Measures for a High Risk Site

Category	Mitigation Measures	
	Highly Recommended	Desirable
Communication	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	None
	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site manager.	
	Display the head or regional office contact information.	
	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. In London additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/or visual inspections.	
Site Management	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner and record the measures taken.	None

Category	Mitigation Measures	
	Highly Recommended	**Desirable**
	Make the complaints log available to the local authority when asked.	
	Record any exceptional incidents that cause and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.	
	Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off=site transport/deliveries which might be using the same strategic road network routes.	
Monitoring	Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of the site boundary, with cleaning to be provided as necessary.	
	Carry out regular site inspections to monitor compliance with the DMP, record inspections results, and make an inspection log available to the local authority when asked.	None
	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	
Preparing and maintaining the site	Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	
	Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.	
	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extended period.	None
	Avoid site runoff of water or mud.	
	Keep site fencing, barriers and scaffolding clean using wet methods.	
	Remove materials that have a potential to produce dust from site as soon as possible. Unless being re-used on site. If	

Category	Mitigation Measures	
	Highly Recommended	**Desirable**
	they are being re-used on-site cover as described below.	
	Cover, seed or fence stockpiles to prevent wind whipping.	
Operating vehicle/ machinery and sustainable travel	Ensure all vehicles switch off engines when stationary – no idling vehicles.	None
	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	
	Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable control measures provided, subject to the approval of the nominated undertaker with the agreement of the local authority, where appropriate).	
	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	
	Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).	
Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	None
	Ensure an adequate water supply on site for effective dust/particulate matter suppression/mitigation, using non-portable water where possible and appropriate.	
	Use enclose chutes and conveyors and covered skips.	
	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	
	Ensure equipment is readily available on site to clean and dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	
Waste Management	Avoid bonfires and burning of waste materials.	None

Table 7.2: Mitigation Measures Specific to Earthworks, Construction and Trackout

Category	Mitigation Measures	
	Highly Recommended	**Desirable**
Earthworks (High Risk Site)	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	None
	Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.	
	Only remove the cover in small areas during work and not all at once.	
Construction (High Risk Site)	Avoid Scabbling (roughening of concrete surfaces) if possible.	For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.
	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	
Trackout (Medium Risk Site)	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any materials tracked out of the site. This may require the sweeper being continuously in use.	None
	Avoid dry sweeping of large areas.	
	Ensure vehicles entering and leaving the sites are covered to prevent escape of materials during transport.	
	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	
	Record all inspections of haul routes and any subsequent action in a site log book.	
	Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	
	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	
	Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	
	Access gates to be located at least 10m from receptors where possible.	

Road Traffic Emissions

7.2 The development will result in minimal increases in pollutant concentrations and no new exceedances of the relevant air quality objectives are predicted.

7.3 However, BMBC's Air Quality Planning Guidance[12] requires the classification of developments as minor, medium or major and the recommendation of appropriate "mitigation options" to minimise impacts on air quality based on this classification. As the proposed development did not require an Environmental Impact Assessment (EIA), it would be classified as a medium development, and the following mitigation recommendations from the guidance are considered appropriate to ensure any incremental changes to local air quality are minimised:

- 1 electric vehicle charging point per unit (with dedicated parking) or 1 per 10 spaces (unallocated parking);
- Travel Plan, including an agreed mechanisms for discouraging high emission vehicle use and encouraging modal shift (i.e. to public transport, cycling and walking), as well as uptake of low emission fuels and technologies – we assume that the transport consultant is already providing a Travel Plan;
- Improved pedestrian access to public transport; new or improved bus stop infrastructure including shelters; raised kerbing; information displays;
- Provision of subsidised or free public transport ticketing;
- Site layout designed to encourage walking; cycle paths to link to local cycle network; and
- Improved, convenient and segregated cycle paths to link to local cycle network.

8. CONCLUSIONS

8.1 An air quality impact assessment was undertaken for the proposed residential development at land south of Halifax Road in Penistone.

8.2 A qualitative construction phase assessment was undertaken and measures were recommended for inclusion in a DMP to minimise emissions during construction activities. With the implementation of these mitigation measures the impact of construction phase dust emissions is considered to be 'not significant' in accordance with IAQM guidance[10].

8.3 A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified existing receptor locations. Road traffic emissions were modelled using the dispersion model ADMS-Roads and concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at identified sensitive receptor locations. The modelling assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance[11]. The development was not predicted to result in any new exceedances of the relevant air quality objectives and the impact of the development on local air quality was predicted to be 'negligible' in accordance with IAQM and EPUK guidance[13].

8.4 Pollutant concentrations were also predicted across the proposed development site. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were all predicted to be below the relevant air quality objectives and therefore the Site was considered to be suitable for the proposed residential use with regard to air quality.

8.5 Consideration was given to Barnsley Metropolitan Borough Council's air quality planning guidance[12] and mitigation measures were recommended in accordance with this guidance.

APPENDICES

APPENDIX A: GLOSSARY OF TERMS

Term	Definition
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	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 the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between two years, which is useful for pollutants that have higher concentrations during the winter months.
AQAP	Air Quality Action Plan.
AQMA	Air Quality Management Area.
AQS	Air Quality Strategy.
Defra	Department for Environment, Food and Rural Affairs.
Exceedance	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
HDV	Heavy Duty Vehicles, (HGVs + buses)
HGV	Heavy Goods Vehicles.
IAQM	Institute of Air Quality Management.
LAQM	Local Air Quality Management.
LDV	Light Duty Vehicles (motorbikes, cars, vans and small trucks)
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O_3	Ozone.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
micrograms per cubic metre ($\mu g.m^{-3}$)	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 pollutant.
UK-AIR	UK Air Information Resource – A source of air quality information provided by Defra.
UKAQS	United Kingdom Air Quality Strategy.

APPENDIX B: PROPOSED DEVELOPMENT MASTERPLAN

BWB


Notes:
Private Barratt
Name | Beds | Total Units
Kenley End | 2 | 6
Kenley Mid | 2 | 5
Maidstone Semi | 3 | 31
Maidstone End | 3 | 9
Maidstone Mid | 3 | 4
Ellerton Semi | 3 | 24
Ellerton End | 3 | 4
Ellerton Mid | 3 | 3
Moresby Det | 3 | 31
Moresby Semi | 3 | 2
Derby | 3 | 38
Windermere | 4 | 48
Kingsley | 4 | 22
Aldersey | 4 | 11
Total | | 215
Private DW
Name | Beds | Total Units
H483 Cornell | 4 | 30
H417 Bretgate | 4 | 26
H456 Avondale | 4 | 10
H408 Holden | 4 | 23
H427 Chatsworth | 4 | 10
H421 Winsford | 4 | 10
Total | | 106
Affordable
Name | Beds | Total Units
Kenley | 2 | 13
Maidstone | 3 | 9
Ellerton | 3 | 31
Type 67 | 2 | 61
Type 69 | 3 | 40
Total | | 158
Total | | 459
STEN ARCHITECTURE
CLIENT: Barratt Homes and David Wilson Homes Yorkshire West (Trading names of DDW Trading Limited)
SITE: Penistone
TITLE: Planning Layout
SCALE AT A3: 1:500
DATE: 11.02.20
DRAWN: TS
CHECKED: SL

APPENDIX C: TRAFFIC DATA UTILISED IN THE AIR QUALITY ASSESSMENT

BWB

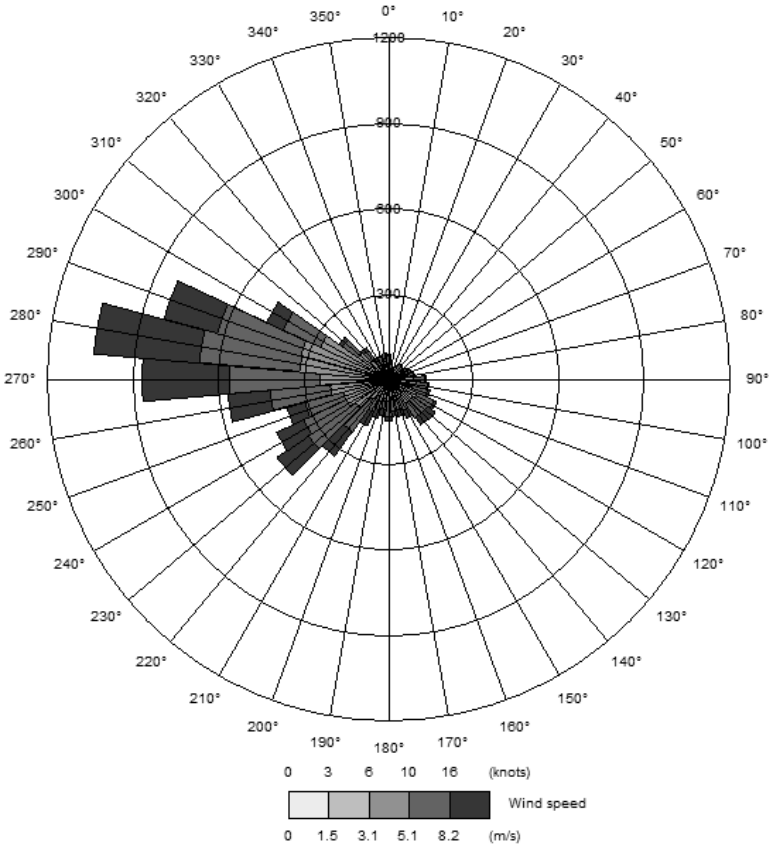
Traffic Data Utilised in the Air Dispersion Modelling Assessment

Road Link	Speed (non-queue)	Scenario 1: 2017 Base/Verification Year		Scenario 2: 2024 Opening Year without development		Scenario 3: 2024 Opening Year without development	
	Km.hr^{-1}	24 hour AADT Total Flow	HDV Flow	24 hour AADT Total Flow	HDV Flow	24 hour AADT Total Flow	HDV Flow
A629 Halifax Road west of site access	75	12,629	379	14,287	429	14,435	433
A629 Halifax Road east of site access	75	12,629	379	14,287	429	15,020	451
A629 Halifax Road west of roundabout	6475	12,804	512	14,485	579	15,542	622
A629 Halifax Road roundabout	64	13,367	401	15,122	454	15,753	473
A629 Halifax Road west of roundabout	65	12,804	512	12,804	512	15,542	622
A628 Barnsley Road east of roundabout	70	16,960	509	19,187	576	20,177	605
A629 High Lee Lane south of roundabout	80	10,639	319	12,035	361	12,468	374
A628 Barnsley Road west of roundabout	80	13,240	397	14,979	449	15,345	460
A628 Barnsley Road west of Well House Lane	64	15,223	304	17,221	344	17,600	352
Well House Lane south of site access	44	2,693	54	3,047	61	3,792	76

Road Link	Speed (non-queue)	Scenario 1: 2017 Base/Verification Year		Scenario 2: 2024 Opening Year without development		Scenario 3: 2024 Opening Year without development	
	Km.hr^{-1}	24 hour AADT Total Flow	HDV Flow	24 hour AADT Total Flow	HDV Flow	24 hour AADT Total Flow	HDV Flow
B6462 Bridge Street	48	14,169	425	16,029	481	16,268	488
A628 Thurlstone Road	48	11,546	346	13,062	392	13,202	396
A616 Stockbridge Bypass	70	15,347	1,786	17,363	2,021	17,363	2,021

APPENDIX D: WIND ROSE FOR 2017 FOR EMLEY MOOR METEOROLOGICAL RECORDING STATION

Meteorological data for 2017 Base Year scenario for the Emley Moor recording station was obtained for use in the air dispersion modelling assessment. The wind rose for 217 is detailed below and illustrates a predominant wind direction from the west.



APPENDIX E: MODEL VERIFICATION

Whilst ADMS-Roads is widely validated for use in this type of assessment, model verification for the area around the Site will not have been included. To determine model performance at a local level, a comparison of modelled results with monitored results in the study area was done in accordance with the methodology provided by Defra[11]. This process of verification aims to minimise modelling uncertainty by correcting modelled results by an adjustment factor to give greater confidence to the results.

The model was run for Scenario 1: 2017 Verification Year to predict the 2017 annual mean road contributions of NOx and PM_{10} at the monitoring locations in the study area. **Tables E1** presents the verification process for NOx.

Diffusion tubes in BMBC AQMA 6 at Langsett were initially included in the verification study, but it was decided that these would provide an unrealistically conservative adjustment factor. The AQMA has unusual emissions characteristics, which result in large recorded exceedances of the 40µg.m^{-3} annual mean objective for NO_2. This is acknowledged by BMBC[21] as being largely due to the steep gradient of the road on what is a key trans-Pennine route with large Heavy Goods Vehicle (HGV) volumes. This was not thought to be at all representative of road conditions in the vicinity of the Site and therefore was excluded from the model verification. This was later confirmed during consultation with BMBC[9].

No monitoring of PM_{10} or $PM_{2.5}$ is undertaken within the study area. Therefore the adjustment factor calculated during the NO_2 verification process was utilised to adjust predicted concentrations of these pollutants.

Table E1: NOx Verification Process

Model Verification Steps	BMBC Diffusion Tube 1
2017 monitored total NO_2 (µg.m^{-3})	35.9
2017 background NO_2 concentration (µg.m^{-3})	8.2
Monitored road contribution NOx (µg.m^{-3})	56.9
Modelled road contribution NOx (µg.m^{-3})	7.7
Ratio of monitored road NOx to modelled road NOx	7.4
Adjustment factor for modelled road contribution NOx	**7.4392**

** Road-NOx component, determined from NOx to NO_2 calculator*

A road-NOx factor of **7.4392** was then applied to the modelled road-NOx concentration at each receptor, before conversion to NO_2 concentrations using the NO_x to NO_2 calculator[16] provided by Defra and the adjusted NO_2 background concentration.

[21] BMBC (2018) Air Quality Annual Status Report

APPENDIX F: SENSITIVITY ANALYSIS

For the sensitivity analysis, pollutant concentrations were predicted at existing receptor locations in the opening year (2024) using background pollutant concentrations and emissions factors for the base year (2017). The results of the sensitivity analysis are presented in **Tables F1**, **F2** and **F3** for NO_2, PM_{10} and $PM_{2.5}$, respectively. The predicted change in pollutant concentrations resulting from development-generated traffic, and the associated impact are also provided.

Table F1: Predicted Annual Mean NO_2 Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted NO_2 Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2024 Without Development	Scenario 3: 2024 With Development	Change	
R1	17.8	18.4	+0.6	Negligible
R2	14.8	15.4	+0.5	Negligible
R3	14.1	15.2	+1.1	Negligible
R4	12.2	12.7	+0.4	Negligible
R5	14.1	14.9	+0.8	Negligible
R6	26.3	27.3	+1.0	Negligible
R7	20.9	21.5	+0.6	Negligible
R8	24.6	25.1	+0.5	Negligible
R9	29.9	30.4	+0.5	Negligible
R10	35.8	36.3	+0.6	Negligible
R11	25.6	25.7	+0.2	Negligible
R12	**42.0**	**42.4**	+0.5	Moderate Adverse
R13	30.3	30.7	+0.4	Negligible
R14	17.5	17.5	0.0	Negligible
R15	15.0	15.0	0.0	Negligible
R16	18.9	19.0	+0.1	Negligible
R17	12.9	13.0	+0.1	Negligible
R18	13.8	13.9	+0.1	Negligible
R19	22.5	23.4	+0.9	Negligible
R20	21.9	22.7	+0.8	Negligible
R21	23.4	23.9	+0.5	Negligible
R22	38.2	38.5	+0.3	Slight Adverse
R23	18.9	18.9	0.0	Negligible

Receptor	Predicted NO_2 Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2024 Without Development	Scenario 3: 2024 With Development	Change	
R24	18.4	18.4	0.0	Negligible

Table F2: Predicted Annual Mean PM_{10} Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted PM_{10} Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2024 Without Development	Scenario 3: 2024 With Development	Change	
R1	12.4	12.5	+0.1	Negligible
R2	11.8	11.9	+0.1	Negligible
R3	11.7	11.8	+0.1	Negligible
R4	11.4	11.4	+0.1	Negligible
R5	11.7	11.8	+0.1	Negligible
R6	13.0	13.2	+0.2	Negligible
R7	12.0	12.1	+0.1	Negligible
R8	12.8	12.9	+0.1	Negligible
R9	14.0	14.1	+0.1	Negligible
R10	15.0	15.1	+0.1	Negligible
R11	12.9	12.9	0.0	Negligible
R12	16.0	16.1	+0.1	Negligible
R13	13.7	13.7	+0.1	Negligible
R14	11.4	11.4	0.0	Negligible
R15	11.9	11.9	0.0	Negligible
R16	12.7	12.7	0.0	Negligible
R17	11.5	11.5	0.0	Negligible
R18	11.7	11.7	0.0	Negligible
R19	13.7	13.9	+0.2	Negligible
R20	13.6	13.8	+0.2	Negligible
R21	13.9	14.0	+0.1	Negligible
R22	15.4	15.5	+0.1	Negligible
R23	12.5	12.5	0.0	Negligible
R24	12.4	12.4	0.0	Negligible

Table F3: Predicted Annual Mean $PM_{2.5}$ Concentrations and Development Impact at Existing Receptor

Receptor	Predicted PM2.5 Concentrations (µg.m-3)			Impact
	Scenario 2: 2024 Without Development	Scenario 3: 2024 With Development	Change	
R1	8.0	8.1	0.1	Negligible
R2	7.7	7.7	0.1	Negligible
R3	7.6	7.7	0.1	Negligible
R4	7.4	7.4	0.0	Negligible
R5	7.6	7.7	0.1	Negligible
R6	8.5	8.6	0.1	Negligible
R7	7.9	8.0	0.1	Negligible
R8	8.3	8.4	0.1	Negligible
R9	9.0	9.1	0.1	Negligible
R10	9.6	9.7	0.1	Negligible
R11	8.4	8.4	0.0	Negligible
R12	10.2	10.3	0.1	Negligible
R13	8.8	8.9	0.0	Negligible
R14	7.5	7.5	0.0	Negligible
R15	7.7	7.7	0.0	Negligible
R16	8.2	8.2	0.0	Negligible
R17	7.5	7.5	0.0	Negligible
R18	7.6	7.6	0.0	Negligible
R19	8.8	8.9	0.1	Negligible
R20	8.7	8.8	0.1	Negligible
R21	8.9	9.0	0.1	Negligible
R22	9.9	9.9	0.0	Negligible
R23	8.1	8.1	0.0	Negligible
R24	8.0	8.0	0.0	Negligible

The predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for Scenario 2: 2024 Opening Year 'without development' and Scenario 3: 2024 Opening year with development are below the relevant annual mean air quality objectives for all receptors, with one exception. Annual mean NO_2 concentrations at R12 are predicted to exceed the 40µg.m^{-3} objective in both Scenarios 2 and 3 and are indicated in bold.

Predicted changes in NO_2, PM_{10} and $PM_{2.5}$ concentrations are considered to be negligible in accordance with IAQM and EPUK guidance[13], which is 'not significant'. This excludes R12 and R24 for NO_2, where impacts that are considered to be moderate and slight adverse, respectively, are predicted. In reality it is anticipated that the impacts associated with the proposed development would lie between the actual emissions year and sensitivity scenarios and overall, the proposed development is considered to have a negligible impact on air quality, which is 'not significant'.

With regard to short term air quality objectives for NO_2 and PM_{10} at the residential development, the predicted annual mean NO_2 concentrations are less than 60µg.m^{-3} and therefore in accordance with Defra guidance it may be assumed that exceedance of the 1-hour mean NO_2 objective are unlikely. With regard to short term air quality objectives for PM_{10} at the existing receptor locations, the calculation detailed in paragraph 3.10 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

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