AECOM Imagine it. Delivered.

Pogmoor Crossroads Air Quality Assessment

Barnsley Metropolitan Borough Council

Project number: 60545510

July 2018

Quality information

Prepared by	Checked and Approved by
Rachel Perryman Senior Air Quality Consultant	Tom Stenhouse Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
V1	07/06/18	Final	Yes	Tom Stenhouse	Technical Director
V2	24/07/18	Final	Yes	Tom Stenhouse	Technical Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name
-	Yes	Barnsley Metropolitan Borough Council

Prepared for:

Barnsley Metropolitan Borough Council

Prepared by:

Rachel Perryman
Senior Air Quality Consultant

AECOM Limited
5th Floor, 2 City Walk
Leeds LS11 9AR
United Kingdom

T: +44 (0)113 391 6800
aecom.com

© 2018 AECOM Limited. All Rights Reserved.

This document has been prepared by AECOM Limited ("AECOM") for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM.

Table of Contents

1. Introduction 6
2. Policy Context 7
3. Assessment Methodology 11
4. Baseline Conditions 19
5. Results 21
6. Mitigation Measures 26
7. Residual Impacts 29
8. Summary and Conclusion 30

Appendix A : Proposed Scheme 33
Appendix B : AQMA and Modelled Sensitive Receptors 35
Appendix C : Construction Methodology 37
Appendix D : Traffic Data 41
Appendix E :Meteorological Data 43
Appendix F : Model Verification 44
Appendix G : Monitoring Locations 46

Figures

Figure 1: Proposed Scheme 34
Figure 2: AQMA and Modelled Sensitive Receptors 36
Figure 3: Meteorological Data, 2015 43
Figure 4: Council Monitoring Locations 47

Tables

Table 1: Air Quality Objectives 7
Table 2: Examples of Where the Air Quality Objectives Apply 8
Table 3: Criteria to undertake a Detailed Air Quality Assessment 13
Table 4: General ADMS-Roads Model Conditions 13
Table 5: Modelled Sensitive Receptors 15
Table 6: Monitored Annual Mean NO_2 Background Concentrations ($\mu g/m^3$). 16
Table 7: Modelled Annual Mean Background Pollutant Concentrations ($\mu g/m^3$). 16
Table 8: Construction Phase Significance Criteria 17
Table 9: Description of Operational Phase impacts 18
Table 10: Local Air Quality Monitoring 19
Table 11: Risk of Unmitigated Dust Impacts 22
Table 12: Predicted Annual Mean NO_2 Concentrations ($\mu g/m^3$) 22
Table 13: Significance of air quality impacts 24
Table 14: Predicted Annual Mean PM_{10} Concentrations ($\mu g/m^3$) 24
Table 15: Predicted Annual Mean $PM_{2.5}$ Concentrations ($\mu g/m^3$) 25
Table 16: Potential Site Operations and Possible Methods of Controlling Dust 27
Table 17: Examples of Dust Sensitive Receptors 37
Table 18: Potential Earthworks Dust Emission Classification 38
Table 19: Potential Track Out Dust Emission Classification 38
Table 20: Sensitivity of the Area to Dust Soiling Effects on People and Property 39
Table 21: Sensitivity of the Area to Human Health Impacts 39

Table 22: Risk of Dust Impacts – Earthworks and Construction Works 39
Table 23: Risk of Dust Impacts – Track-out 39
Table 24: Traffic Data 41
Table 25: Comparison of Modelled and Monitored NO_2 Concentrations, 2015 44
Table 26: Determination of Modelled and Monitored Rd NO_2 and Modelled Rd NO_X 45
Table 27: Determination of the Adjustment Factor and Total Adjusted NO_2 45

1. Introduction

1.1 AECOM was commissioned to undertake a local air quality assessment for the proposed junction improvements to the existing traffic-light controlled junction at the Broadway/Pogmoor Road crossroads, to the east of the M1, junction 37. The proposed junction improvements, referred to hereafter as 'the scheme', are illustrated in Appendix A.

1.2 Barnsley Metropolitan Borough Council (BMBC) has declared an Air Quality Management Area (AQMA) encompassing residential properties along Dodworth Road between Junction 37 of the M1 and Town End Roundabout due to high concentrations of nitrogen dioxide (NO_2), therefore air quality is considered a concern in this area. Refer to Appendix B which illustrates the location of the scheme in relation to the AQMA.

Scope of the assessment

1.3 A qualitative construction phase assessment has been undertaken with reference to the Institute of Air Quality Management (IAQM, 2014) 'Guidance on the assessment of dust from demolition and construction' to determine the potential dust and vehicle emission effects. Taking into consideration the risk of potential effects, appropriate mitigation measures have been recommended.

1.4 An operational phase assessment has been undertaken in accordance with the Environmental Protection UK/IAQM (EPUK/IAQM, 2017) 'Land-Use Planning & Development Control: Planning for Air Quality'. Detailed dispersion modelling using the ADMS-Roads modelling software was conducted to determine the effect of traffic derived pollutant concentrations at nearby sensitive receptors. The assessment was conducted for the base year (2015) and the following scenarios:

- 2019 DM and DS (with and without the proposed road scheme, excluding other development traffic). This scenario assessed the local air quality impacts of the scheme only. This scenario determined the effectiveness of the road scheme at reducing congestion in the study area and the consequential changes in air quality.
- 2021 DM and DS (with and without the proposed road scheme). This scenario assessed the local air quality impacts of the scheme; however, the traffic data incorporated an appropriate level of traffic associated with developments in the area.
- 2023 DM and DS (with and without the proposed road scheme). This scenario assessed the local air quality impacts of the scheme; however, the traffic data incorporated an appropriate level of traffic associated with developments in the area.

1.5 It should be noted that the assessed scenarios do not include the operation of the Claycliffe link road. This link road will be constructed as developments to the west of Barnsley become operational, to provide an additional access route to and from the city centre. It is unknown when the Claycliffe link road will be constructed. However, once constructed, traffic flow on Dodworth Road will likely reduce and therefore, by assuming the link road is operational after 2023 the air quality assessment is robust.

1.6 Consultation regarding the local air quality assessment methodology was undertaken with Chris Shields, Technical Officer (Pollution Control), Regulatory Services at BMBC, who confirmed the methodology was satisfactory. Chris Shields also confirmed that there was no requirement to undertake a WebTAG assessment or to determine the damage costs of the scheme.

2. Policy Context

European and National Air Quality Legislation and Policy

European Legislation

2.1 European Union (EU) air quality legislation is provided within Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidated previous legislation which was designed to deal with specific pollutants in a consistent manner and provided new air quality objectives for particulate matter with an aerodynamic diameter of less than 2.5µm ($PM_{2.5}$). The consolidated Directives include:

- Directive 99/30/EC - the First Air Quality "Daughter" Directive - sets ambient Air Quality Limit Values (AQLVs) for NO_2, oxides of nitrogen (NOx), sulphur dioxide, lead and particulate matter with an aerodynamic diameter of less than 10µm (PM_{10});
- Directive 2000/69/EC - the Second Air Quality "Daughter" Directive - sets ambient AQLVs for benzene and carbon monoxide; and
- Directive 2002/3/EC - the Third Air Quality "Daughter" Directive - seeks to establish long term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

2.2 The fourth daughter Directive was not included within the consolidation and is described as:

- Directive 2004/107/EC - sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

National Legislation

2.3 The Air Quality Standards Regulations (2010) came into force on 11th June 2010 and transpose the EU Directive 2008/50/EC into UK law. AQLVs were published in these regulations for 7 pollutants, as well as Target Values for an additional 5 pollutants.

2.4 Part IV of the Environment Act (1995) requires UK government to produce a national Air Quality Strategy (AQS) which contains standards, objectives and measures for improving ambient air quality. The most recent AQS was produced by the Department for Environment, Food and Rural Affairs (DEFRA) and published in July 2007 (Defra, 2007). The AQS sets out AQOs that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedances over a specified timescale. These are generally in line with the AQLVs, although the requirements for compliance vary slightly.

2.5 Table 1 presents the AQOs for pollutants considered within this assessment.

Table 1: Air Quality Objectives

Pollutant	Air Quality Objectives	
	Concentration (µg/m^3)	Averaging Period
NO_2	40	Annual mean
	200	1-hour mean; not to be exceeded more than 18 times a year
PM_{10}	40	Annual mean
	50	24-hour mean; not to be exceeded more than 35 times a year
$PM_{2.5}$	25	Annual Mean

2.6 Table 2 summarises the advice provided in DEFRA guidance LAQM (TG16) (Defra 2016) on where the AQOs for pollutants considered within this report apply.

Table 2: Examples of Where the Air Quality Objectives Apply

Averaging Period	Objectives Should Apply At	Objectives Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades 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 Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
24-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and 24-hour mean objectives apply. Kerbside sites (for example, 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 reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

Local Air Quality Management

2.7 The provisions of Part IV of the Environment Act 1995 establish a national framework for air quality management, which requires all local authorities in England, Scotland and Wales to conduct local air quality reviews. Section 82(1) of the Act requires these reviews to include an assessment of the current air quality in the area and the predicted air quality in future years. Should the reviews indicate that the objectives prescribed in the UK Air Quality Strategy (Defra 2007) (AQS) and the Air Quality (England) Regulations (Defra 2010) will not be met; the local authority is required to designate an Air Quality Management Area (AQMA). Action must then be taken at a local level to ensure that air quality in the area improves. This process is known as 'local air quality management' or LAQM.

Dust

2.8 The main requirements with respect to dust control from industrial or trade premises not regulated under the Environmental Permitting (England and Wales) Regulations (2010) and subsequent amendments, such as construction sites, is that provided in Section 79 of Part III of the Environmental Protection Act (1990). The Act defines nuisance as:

> *"any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance."*

2.9 Enforcement of the Act, in regard to nuisance, is currently under the administration of the local Environmental Health Department, whose officers are deemed to provide an independent evaluation of nuisance. If the LA is satisfied that a statutory nuisance exists, or is likely to occur or happen again, it must serve an Abatement Notice under Part III of the Environmental Protection Act (1990). Enforcement can insist that there be no dust beyond the boundary of the works. The only defence is to show that the process to which the nuisance has been attributed and its operation are being controlled according to best practice measures.

National Planning Policy

National Planning Policy Framework

2.10 The National Planning Policy Framework (NPPF) (CLG, 2012) states that "Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the

cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

2.11 The NPPF was supplemented by Planning Practice Guidance (PPG) in March 2014. The PPG states 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 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).

2.12 The decision as to whether air quality is relevant to a planning application may be guided by whether the development would:

- Significantly affect road traffic in the vicinity of the proposed development site (e.g. increased congestion, increases in traffic volume, changes in the vehicle fleet composition).
- 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, biomass boilers or biomass-fuelled CHP plant, centralised boilers or CHP plant.
- Expose people to existing sources of air pollutants e.g. the building of 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.

2.13 The PPG also indicates that with regard to the development management process, should a development (following mitigation) lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or national objectives for pollutants or fail to comply with the requirements of the Habitats Regulations, then consideration should be given to how the proposal could be amended to make it acceptable, or where not practicable, to whether planning permission should be refused.

2.14 Although the NPPF and PPG focuses on 'developments' the same criteria outlined in paragraph 2.12 can be applied to road schemes.

Assessment Guidance

2.15 In addition to the above, the assessment is guided by two key publications;

- Institute of Air Quality Management (EPUK, 2014) 'Guidance on the assessment of dust from demolition and construction', to determine the potential dust and vehicle emission impacts.
- Environmental Protection UK (EPUK)/IAQM 'Land Use Planning & Development Control: Planning for Air Quality' (EPUK/IAQM, 2017).

Local Planning Policy

Barnsley Core Strategy

2.16 Barnsley Core Strategy, adopted in September 2011, provides a spatial strategy for the future development of Barnsley up to the year 2026. The Core Strategy includes the following policies which are relevant to air quality:

CSP 28 Reducing the Impact of Road Travel

We will reduce the impact of road travel by:

- *developing and implementing robust, evidence based air quality action plans to improve air quality*
- *working with our sub regional partners, fleet and freight operators to improve the efficiency of vehicles and goods delivery, and reduce exhaust emissions*

- *implementing measures to ensure the current road system is used efficiently.*

CSP 40 Pollution Control and Protection

Development will be expected to demonstrate that it is not likely to result, directly or indirectly, in an increase in air, surface water and groundwater, noise, smell, dust, vibration, light or other pollution which would unacceptably affect or cause a nuisance to the natural and built environment or to people.

We will not allow development of new housing or other environmentally sensitive development where existing air pollution, noise, smell, dust, vibration, light or other pollution levels are unacceptable and there is no reasonable prospect that these can be mitigated against.

Developers will be expected to minimise the effects of any possible pollution and provide mitigation measures where appropriate.

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.

2.17 The Local Plan is currently being prepared. Once adopted, it will replace the Core Strategy as well as the Unitary Development Plan.

Air Quality Action Plan

2.18 In April 2017, BMBC published its Air Quality Action Plan (AQAP) which outlines actions to improve air quality in Barnsley between 2017 and 2021 and contains a number of actions designed to improve air quality in the AQMA as well as the Borough as a whole.

2.19 These actions include:

- Congestion management;
- Voluntary Bus Agreement;
- Encourage uptake of lower emission vehicles and alternative fuels;
- Planning applications – air quality assessment and mitigation;
- Speed restrictions on gradient Feasibility Study;
- Barnsley Intelligent Transport System (MOVA/SCOOT); and
- Assessment of air quality impact of major traffic schemes.

3. Assessment Methodology

Scope of the Assessment

3.1 The proposed scheme has the potential to impact upon local air quality at nearby sensitive receptors during both construction and operational phases.

3.2 Impacts during the construction phase will be mainly associated with on-site vehicle and plant emissions and dust generation.

3.3 Impacts during the operational phase will be associated with vehicle emissions.

3.4 The following assessment methodology has been agreed with Chris Shields at Barnsley Metropolitan Borough Council (BMBC) via e-mail on 29th March and 16th May 2018. A meeting was also held between AECOM and BMBC on the 21st June 2018 to confirm the operational phase scenarios.

Construction Phase

3.5 The impacts associated with the construction phase of the proposed scheme have been qualitatively assessed with reference to the IAQM published 'Guidance on the assessment of dust from demolition and construction' (IAQM, 2014).

3.6 According to the IAQM, the main air quality impacts that may arise during construction activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes, which are evidence of dust emissions;
- Elevated PM_{10} concentrations, as a result of dust generating activities on site; and
- An increase in concentration of airborne particles and NO_2 due to exhaust emissions from diesel powered vehicles and equipment on site and vehicles accessing the site.

3.7 Information regarding the number of construction phase Heavy Goods Vehicle (HGV) (>3.5 tonnes) movements associated with the scheme were unknown at the time of writing. According to the EPUK Guidance (EPUK, 2010) criteria, a quantitative construction phase assessment of potential emissions from vehicles should only be undertaken for, 'large, long term construction sites that would generate large HGV flows (>200 movements per day) over a period of a year or more'. Taking into consideration the scale of the scheme and the proposed works, it is very unlikely that the EPUK Guidance criteria would be exceeded. Therefore, a quantitative assessment is not considered to be required and the impacts due to vehicle emissions during this phase should be considered insignificant.

3.8 Activities on construction sites are classified into four types to reflect their different potential impacts:

- Demolition;
- Earthworks;
- Construction; and
- Track-out.

3.9 The following steps, as defined by the IAQM, were followed;

- Step 1: Screen the requirement for a detailed assessment. Human and ecological receptors were identified and distance to the scheme and construction routes were determined;
- Step 2: Assess the risk of dust impacts. The potential risk of dust impacts occurring for each activity was determined, based on the magnitude of the potential dust emissions and the sensitivity of the area;
- Step 3: Identify the need for site-specific mitigation. Based on the risk of impacts occurring, site specific mitigation measures were determined; and

- Step 4: Define impacts and their significance. The significance of the potential residual dust impacts (taking mitigation into account) for each activity was determined.

3.10 It should be noted that the IAQM guidance (2014) assessment methodology is more applicable to developments rather than road schemes. As no alternative assessment methodology is available, specifically for road schemes, the construction phase assessment has been undertaken with reference to the IAQM guidance and professional judgement.

3.11 Further details are provided in Appendix C.

Operational Phase

3.12 A detailed level local air quality assessment has been undertaken with reference to the EPUK/IAQM (2015) 'Land-Use Planning & Development Control: Planning for Air Quality' guidance. ADMS roads modelling software has been used to predict concentrations of road transport derived pollutants, NO_2, PM_{10} and $PM_{2.5}$, at selected sensitive receptors. The following scenarios were assessed:

- 2019 DM and DS (with and without the proposed road scheme, excluding other development traffic). This scenario assessed the local air quality impacts of the scheme only. This scenario determined the effectiveness of the road scheme at reducing congestion in the study area and the consequential changes in air quality.
- 2021 DM and DS (with and without the proposed road scheme). This scenario assessed the local air quality impacts of the scheme; however, the traffic data incorporated an appropriate level of traffic associated with developments in the area.
- 2023 DM and DS (with and without the proposed road scheme). This scenario assessed the local air quality impacts of the scheme; however, the traffic data incorporated an appropriate level of traffic associated with developments in the area.

3.13 It should be noted that the assessed scenarios do not include the operation of the Claycliffe link road. This link road will be constructed as developments to the west of Barnsley become operational, to provide an additional access route to and from the city centre. It is unknown when the Claycliffe link road will be constructed. However, once constructed, traffic flow on Dodworth Road will likely reduce and therefore, by assuming the link road is operational after 2023 the air quality assessment is robust.

Assessment Methodology

3.14 The EPUK/IAQM Guidance sets out a two-stage approach to determine the need for an operational phase air quality assessment. Stage 1 uses a criterion to determine if an air quality assessment is required, whilst Stage 2 is applied to assist local authorities to determine the requirements for an appropriate air quality assessment.

3.15 The Stage 1 criteria utilises the number/size of a proposed development as well as the number of proposed car parking spaces to determine the need for an air quality assessment. Due to the nature of this proposal i.e. road scheme, the Stage 1 criterion is not applicable. The proposed scheme will likely result in both adverse and beneficial impacts due to the redistribution of traffic and roads moving closer to some residential properties but further from other. As such, Chris Shields, Technical Officer (Pollution Control) at BMBC, requested an air quality assessment.

3.16 The criterion in Stage 2 provides more specific guidance as to when a quantitative air quality assessment is likely to be required (Table 3).

Table 3: Criteria to undertake a Detailed Air Quality Assessment

The Proposal will:	Indicative Criteria to proceed to an Air Quality Assessment
Realign roads i.e. changing the proximity of receptors to traffic lanes	Where the change is 5m or more and the road is within an AQMA.
Introduce a new junction or remove an existing junction near to relevant receptors	Applies to junctions that causes traffic to significantly change vehicle acceleration/deceleration e.g. traffic lights or roundabouts.
Cause a significant change in Light Duty Vehicles (LDV) traffic flows on local roads within relevant receptors	A change of LDV flow of: • More than 100 AADT within or adjacent to an AQMA. • More than 500 AADT elsewhere.
Cause a significant change in Heavy Duty Vehicles (HDV) flows on local roads with relevant receptors	A change of HDV flows of: • More than 25 AADT within or adjacent to an AQMA • More than 100 AADT elsewhere.

3.17 Dodworth Road lies within the BMBC AQMA 2A (Appendix B). The scheme will introduce a gyratory system to reduce congestion at the Broadway/ Pogmoor Road crossroads. As such new junctions will be constructed as well as the realignment of existing roads (Appendix A). In addition, the AADT on Dodworth Road is anticipated to increase due to the proposed scheme and as developments to the west of Barnsley become operationa (further details are provided in the 'traffic data' section below. As such the criterion in Table 2 is exceeded and a detailed quantitative air quality assessment is required.

Emissions Modelling

3.18 This assessment has used the latest version of dispersion model software ADMS-Roads (v4.1.1) to quantify baseline and with-scheme pollution levels at selected receptors. ADMS-Roads is a modern dispersion model that has an extensive published track record of use in the UK for the assessment of local air quality impacts, including model validation and verification studies.

3.19 Details of general model conditions are provided in Table 4.

3.20 The 2015 emission rates were applied to the base year scenario; however to reflect a degree of improvement between 2015 and 2019, 2017 emission factors were applied to the 2019 modelled scenarios. The rate of improvement in vehicle emission factors further into the future is more uncertain. Some modest improvement (rather than no improvement) has been assumed: 2018 emission rates were applied to the 2021 modelled scenarios and 2019 emission rates were applied to the 2023 scenarios.

Table 4: General ADMS-Roads Model Conditions

Variables	ADMS Roads Model Input
Surface roughness at source	0.5
Minimum Monin-Obukhov length for stable conditions	30
Terrain types	Flat
Receptor location	X, Y and Z coordinates determined by GIS
Emissions	NO_X, PM_{10} and $PM_{2.5}$, based on the traffic data supplied
Emission factors	Emission Factor Toolkit (Version 8.0.1)
Meteorological data	Hourly sequential data from Robin Hood Airport in 2015
Emission profiles	None assumed
Receptors	Selected receptors only
Model output	Long-term annual mean road contributions for NO_X, PM_{10} and $PM_{2.5}$

Conversion of NO_X to NO_2

3.21 The proportion of NO_2 in NO_X varies greatly with location and time according to a number of factors including the amount of oxidant available and the distance from the emission source. NO_X concentrations are expected to decline in future years due to falling emissions, therefore NO_2 concentration will not be limited as much by ozone and consequently it is likely that the NO_2/NO_X ratio will in the future increase. In addition, a trend has been noted in recent years whereby roadside NO_2 concentrations have been increasing at certain roadside monitoring sites, despite emissions of NO_X falling. The direct NO_2 phenomenon is having an increasingly marked effect at many urban locations throughout the UK and must be considered when undertaking modelling studies.

3.22 In this study modelled NO_X values were converted to NO_2 using the 'NO_X to NO_2' calculator (V6.1), released in October 2017, and available at the Air Quality Archive. The year and region for which the modelling has been undertaken are specified and local factors, such as an appropriate factor of NO_X emitted as NO_2, are used in the calculation.

Traffic Data

3.23 Traffic data in the form of Annual Average Daily Traffic (AADT) flows, number of HGVs (vehicles greater than 3.5t) and average vehicle speeds for all road links within the model domain and for all modelled scenarios were provided by the project transport consultants (AECOM). Refer to Appendix D.

3.24 Base year traffic data was provided for 2014. However, the current emission factor toolkit only provides vehicle emission rates from 2015 onwards. As such, 2015 was selected as the base year, with 2015 meteorological data, monitoring data and emission factors applied to the model. This approach assumes that there was negligible difference in traffic between 2014 and 2015.

3.25 Vehicle speeds were provided and applied to the model for the relevant links, although were reduced near junctions to account for congestion. The purpose of the scheme is to alleviate congestion at the Broadway/Pogmoor Road crossroads. The speed profile reflects this.

3.26 The following should be noted in the traffic data applied to the model:

- There is a significant increase in vehicle flows (particularly the number of HGVs) travelling southwards on the M1 between 2014 and 2019 and a significant decrease in the number of vehicles using the slip roads on and off the M1 northbound carriageway at junction 37. This is due to the construction of the Birdwell improvements at junction 36 of the M1, which encourages more vehicles to use junction 36 to access Barnsley rather than junction 37. These improvements were completed in 2016/2017 and therefore included in the 2019, 2021 and 2023 scenarios.
- The scheme will result in a significant increase in the number of vehicles in the DS scenarios compared to the DM scenarios on Dodworth Road. This is due to the scheme resulting in a reduction in congestion at the Broadway/Pogmoor Road crossroads, particularly during the AM peak which draws additional traffic onto the corridor in the DS scenario. In reality this will result in a reduction in traffic elsewhere on other access roads into Barnsley.
- The 2021 and 2023 DS scenarios include traffic associated with developments in the area. Assumptions were made by the project transportation team with regards to an 'appropriate' level of development which would be operational in 2021 and 2023. All assumptions were agreed with BMBC.

Receptors

3.27 Air quality receptors sensitive to changes in air quality typically include residential properties, schools, care homes, hospitals and designated ecological sites.

3.28 Thirteen sensitive receptors were selected, all of which were residential properties. The receptors were selected based on the traffic data and their proximity to the roads so as to ensure that the greatest impacts (adverse and beneficial) of the scheme were modelled. Eleven out of the thirteen receptors were located within the AQMA.

3.29 In addition, as requested by BMBC an additional receptor (14) was selected to represent a playpark proposed on the vacant area in the middle of the scheme. At this location the hourly NO_2 objective is of relevance. According to the LAQM.TG(16) (Defra, 2016), 'exceedences of the NO_2 1-hour mean are unlikely to occur where the annual mean is below 60 $\mu g/m^3$'.

3.30 Annual mean NO_2 concentrations have also been predicted at two monitoring sites, DT19 and CM2. DT19 is located on Dodworth Road, west of the crossroads and is considered to be representative of relevant exposure. The continuous monitor (CM2) is located adjacent to the crossroads.

3.31 The air quality sensitive receptors considered in this assessment are shown in Appendix B and listed in Table 5.

3.32 There are no ecological receptors in the vicinity of the site.

Table 5: Modelled Sensitive Receptors

ID	In AQMA?	Location	Height (m)	X	Y
1	No	Pogmoor Road	1.5	432593	406356
2	No	Pogmoor Road/White Hill Avenue	1.5	432606	406258
3	Yes	Dodworth Road/Pogmoor Road	1.5	432651	406159
4	Yes	Dodworth Road/Broadway	1.5	432656	406128
5	Yes	Dodworth Road west	1.5	432718	406163
6	Yes	Dodworth Road centre	1.5	432744	406178
7	Yes	Dodworth Road east	1.5	432927	406272
8	Yes	Dodworth Road, adjacent to recreation ground	1.5	432911	406302
9	Yes	Dodworth Road, near Moorland Avenue	1.5	432537	406064
10	Yes	Dodworth Road, near M1 junction 37	1.5	432396	406020
11	Yes	Dodworth Road, near May Terrace	1.5	433201	406340
12	Yes	Dodworth Road, west of Shaw Lane	1.5	433366	406296
13	Yes	Dodworth Road, east of Shaw Lane	1.5	433480	406291
14	No	Playpark	1.5	432718	406309
15	Yes	DT19	1.7	432680	406174
16	Yes	CM2	2.75	432481	406068

Meteorological Data

3.33 The meteorological dataset used in the assessment was recorded at the meteorological station at Robin Hood airport, Doncaster, in 2015, located approximately 35 km to the south east of the proposed scheme.

3.34 The meteorological site is considered to be representative of regional meteorological conditions and sufficient to satisfy the requirements of this assessment. The wind rose for this site and further details are provided in Appendix E.

Background Pollutant Concentration Data

3.35 A large number of sources of air pollutants exist which individually may not be significant, but collectively, over a large area, need to be considered. The concentrations calculated by the model due to vehicle emissions can then be added to these background concentrations to give the total concentration.

Monitored Concentrations

3.36 BMBC undertakes NO_2 monitoring at four urban background locations. No monitoring of PM_{10} is undertaken at background locations

Table 6: Monitored Annual Mean NO_2 Background Concentrations (µg/m^3).

ID[A]	Type	Distance from study area	2013	2014	2015	2016
CM3	Continuous Monitor	1.2km	22.0	19.0	19.0	19.0
DT10 (DT62)	Diffusion tube	3.5km	28.8	30.3	29.6	29.1
DT29 (DT2)	Diffusion Tube	5.5km	31.0	32.8	32.7	31.3
DT45 (DT18)	Diffusion Tube	13.5km	22.2	23.9	23.7	24.1

[A] Numbers in brackets were diffusion tube ID numbers between 2013 and 2015.

3.37 Annual mean NO_2 concentrations at all four sites have remained fairly stable between 2013 and 2016. However, BMBC have provided 2017 annual mean NO_2 concentrations at CM3 of 16.1µg/m^3, which indicates a slight reduction compared to previous years.

3.38 Annual mean NO_2 concentrations recorded at DT10 and DT29 were significantly higher than at CM3 and DT45. The reason for this is that sites DT10 and DT29 are located within 40 m of the M1 and therefore the measured concentrations will be influenced by emissions from the road.

3.39 DT45 and CM3 are located approximately 13.5 km to the south east and 1.1 km to the north of the proposed road scheme, respectively.

Modelled Concentrations

3.40 Modelled estimations of background air quality concentrations are provided by Defra for each 1 km square in the UK for each year between 2015 and 2030. Road sources were discounted from the total background pollutant concentrations, to give 'adjusted' values. The estimated background concentrations for the Ordnance Survey grid square containing the proposed scheme are provided in Table 7 for 2015 (base year) and 2019 (proposed opening year). These data were downloaded in April 2018.

Table 7: Modelled Annual Mean Background Pollutant Concentrations (µg/m^3).

Pollutant	2015	2019
NO_2	13.7	11.7
PM_{10}	12.1	11.7
$PM_{2.5}$	7.9	7.6

3.41 The Defra modelled background concentrations assume that both NO_2 and particulate matter concentrations will decrease year on year. However, the BMBC monitoring sites indicate that annual mean NO_2 concentrations in fact have remained relatively stable between 2013 and 2016

3.42 It is preferential to use monitored rather than modelled background concentrations for modelling purposes. Therefore, annual mean NO_2 concentrations recorded at CM3 in 2015 were applied to the model (19 µg/m^3) in the base year. However, to reflect the decrease in annual mean NO_2 concentrations monitored at CM3, 2017 concentrations (16.1 µg/m^3) were applied to the 2019, 2021 and 2023 scenarios.

3.43 As no monitoring of PM_{10} or $PM_{2.5}$ is undertaken at background locations, Defra modelled concentrations were applied to the air quality model. A cautious approach was taken and it was assumed that there were no improvements in background PM_{10} and $PM_{2.5}$ concentrations between 2015 and 2023.

Model Verification

3.44 When using modelling techniques to predict concentrations, it is necessary to make a comparison between the modelling results and available roadside monitoring data, to ensure that the model is reproducing actual observations. The accuracy of the future year modelling results are relative to the accuracy of the base year results, therefore greater confidence can be placed in the future year concentrations if good agreement is found for the base year.

3.45 Modelling results are subject to systematic and random error; such errors arise due to many factors, such as uncertainty in the traffic data and the composition of the vehicle fleet, and uncertainty in the meteorological dataset. This can be considered by factoring the modelled results against monitoring data.

3.46 This is referred to as model verification. The first step of which is to compare the road NO_X contributions predicted and monitored at the same locations in the modelled base year 2015. It was then noted that there were three distinct areas within the study, with varying degrees of how well the modelled concentrations compared to the monitored concentrations.

- Area 1: Dodworth Road between M1 junction 37 and Moorland Avenue;
- Area 2: North of Dodworth Road
- Area 3: South of Dodworth Road.

3.47 Three separate adjustment factors were calculated to account for the bias (Area 1: 2.39, Area 2: 1.07 and Area 3: 1.98). These factors were applied to the modelled road NO_X contribution, before being converted into total NO_2 concentrations. Further details are provided in Appendix F.

3.48 To quantify the accuracy of the dispersion model, the Root Mean Square Error (RMSE) is calculated. According to current Defra guidance (LAQM, 2016), an RMSE that is within 10% of measured values is considered the ideal. Following adjustment, the RMSE for the Pogmoor Road dispersion model is 2.0 $\mu g/m^3$ (5%).

3.49 The appropriate adjustment factor has been applied to the predicted road contributions of NO_X, PM_{10} and $PM_{2.5}$ at all receptor locations considered in this assessment.

Significance Criteria

Construction Phase

3.50 For amenity effects (including that of dust), the aim is to bring forward a scheme, including mitigation measures if necessary, that does not introduce the potential for additional complaints to be generated as a result of the scheme.

3.51 The scale of the risk of adverse effects occurring due to each group of activities, with mitigation in place is described using the terms high, medium and low risk. The basis for the choice of descriptor is set out for each section. Experience in the UK is that good site practice is capable of mitigating the impact of fugitive emissions of particulate matter effectively. So that in all but the most exceptional circumstances, effects at receptors (Table 8) can be controlled to ensure effects are of negligible or slight adverse significance at worse.

Table 8: Construction Phase Significance Criteria

Significance of Effect at Single Receptor	Description
Substantial	Standard practice mitigation measures not sufficient to control particulate emissions with impacts beyond the site boundary and complaints likely. A significant effect that is likely to be a material consideration in its own right
Moderate	Standard practice mitigation measures generally sufficient to control particulate emissions with limited impact beyond the site boundary and some complaints possible. A significant effect that may be a material consideration in combination with other significant effects, but is unlikely to be a material consideration in its own right.
Slight	Standard practice mitigation measures sufficient to control particulate emissions with limited impact beyond the site boundary, but complaints remain unlikely. An effect that is not significant but that may be of local concern.
Negligible	Standard practice mitigation measures sufficient to control particulate emissions to the extent that no impact is detected beyond the site boundary and no complaints are likely. An effect that is not significant change.

Operational Phase

3.52 Air quality effects may be considered to be significant if air quality objectives are predicted to be breached or if the scheme leads to significant effects on air quality due to road traffic emissions at sensitive receptors. According to EPUK/IAQM Guidance there is a two-stage process to be followed in the assessment:

- Magnitude: a qualitative or quantitative description of the impacts on local air quality arising from the scheme; and
- Significance: a judgement on the overall significance of the effects of any impacts.

3.53 The EPUK/IAQM states that a meaningful description to the degree of an impact is to express the magnitude of incremental change as a proportion of a relevant assessment level, and then to examine this change in the context of the new total concentration and its relationship with the assessment criterion.

Table 9: Description of Operational Phase impacts

Long term average Concentration at receptor in assessment year	% change in concentration relative to Air Quality Assessment Level (AQAL)			
	< 2	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

3.54 An air quality effect can be described as ‘significant’ or ‘not significant’. The impact descriptors in Table 9, are intended for application at the modelled sensitive receptors and whilst there may be a ‘slight’, ‘moderate’ or ‘substantial’ impact at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances. Any judgement on the overall significance of the effects of a development will need to take into account such factors as:

- The existing and future air quality in the absence of the road scheme;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

4. Baseline Conditions

4.1 The local air quality management review and assessment responsibilities for the area encompassing the proposed junction improvements are undertaken by BMBC.

4.2 BMBC have declared six AQMAs within the Borough, all with respect to the annual mean NO_2 objective. AQMA 2a includes residential properties along Dodworth Road between Junction 37 of the M1 motorway and Town End Roundabout, including a portion of Summer Lane. The location of the road scheme in relation to the AQMA is illustrated in Appendix B.

Pollutant Monitoring

4.3 BMBC operates an extensive network of NO_2 passive and automatic air quality monitoring equipment.

4.4 A summary of the air quality monitoring sites nearest to the proposed road scheme are provided in Table 10. All these sites are located within the AQMA and include a continuous monitor (CM2) and diffusion tubes DT14 to DT23. The location of these sites is illustrated in Appendix B.

4.5 Table 10 provides the annual mean NO_2 concentrations within the study area between 2013 and 2016. It should be noted that, where appropriate, BMBC distance corrected the monitored concentrations to the nearest relevant exposure and report these. However, for 2015 (modelled base year) both monitored concentrations and distance corrected concentrations are reported in Table 10.

4.6 The monitored annual mean NO_2 concentrations indicated that concentrations were generally higher in 2014 than 2013, and lower in 2016 than 2013within AQMA 2a. Despite this, concentrations continued to slightly exceed the objective at one site in 2016, located on Dodworth Road (DT21). This is due to the steep gradient of Dodworth Road at this point as vehicles' emission rates increase as more acceleration is required due to the gradient of the road.

4.7 Annual mean NO_2 concentrations were generally lower in 2014 than 2013 at the continuous monitor but were higher in 2015 and 2016.

Table 10: Local Air Quality Monitoring

ID[A]	Type	Annual Mean NO_2 Concentration ($\mu g/m^3$)			
		2013	2014	2015[B]	2016
CM2	Roadside	37.0	35.0	39.0	36.0
DT14 (17)	Roadside	34.9	37.3	(49.8) 36.3	36.1
DT15/16/17 (49/50/51)	Roadside	-	-	38.6	35.2
DT18 (52)	Roadside	38.4	40.0	(44.4) 38.2	32.6
DT19 (53)	Roadside	30.8	34.1	30.9	28.1
DT20 (69)	Roadside	37.5	38.2	(44.7) 34.4	33.8
DT21 (54)	Roadside	42.2	45.9	(58.1) 44.8	40.3
DT22 (55)	Kerbside	40.8	41.7	(53.2) 40.1	38.3
DT23 (56)	Roadside	39.9	39.1	(49.8) 38.2	38.3

[A] Numbers in brackets were diffusion tube ID numbers between 2013 and 2015. [B] Numbers in brackets were monitored concentrations at diffusion tubes

4.8 No monitoring of PM_{10} or $PM_{2.5}$ is undertaken near to the proposed road scheme.

5. Results

Construction Phase

5.1 A four-step process was followed to determine the risk of potential effects during the construction phase.

STEP 1: Screen the Requirement for a Detailed Assessment

5.2 The nearest sensitive receptors to the proposed scheme are the residential properties on Pogmoor Road, Dodworth Road, Garden Court and Grosvenor View. The nearest of which is located on Dodworth Road, approximately 25 m from the propose construction works associated with the scheme.

5.3 It is anticipated that construction traffic will access the site from the M1 and A628. Residential properties are located adjacent to the A628 between the site and the M1.

5.4 There are no ecological receptors, as defined by the IAQM Guidance, located within 50m of the Site.

5.5 Taking the above into consideration, according to the IAQM guidance, a detailed construction phase assessment has been undertaken.

STEP 2: Assess the Risk of Dust Impacts

STEP 2A – Define the Potential Dust Emission Magnitude

Demolition

5.6 Part of the proposed scheme is currently occupied by Penny Pie Park. With the exception of the existing playpark, no demolition works will be undertaken. As such, potential dust effects during the demolition works are considered insignificant and not considered further in this assessment.

Earthworks & Construction

5.7 With respect to road schemes, earthworks and construction works will be undertaken simultaneously. With reference to the IAQM guidance and using professional judgement a single 'potential dust emission' magnitude has been determined for both activities. Taking into consideration the size of the site and proposed works, the potential dust emission class is considered to be '**Medium'**.

Track-Out

5.8 With regard to the criteria for the dust-generating potential of the surface material and the length of unpaved road, it is considered appropriate to classify the potential dust effects as **'Small'**.

STEP 2B – Define the Sensitivity of the Area

5.9 The following were taken into consideration when determining the sensitivity of the area to dust soiling and health impacts of PM_{10}:

- The Site is located in a residential area on the outskirts of Barnsley. The site is surrounded by residential dwellings and therefore the receptor sensitivity is considered to be High;
- It is estimated that there will be < 10 residential properties located within 20m of the works; and
- No background monitoring of PM_{10} is undertaken by STBC; however, the modelled PM_{10} concentrations provided by Defra predicted a concentration of 12.1/m^3 in 2015 (Table 7).

5.10 Taking the above into consideration the sensitivity of the area to dust soiling effects is 'Medium' and 'Low' for human health effects.

STEP 2C – Define Risk of Impacts

5.11 Taking into consideration the conclusion from Steps 2A and 2B, the risk of dust impacts for each activity are provided in Table 11.

Table 11: Risk of Unmitigated Dust Impacts

Source	Dust Soiling	Human Health
Earthworks & Construction	Medium	Low
Track-out	Negligible	Negligible

5.12 Step 3 and Step 4 of the construction dust assessment are considered later in this chapter.

Operational Phase

5.13 The predicted annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ at the selected sensitive receptors in the 2019, 2021 and 2023 with and without the scheme are listed in the following Tables. The tables also provide the predicted change in concentration at the modelled sensitive receptors.

Nitrogen Dioxide

5.14 Modelled annual mean NO_2 concentrations for all scenarios are provided in Table 12.

Table 12: Predicted Annual Mean NO_2 Concentrations (µg/m^3)

	Annual Mean NO_2 Concentrations						Change in Concentrations		
	2019 DM	2019DS	2021DM	2021DS	2023DM	2023DS	2019	2021	2023
1	22.5	23.2	21.9	22.6	21.4	22.0	0.7	0.7	0.6
2	22.1	21.0	21.6	20.6	21.1	20.3	-1.1	-1.0	-0.9
3	36.7	29.9	35.0	28.8	33.5	27.9	-6.8	-6.2	-5.6
4	**45.6**	37.3	**43.3**	35.7	**41.2**	34.3	-8.3	-7.6	-6.8
5	38.0	38.2	36.5	36.5	34.9	34.9	0.2	0.0	0.0
6	32.0	32.7	30.9	31.6	29.8	30.2	0.7	0.7	0.4
7	25.5	28.9	24.9	28.0	24.3	27.0	3.4	3.0	2.7
8	22.3	25.0	21.9	24.3	21.5	23.6	2.7	2.3	2.1
9	39.2	37.6	37.1	35.9	35.4	34.5	-1.6	-1.2	-0.9
10	**46.3**	**43.9**	**44.1**	**41.8**	**41.8**	39.7	-2.4	-2.3	-2.1
11	22.4	25.2	21.9	24.5	21.4	23.8	2.8	2.6	2.4
12	23.4	25.8	23.0	25.0	22.3	24.3	2.4	2.0	1.9
13	24.8	27.0	23.7	25.5	22.4	23.9	2.2	1.8	1.5
14	-	23.7	-	23.1	-	22.6	-	-	-
DT19	27.2	26.3	26.2	25.5	25.4	24.7	-0.9	-0.7	-0.6
CM2	35.8	34.3	34.3	32.8	32.8	31.5	-1.5	-1.5	-1.3

5.15 Annual mean NO_2 concentrations were predicted to decrease between 2019 and 2023, if the proposed scheme does not go ahead, due to improvements in vehicle exhaust emission rates. Despite this, exceedences of the NO_2 objective were predicted at two of the selected receptors (4 and 10) in all three assessed years; however, if the scheme goes ahead then annual mean NO_2 concentrations were predicted to reduce at Receptor 4 to below the objective and therefore only receptor 10 was predicted to remain above the objective, although by 2023, concentrations at receptor 10 are predicted to be just below the objective.

5.16 According to Table 12, if the proposed scheme goes ahead then both beneficial and adverse annual mean NO_2 impacts were predicted to be experienced in all three assessment years.

5.17 In 2019, beneficial impacts were predicted to be experienced on Dodworth Road, west of the existing Pogmoor Crossroads (Receptors 3,4,9 and 10) and on Pogmoor Road (Receptors 2 and 3) in all three assessment years. The largest beneficial impacts were predicted at Receptors 3 and 4. Annual mean NO_2 reductions of up to 8.3$\mu g/m^3$ were predicted at these receptors. The predicted beneficial impacts were due to two reasons. Firstly, the existing Pogmoor Road, south of the railway line will be closed to vehicles, except those accessing White Hall Avenue. The new road will be constructed approximately 30 m to the east of the existing Pogmoor Road, thus moving traffic further from Receptors 2 and 3. Secondly, the proposed road scheme will reduce congestion at the Broadway/Pogmoor Road junction.

5.18 In 2019, adverse impacts were predicted at sensitive receptors on Dodworth Road, east of the proposed scheme. The reason for this increase in NO_2 concentration is due to the redistribution of traffic associated with the scheme. For example, vehicles on Pogmoor Road, heading to the M1, previously turned right at the Broadway/Pogmoor Road junction; however, these vehicles must now travel round the new gyratory and along Dodworth Road, passing Receptors 5 to 8 to gain access to the M1, thus increasing the traffic flow on this stretch of Dodworth Road. In addition, as part of the scheme, a new junction will be constructed opposite Receptors 5 and 6, with a second junction located to the west of Receptors 7 and 8. This will result in increased emissions near these properties and therefore an increase in NO_2 concentrations. Also, the scheme will reduce congestion at the Broadway/Pogmoor Road crossroads which will in turn attract more vehicles to use the corridor to gain access to Barnsley on Dodworth Road. It is this reason for the impacts predicted at Receptors 11, 12 and 13.

5.19 As discussed, scenarios 2021 and 2023 include traffic flows associated with developments in the areas which are likely to be constructed and operational by these years. Table 12 indicates that in both these years beneficial and adverse are anticipated. Larger impacts were predicted in 2021 than 2023 due to assumed improvements in emission factors applied to the model, despite higher levels of traffic flow in the 2023 scenario as more developments become operational. Similarly to above, beneficial impacts were predicted at sensitive receptors on Dodworth Road, west of the Pogmoor Crossroads and on Pogmoor Road, whilst adverse impacts were predicted on Dodworth Road, east of the scheme.

5.20 Annual mean NO_2 concentrations at Receptor 14 (playpark) were predicted to be well below the objective and therefore it can be concluded that exceedences of the NO_2 1-hour mean are unlikely to occur.

5.21 In accordance with the EPUK/IAQM Guidance, the significance of the predicted impacts have been provided (Table 13). The significance of the impacts was determined based on change in concentration predicted associated with the proposed scheme as well as the absolute concentrations predicted.

Table 13: Significance of air quality impacts

	Significance of Impact		
	2019	2021	2023
1	Negligible	Negligible	Negligible
2	Negligible	Negligible	Negligible
3	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial
4	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial
5	Slight Adverse	Negligible	Negligible
6	Negligible	Negligible	Negligible
7	Slight Adverse	Slight Adverse	Slight Adverse
8	Slight Adverse	Slight Adverse	Slight Adverse
9	Slight Beneficial	Slight Beneficial	Negligible
10	Substantial Beneficial	Moderate Beneficial	Moderate Beneficial
11	Slight Adverse	Slight Adverse	Slight Adverse
12	Slight Adverse	Slight Adverse	Negligible
13	Slight Adverse	Negligible	Negligible
DT19	Negligible	Negligible	Negligible
CM2	Slight Beneficial	Slight Beneficial	Slight Beneficial

According to Table 13, beneficial impacts of up to substantial significance were predicted at sensitive receptors, whilst adverse impacts of up to slight significance were predicted.

Particulate Matter

5.22 Modelled annual mean PM_{10} and $PM_{2.5}$ concentrations for all scenarios are provided in Tables 14 and 15.

Table 14: Predicted Annual Mean PM_{10} Concentrations (µg/m^3)

	Annual Mean PM_{10} Concentrations						Change in Concentrations		
	2019 DM	2019DS	2021DM	2021DS	2023DM	2023DS	2019	2021	2023
1	12.9	13.1	12.9	13.0	12.9	13.0	0.2	0.2	0.2
2	12.8	12.8	12.8	12.8	12.8	12.8	-0.1	0.0	0.0
3	14.2	14.1	14.1	14.0	14.1	14.0	-0.1	-0.1	-0.1
4	15.2	15.2	15.2	15.2	15.1	15.1	0.0	0.0	0.1
5	14.3	14.9	14.2	14.8	14.2	14.8	0.6	0.6	0.6
6	13.9	14.3	13.9	14.3	13.8	14.3	0.4	0.5	0.4
7	13.4	13.8	13.3	13.8	13.3	13.8	0.5	0.5	0.5
8	12.9	13.3	12.9	13.3	12.9	13.3	0.4	0.4	0.4
9	15.2	15.3	15.1	15.3	15.1	15.2	0.2	0.2	0.2
10	16.1	16.2	16.0	16.2	15.9	16.1	0.1	0.1	0.2
11	13.0	13.3	13.0	13.3	13.0	13.2	0.2	0.2	0.2
12	13.1	13.3	13.1	13.3	13.1	13.3	0.2	0.2	0.2
13	13.3	13.5	13.2	13.5	13.2	13.4	0.3	0.2	0.2
14	-	13.2	-	13.2	-	13.2	-	-	-
DT19	13.5	13.6	13.5	13.5	13.4	13.5	0.1	0.1	0.1
CM2	14.1	14.5	14.0	14.4	14.0	14.4	0.4	0.4	0.4

Table 15: Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m^3)

	Annual Mean $PM_{2.5}$ Concentrations						Change in Concentrations		
	2019 DM	2019DS	2021DM	2021DS	2023DM	2023DS	2019	2021	2023
1	8.5	8.6	8.4	8.5	8.4	8.5	0.1	0.1	0.1
2	8.4	8.4	8.4	8.4	8.4	8.4	0.0	0.0	0.0
3	9.3	9.2	9.2	9.1	9.2	9.1	-0.1	-0.1	-0.1
4	9.9	9.8	9.8	9.8	9.8	9.7	-0.1	-0.1	0.0
5	9.3	9.7	9.3	9.6	9.2	9.6	0.3	0.3	0.3
6	9.1	9.3	9.0	9.3	9.0	9.2	0.2	0.3	0.2
7	8.7	9.0	8.7	9.0	8.7	9.0	0.3	0.3	0.3
8	8.5	8.7	8.5	8.7	8.4	8.7	0.2	0.2	0.2
9	9.8	9.9	9.8	9.8	9.7	9.8	0.1	0.1	0.1
10	10.4	10.5	10.3	10.4	10.2	10.3	0.0	0.1	0.1
11	8.5	8.7	8.5	8.7	8.5	8.6	0.2	0.1	0.1
12	8.6	8.7	8.5	8.7	8.5	8.7	0.1	0.1	0.1
13	8.7	8.9	8.6	8.8	8.6	8.7	0.2	0.2	0.1
14		8.6		8.6		8.6			
DT19	8.8	8.8	8.8	8.8	8.8	8.8	0.0	0.0	0.0
CM2	9.2	9.4	9.1	9.4	9.1	9.3	0.2	0.2	0.2

5.23 Annual mean concentrations of PM_{10} and $PM_{2.5}$ were well below the objective regardless of whether the proposed road scheme goes ahead or not. According to EPUK and IAQM guidance, negligible changes in PM_{10} and $PM_{2.5}$ concentrations were predicted at all modelled receptors.

Summary

5.24 Overall, the proposed scheme is considered to improve air quality within the AQMA, declared by BMBC, on Dodworth Road. At sensitive receptors located to the west of the crossroads, the proposed scheme is predicted to result in large reductions in annual mean NO_2 concentrations of up to substantial significance. The proposed scheme will continue to result in improvements in NO_2 concentrations in this area, even when additional traffic flows associated with nearby developments are included. By 2023, annual mean NO_2 concentrations are anticipated to be below or close to the objective. To the east of the crossroads, slight adverse impacts are predicted at sensitive receptors; however, the absolute concentrations will remain below the objective. All modelled receptors were anticipated to experience annual mean PM_{10} and $PM_{2.5}$ concentrations below the objective in all scenarios with negligible impacts.

6. Mitigation Measures

Construction phase

6.1 Determining site-specific mitigation measures corresponds to Step 3 of the assessment methodology (Section 3.2).

6.2 A number of mitigation measures can be adopted to reduce the production and/or dispersal of dust to lessen the nuisance and limit the human health impacts. Ideally dust should be controlled at the source as once airborne it is difficult to suppress.

6.3 Appropriate mitigation measures are provided in the IAQM 'Guidance on the assessment of dust from demolition and construction' (IAQM, 2014). However, additional mitigation measures are provided in the following guidance documents:

- BRE (2003a): Guidance on the Control of Dust from Construction and Demolition Activities;
- BRE (2003b): Controlling Particulates, Vapours and Noise Pollution from Construction Sites; and,
- Greater London Councils (2006): The control of dust and emissions from construction and demolition: Best Practice Guidance.

6.4 According to the IAQM Guidance (IAQM, 2014), the dust risk for each of the activities determined in Step 2C should be used to define the appropriate site specific mitigation measures to be adopted. Where a negligible risk of dust impacts was determined, no mitigation measures, beyond those required by legislation are required. However, mitigation measures may be applied as part as good practice.

6.5 Appropriate mitigation measures, taking into consideration the risk of dust impacts determined in Step 2C, are provided in Table 16. Mitigation should be implemented through a site-specific Construction Environmental Management Plan (CEMP), and the measures should be enforced and adhered to. Contractors should also carry the 'Considerate Contractors' registration.

Table 16: Potential Site Operations and Possible Methods of Controlling Dust

Activity	Possible Dust Control Methods
Communication	• Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. • Display the head or regional office contact information.
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. • Make the complaints log available to the local authority when asked. • Record any exceptional incidents that cause dust and/or air emissions, either on or off site and the action taken to resolve the situation in the log book
Monitoring	• Undertake daily on-site and off-site inspections, where receptors (including roads) are nearby, to monitor dust, record inspection results and make the log available to the local authority when asked. • Carry out regular site inspections, record inspection results and make an inspection log available to the local authority when asked. • 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 site layout so that machinery and dust causing activities are located away from receptors as far as possible. • Erect solid screens or barriers around dusty activities that are at least as high as any stockpiles on site. • Remove materials that have a potential to produce dust from site as soon as possible unless being re-used on site. • 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. • 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 unsurfaced haul roads and work area.
Operations	• Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation • Use enclosed chutes and conveyors and covered skips • Minimise drop heights
Waste Management	• Avoid bonfires and burning of waste materials
Earthworks & Construction	• Re-vegetate earthworks and exposed areas/ soil stockpiles to stabilise surfaces as soon as practicable. • Use Hessian or mulches where it is not possible to re-vegetate or cover the topsoil as soon as practicable. • Only remove the cover in small areas during work and not all at once. • Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out
Track out	• Use water assisted dust sweeper(s) on the access and local roads, to remove, as necessary any material tracked out of the site. • Avoid dry sweeping of large areas. • Ensure vehicles entering and leaving the site are covered to prevent escape of materials during transport. • Implement a wheel washing system.

Operational Phase

6.6 The operational phase air quality assessment indicated that the proposed scheme will result in both beneficial and adverse impacts. At sensitive receptors located to the west of the crossroads, the proposed scheme is predicted to result in large reductions in annual mean NO_2 concentrations of up to substantial significance. By 2023, annual mean NO_2 concentrations in this area are anticipated to be below or close to the objective. To the east of the crossroads, slight adverse impacts are predicted at sensitive receptors; however, the absolute concentrations will remain below the objective. All modelled receptors were anticipated to experience annual mean PM_{10} and $PM_{2.5}$ concentrations below the objective in all scenarios with negligible impacts.

6.7 As such no project specific operational phase mitigation measures are required.

7. Residual Impacts

Construction Phase

7.1 Determining the residual impacts corresponds to Step 4 of the assessment methodology.

7.2 The impacts associated with the construction phase of the proposed development have been qualitatively assessed with reference to the Institute of Air Quality Management (IAQM) published draft 'Guidance on the assessment of dust from demolition and construction' (IAQM, 2014).

7.3 The IAQM guidance states that '*in the case of demolition / construction it is assumed that mitigation (secured by planning conditions, legal requirements or required by regulations) will ensure that a potential significant adverse effect will not occur, so the residual effect will normally be 'not significant'*".

7.4 Therefore, overall it is considered that the impacts during the construction phase will be of **'Negligible'** significance.

Operational Phase

7.5 As no mitigation measures are required, the residual effects remain as presented in Section 5, with both beneficial and adverse impacts predicted.

8. Summary and Conclusion

8.1 AECOM was commissioned to undertake a local air quality assessment for the proposed junction improvements to the existing traffic-light controlled junction at the Broadway/Pogmoor Road crossroads, to the east of the M1, junction 37.

8.2 BMBC has declared an AQMA encompassing residential properties along Dodworth Road between Junction 37 of the M1 and Town End Roundabout due to high annual mean concentrations of NO_2, therefore air quality is considered a concern in this area.

8.3 A qualitative construction phase assessment has been undertaken with reference to the Institute of Air Quality Management (IAQM, 2014) 'Guidance on the assessment of dust from demolition and construction'.

8.4 An operational phase assessment has been undertaken in accordance with the Environmental Protection UK/IAQM (EPUK/IAQM, 2017) 'Land-Use Planning & Development Control: Planning for Air Quality'. Detailed dispersion modelling using the ADMS-Roads modelling software was conducted to determine the effect of traffic derived pollutant concentrations (NO_2, PM_{10} and $PM_{2.5}$) at nearby sensitive receptors. The assessment was conducted for a base year, 2015, as well as the following scenarios:

- 2019 DM and DS (with and without the proposed road scheme, excluding other development traffic). This scenario assessed the local air quality impacts of the scheme only. This scenario determined the effectiveness of the road scheme at reducing congestion in the study area and the consequential changes in air quality.
- 2021 DM and DS (with and without the proposed road scheme). This scenario assessed the local air quality impacts of the scheme; however, the traffic data incorporated an appropriate level of traffic associated with developments in the area.
- 2023 DM and DS (with and without the proposed road scheme). This scenario assessed the local air quality impacts of the scheme; however, the traffic data incorporated an appropriate level of traffic associated with developments in the area.

8.5 It should be noted that the assessed scenarios do not include the operation of the Claycliffe link road. This link road will be constructed as developments to the west of Barnsley become operational, to provide an additional access route to and from the city centre. It is unknown when the Claycliffe link road will be constructed. However, once constructed, traffic flow on Dodworth Road will likely reduce and therefore, by assuming the link road is operational after 2023 the air quality assessment is robust.

8.6 Consultation regarding the local air quality assessment methodology was undertaken with Chris Shields, Technical Officer (Pollution Control), Regulatory Services at BMBC, who confirmed the methodology was satisfactory.

Construction Phase

With regard to potential impacts during the construction phase, the assessment concludes the following:

- The nearest sensitive receptors to the proposed junction improvements are the residential properties on Pogmoor Road, Dodworth Road, Garden Court and Grosvenor View. The nearest of which is located on Dodworth Road, approximately 25 m from the proposed construction works associated with the scheme.
- No PM_{10} monitoring is undertaken in the vicinity of the scheme; however, the modelled background concentrations indicate that PM_{10} concentrations were 12.1 $\mu g/m^3$ in 2015.
- Taking the above into consideration the sensitivity of the area to dust soiling impacts was considered to be medium and low for human health impacts.
- The potential risk of dust soiling was determined to be Medium during earthworks and construction works and low during track-out.

- The potential risk of human health impacts was considered to be negligible during earthworks, construction works and during track out.
- Appropriate mitigation measures were recommended to effectively control the effects during the construction phase.
- Therefore, overall it is considered that the impacts during the construction phase will be of Negligible significance.

Operational Phase

With regard to potential impacts during the operational phase, the assessment concludes the following:

- Annual mean NO_2 concentrations were predicted to decrease between 2019 and 2023, if the proposed scheme does not go ahead, due to improvements in vehicle exhaust emission rates. Despite this, exceedences of the NO_2 objective were still predicted at two modelled sensitive receptors in all three assessed years.
- If the scheme goes ahead then annual mean NO_2 concentrations were predicted to be below the objective in 2019, except at one receptor on Dodworth Road, west of the junction. However, by 2023, concentrations at this receptor were predicted to be just below the objective.
- The scheme is anticipated to result in both beneficial and adverse impacts.
- Beneficial impacts were predicted to be experienced at receptors located near the existing Broadway/Pogmoor Road crossroads as well as those adjacent to the existing Pogmoor Road, south of the railway line. Decreases in annual mean NO_2 concentrations, of up to 8.3 $\mu g/m^3$, were predicted.
- Beneficial impacts were predicted with the scheme operational due to the existing Pogmoor road, south of the railway line being closed to vehicles, except those accessing White Hall Avenue. The new road will be constructed approximately 30 m to the east of the existing Pogmoor Road, thus moving traffic further from sensitive receptors. Secondly, the proposed scheme will reduce congestion at the Broadway/Pogmoor Road junction.
- Adverse NO_2 impacts, of up to 3.4 $\mu g/m^3$, were predicted at receptors on Pogmoor Road, north of the scheme and on Dodworth Road.
- The reason for this increase in NO_2 concentration is due to the redistribution of traffic associated with the scheme. In addition, as part of the scheme, two new junctions will be constructed along Dodworth Road resulting in increased annual mean NO_2 concentrations at properties near these junctions. Also, the scheme will reduce congestion at the Broadway/Pogmoor Road crossroads which will in turn attract more vehicles to use the corridor to gain access to Barnsley, thus increasing traffic flows on Dodworth Road.
- Negligible changes in annual mean PM_{10} and $PM_{2.5}$ concentrations associated with the scheme were predicted at modelled sensitive receptors.

8.7 Overall, the proposed scheme is considered to improve air quality within the AQMA, declared by BMBC, on Dodworth Road. At sensitive receptors located to the west of the crossroads, the proposed scheme is predicted to result in large reductions in annual mean NO_2 concentrations of up to substantial significance. The proposed scheme will continue to result in improvements in NO_2 concentrations in this area, even when additional traffic flows associated with nearby developments are included. By 2023, annual mean NO_2 concentrations are anticipated to be below or close to the objective. To the east of the crossroads, slight adverse impacts are predicted at sensitive receptors; however, the absolute concentrations will remain below the objective. All modelled receptors were anticipated to experience annual mean PM_{10} and $PM_{2.5}$ concentrations below the objective in all scenarios with negligible impacts.

Reference List

Air Quality Archive (2014) *http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc (accessed April 2018)*

Barnsley Metropolitan Borough Council (2016) Air quality Annual Status Report

Barnsley Metropolitan Borough Council (2011) Core Strategy

Barnsley Metropolitan Borough Council (2012) Air Quality Action Plan

BRE (2003a) *Guidance on the Control of Dust from Construction and Demolition Activities*

BRE (2003b) *Controlling Particulates, Vapours and Noise Pollution from Construction Sites*

CLG (March 2012) *National Planning Policy Framework*

CLG (March 2014) *Planning Practice Guidance*

Council Directive 2008/50/EC *on Ambient Air Quality and Cleaner Air for Europe.*

Defra (2007) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland*

Defra (2010) *The Air Quality Standards Regulations 2010 Statutory Instrument 2010 No. 64*

Defra (2011) *https://uk-air.defra.gov.uk/data/laqm-background-home (accessed April 2018)*

Defra (2016). *Local Air Quality Management Technical Guidance LAQM.TG(16)*

Environmental Protection UK (2010) *Development Control: Planning For Air Quality.*

Environmental Protection UK and Institute of Air Quality Management (2017) *Land Use Planning & Development Control: Planning for Air Quality*

Greater London Councils (2006). *The control of dust and emissions from construction and demolition: Best Practice Guidance*

Institute of Air Quality Management (IAQM) (2014) *Guidance on the assessment of dust from demolition and construction*

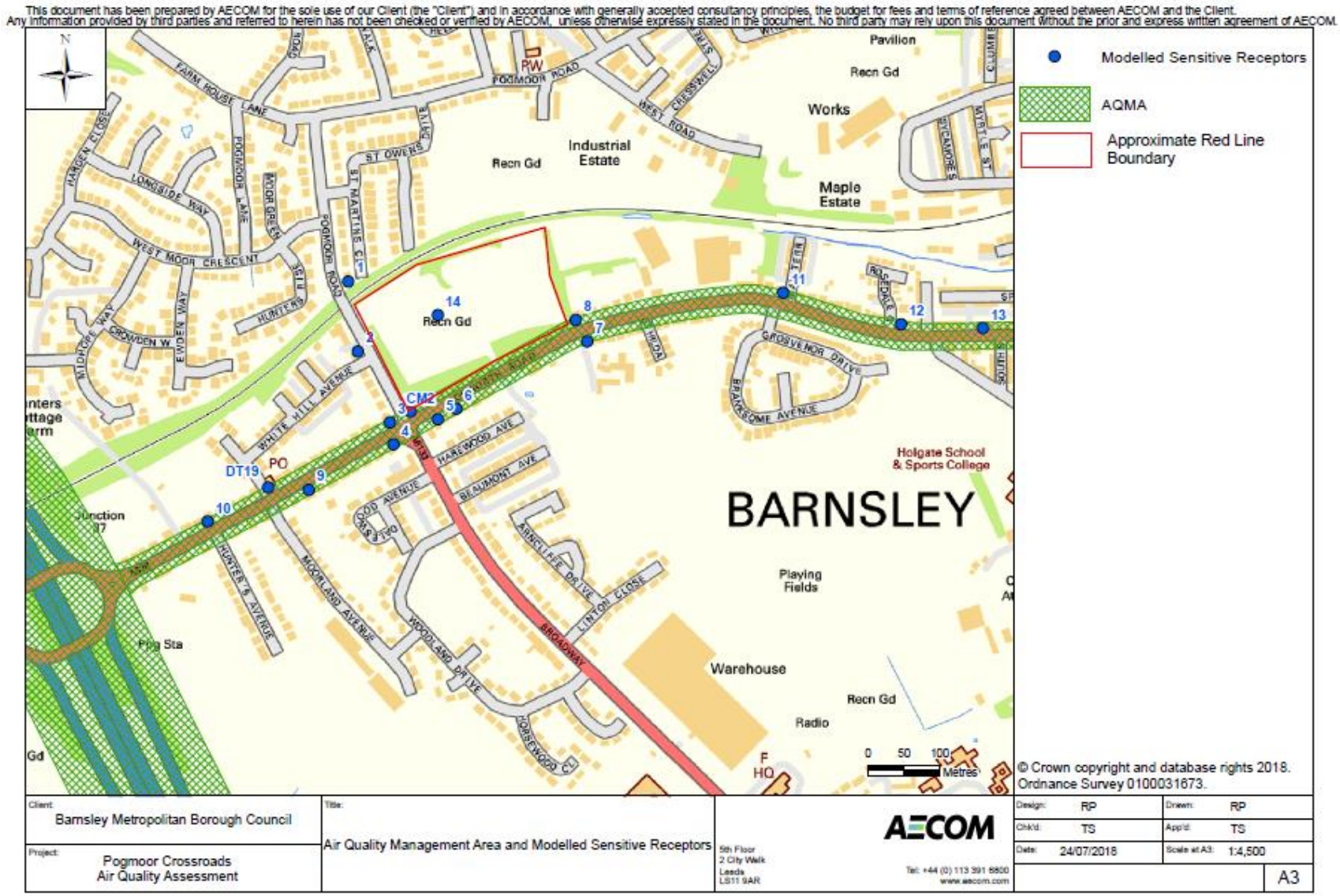
Appendix A : Proposed Scheme

Figure 1: Proposed Scheme



Appendix B : AQMA and Modelled Sensitive Receptors

Figure 2: AQMA and Modelled Sensitive Receptors



Appendix C : Construction Methodology

STEP 1: Screen the Requirement for a Detailed Assessment

Sensitive receptors were identified and the distance to the site and construction routes were determined according to the examples of sensitivity shown in Table 17. According to the IAQM, an assessment will normally be required where there are sensitive receptors within 350 metres (m) of the boundary of a site and/or within 50 m of route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance. A human receptor, as considered within the IAQM guidance, is any location where a person or property may experience:

- The annoyance effects of airborne dust or dust soiling e.g. dwellings, industrial or commercial premises such as a vehicle showroom, food manufacturers, electronics manufacturers, amenity areas and horticultural operations; or
- Exposure to PM_{10} over a period relevant to the air quality objectives.

Ecological receptors within 50 m of the boundary of the site or routes used by construction vehicles on the public highway, up to 500 m from the site entrance, also need to be identified.

There are no ecological receptors which need to be considered as part of this assessment.

Table 17: Examples of Dust Sensitive Receptors

Sensitivity	Dust Soiling	Human Health	Ecological
High	Dwellings, Museum and other culturally important collections, Medium and long term car parks Car showrooms.	Residential properties. Hospitals, Schools Residential care homes	Locations with an international or national designation (e.g. SAC) and the designated features may be affected by dust soiling
Medium	Parks Places of work.	Office and shop workers, but will generally not include workers occupationally exposed to PM10, as protection is covered by Health and Safety at Work legislation.	Locations with a national designation (e.g. SSSI) where the features may be affected by dust deposition
Low	Playing fields Farmland (unless commercially-sensitive horticultural), Footpaths, Short term car parks Roads	Public footpaths, Playing fields, Parks Shopping streets.	Locations with a local designation where the features may be affected by dust deposition local Nature Reserve with dust sensitive features.

SAC: Special Area of Conservation; SSSI: Site of Special Scientific Interest

STEP 2: Assess the Risk of Dust Impacts

The risk of dust arising in sufficient quantities to cause annoyance and/or health effects was determined for each activity (demolition, earthworks, construction works and track out), taking account of:

- The scale and nature of the works, which determines the potential dust emission magnitude (small, medium or large) (Step 2A); and
- The sensitivity of the area (low, medium or high) (Step 2B).

These factors were then combined to give the risk of dust effects with no mitigation applied, as Negligible, Low, Medium or High.

It should be noted that where detailed information was not available to inform the risk category, professional judgement and experience was used and a cautious approach adopted, in accordance with the guidance.

Step 2A – Define the Potential Dust Emission Magnitude

Demolition

Demolition Works were considered to be undertaken.

Earthworks and Construction Works

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. The classifications in Table 18 are based on examples of suitable criteria. Factors such as existing land use, topography, seasonality, duration and scale were also taken into consideration, where possible.

Table 18: Potential Earthworks Dust Emission Classification

Potential Dust Emission Classes	Criteria
Large	Total site area: >10,000 m^2 Potentially dusty soil type (e.g. clay) >10 heavy earth moving vehicle active at any one time Formation of bunds >8 m in height Total material moved >100,000 tonnes
Medium	Total site area: 2,500 - 10,000 m^2 Moderately dusty soil type (e.g. silt) 5 -10 heavy earth moving vehicle active at any one time Formation of bunds 4 - 8 m in height Total material moved 20,000 – 100,000 tonnes
Small	Total site area: <2,500 m^2 Soil type with large grain size (e.g. sand) < 5 heavy earth moving vehicle active at any one time Formation of bunds < 4 m in height Total material moved <20,000 tonnes Earthworks during wetter months

Track-out

Track-out is the transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the local road network. The classifications in Table 19 are based on examples of suitable criteria. Factors such as vehicle size, speed, numbers, geology and duration were also taken into consideration, where possible.

Table 19: Potential Track Out Dust Emission Classification

Potential Dust Emission Classes	Criteria
Large	50 HGV (>3.5t) outward movements in any one day Potentially dusty surface material Unpaved road length > 100 m
Medium	25 – 100 HGV (>3.5t) outward movements in any one day Moderately dusty surface material Unpaved road length 50 – 100 m
Small	< 25 HGV (>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

The sensitivity of the area takes account of the following factors:

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentrations; and

- Site specific factors, such as whether there are natural shelters, such as trees to reduce the risk of wind-blown dust.

The sensitivity of the area is determined separately for dust soiling impacts on people and properties (Table 20), human health impacts (Table 21).

Table 20: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		< 20	< 50	< 100	< 350
High	>100	High	High	Medium	Low
	10 – 100	High	Medium	Low	Low
	1 -10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 21: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance to Source				
			<20	<50	<100	<200	<350
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10 – 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 – 32 µg/m^3	>100	High	High	Medium	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 – 28 µg/m^3	>100	High	Medium	Low	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10 – 100	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Step 2C - Define the Risk of Impacts

The dust emission magnitude determined at Step 2A should be combined with the sensitivity of the area determined at Step 2B to determine the risk of effects with no mitigation applied (Table 22 and Table 23). This Step is undertaken for each activity undertaken on site.

Table 22: Risk of Dust Impacts – Earthworks and Construction Works

Sensitivity of Area	Dust Emission Classification		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table 23: Risk of Dust Impacts – Track-out

Sensitivity of Area	Dust Emission Classification		
	Large	Medium	Small
High	High	Medium	Medium
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

STEP 3: Identify the need for Site-Specific Mitigation

Based on the risk of effects determined in Step 2C for each activity, appropriate site-specific mitigation measures were recommended. Appropriate mitigation measures are set out in the IAQM Guidance.

STEP 4: Define impacts and their significance

Finally the significance of the potential residual dust impacts, i.e. after mitigation, was determined. According to the IAQM Guidance[1] the residual impacts assumes that all mitigation measures (recommended in Step 3) to avoid or reduce impacts are adhered to, and therefore the residual impacts should be considered to be 'not significant'.

Appendix D : Traffic Data

Table 24: Traffic Data

Road Link	AADT							HGV							Speed (km/hr)
	2014	2019 DM	2019 DS	2021 DM	2021 DS	2023 DM	2023 DS	2014	2019 DM	2019 DS	2021 DM	2021 DS	2023 DM	2023 DS	
M1 (northbound)	34543	35263	35207	35940	35927	36508	36521	7609	5412	5477	5517	5538	5366	5381	108
M1 (southbound)	27262	32992	32971	33632	33614	34192	34126	1924	4950	5398	5433	5451	5397	5366	108
Slip road on northbound	13483	8325	8217	8508	8443	8683	8549	6079	877	897	895	895	901	894	93
Slip road off northbound	18354	13338	13859	13660	14276	13987	14625	7156	1859	1911	2518	1929	1909	1958	57
Slip road on southbound	11561	10996	11130	11317	11407	11658	11713	1712	1479	1479	1498	1482	1517	1502	93
Slip road off southbound	7723	8047	8475	8374	8847	8567	9125	766	700	748	732	768	743	792	48
Dodworth Road between M1 junction and Moorland Avenue	32914	33070	35972	33418	36631	33756	37215	2997	2665	2819	2695	2801	2721	2793	45
Dodworth Road between Moorland Avenue and Pogmoor Road	35500	35751	38834	36200	39583	36606	40244	3097	2739	2895	2770	2880	2799	2875	50
Dodworth Road between Pogmoor Road and St Hilda	18029	17262		17564		18398		1265	1171		1196		1197		28
Dodworth Road between St Hilda and Rosedale Gardens	16444	17810		18133		18398		1231	1199		1224		1226		36
Dodworth Road, east of Rosedale Gardens	17277	17950	22247	18282	22542	18571	22812	1263	1192	1436	1218	1431	1220	1457	26
Broadway North	12976	14104	12917	14267	13210	14471	13559	1004	841	768	840	772	847	776	45
Broadway South	11579	12738	11553	11317	11407	13028	12137	1004	841	768	840	772	847	776	45
Pogmoor Road south of railway line	11684	11803		11783		11848		1003	926		918		935		25
Pogmoor Road, north of railway line	11684	11803	12478	11783	12770	11848	12956	1003	926	936	918	915	935	873	27
Dodworth Road between (existing) Pogmoor Road and new Road	-		17873		18167		18468	-		1281		1284		1300	25
Dodworth Road between new junctions	-		19210		19546		19880	-		1324		1327		1345	44

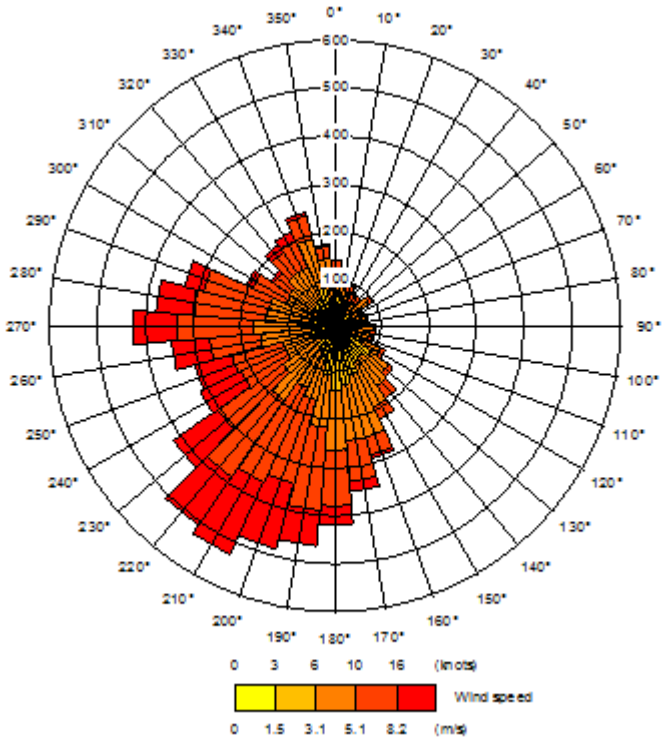
Dodworth Road, between new junction and Rosedale Gardens	-		22303		22600		22868	-		1445		1441		1467	36
New Road between Dodworth Road and Pogmoor Road (near Broadway)	-		23507		23878		24210	-		1698		1682		1659	32
New Road between Pogmoor Road and Dodworth Road	-		21676		22165		22552	-		1319		1326		1355	48
Dodworth Road, east of Shaw Lane	14780	16538	20649	16848	20919	17102	21163	1250	1182	1425	1207	1420	1209	1445	34
Shaw Lane	587	650	698	652	702	659	709	3	2	3	3	3	3	3	14

Appendix E :Meteorological Data

The meteorological dataset used in the assessment was recorded at the meteorological station at Robin Hood airport in Doncaster in 2015, located approximately 35 km to the south east of the proposed development site. This site is considered to be representative of regional meteorological conditions and sufficient to satisfy the requirements of this assessment.

The meteorological data were used to produce a wind/stability rose. This illustrates the wind direction and wind speed as a function of the proportion of the year.

Figure 3: Meteorological Data, 2015



Appendix F : Model Verification

The model was verified by comparison with NO_2 diffusion tubes operated by Barnsley Metropolitan Borough Council (BMBC) in 2015. The model under-estimated concentrations when compared to the monitoring data and so the modelled results for NO_2 and PM_{10} were adjusted in accordance with the procedure detailed in technical guidance LAQM.TG(16).

Table 25: Comparison of Modelled and Monitored NO_2 Concentrations, 2015

Monitoring Site	Monitor Type	Monitored Total NO_2	Modelled Total NO_2	% Difference [(modelled-monitored)/monitored]
CM2	Continuous Monitor	39.0	38.0	-2.6
DT49/50/51	Diffusion Tube	38.6	38.0	-1.5
DT17	Diffusion Tube	49.8	35.5	-40.3
DT52	Diffusion Tube	44.4	41.7	-6.4
DT53	Diffusion Tube	30.9	30.8	-0.4
DT69	Diffusion Tube	44.7	33.3	-34.4
DT54	Diffusion Tube	58.1	36.2	-60.3
DT55	Diffusion Tube	53.2	37.3	-42.6

The extent to which the model under-estimated annual mean NO_2 concentrations varied significantly. Three distinct areas were noted:

1. Dodworth Road, between the M1 junction 37 and Moorland Avenue (monitoring sites highlighted in orange). This road is characterised by a relatively steep gradient (compared to the remainder of the study area) and significant congestion during peak hours. Limitations exist when attempting to model the effect of this on vehicle exhaust emissions.
2. North of Dodworth Road (monitoring sites highlighted in green). The model was 'good' at replicating conditions in this area, with significantly smaller differences between the modelled and monitored concentrations than the rest of the study area.
3. South of Dodworth Road (monitoring sites highlighted in blue). The model significantly under-estimated monitored concentrations in this area. This is due to local factors, such as local meteorological conditions which cannot be accurately replicated in the model.

The adjustment factors were calculated as follows:

$$NO_{X\ [monitored,\ traffic\ contribution]} = NO_{X\ [monitored]} - NO_{X\ [background]}$$

$$NO_{X\ [modelled,\ traffic\ contribution]} = NO_{X\ [modelled]} - NO_{X\ [background]}$$

$$\text{Adjustment Factor} = NO_{X\ [monitored,\ traffic\ contribution]} / NO_{X\ [modelled,\ traffic\ contribution]}$$

The following adjustment factors were calculated:

1. For Area 1 Dodworth Road, between the M1 junction 37 and Moorland Avenue, the adjustment factor was 2.39.
2. For Area 2 North of Dodworth Road, the adjustment factor was 1.07.
3. For Area 3 South of Dodworth Road, the adjustment factor was 1.98.

The adjustment factors were subsequently applied to the modelled NO_X concentrations, and background NO_X added to give the adjusted NO_X concentrations (NO_X [model adjusted]) (Table 26):

$$NO_{X\ [model\ adjusted,\ traffic\ contribution]} = NO_{X\ [modelled,\ traffic\ contribution]} \times \text{Adjustment Factor}$$

$$NO_{X\ [model\ adjusted]} = NO_{X\ [model\ adjusted,\ traffic\ contribution]} + NO_{X\ [background]}$$

The adjusted NO_X concentrations were then converted to NO_2. using version 6.1 of the 'NO_2 to NO_X' calculator provided by the Air Quality Archive and in accordance with the technical guidance, LAQM.TG(16).

In the absence of suitable PM_{10} data for verification, the road-NO_X adjustment factor was also applied to the modelled road-PM_{10}. This is in accordance with LAQM.TG(16).

Table 26: Determination of Modelled and Monitored Rd NO_2 and Modelled Rd NO_X

ID	Monitored Road NO_X	Background NO_2	Modelled Road NO_X
CM2	42.2	19	39.9
DT49/50/51	41.2	19	39.9
DT17	68.9	19	34.1
DT52	55.2	19	48.6
DT53	24.1	19	23.8
DT69	55.9	19	29.2
DT54	91.5	19	35.8
DT55	78.0	19	38.2

Table 27: Determination of the Adjustment Factor and Total Adjusted NO_2

ID	Adjustment Factor for Modelled Road Contribution	Adjusted Modelled Road Contribution NO_X	Adjusted Modelled Total NO_2	Monitored Total NO_2	% Difference [(mod-mon)/mon]
CM2	1.07	42.6	39.2	39.0	0.5
DT49/50/51	1.07	42.6	39.2	38.6	1.5
DT17	1.98	67.4	49.2	49.8	-1.1
DT52	1.07	51.9	43.1	44.4	-3.0
DT53	1.07	25.4	31.5	30.9	2.0
DT69	1.98	57.6	45.4	44.7	1.5
DT54	2.39	85.5	56.0	58.1	-3.8
DT55	2.39	91.3	58.0	53.2	8.3

Appendix G : Monitoring Locations

Figure 4: Council Monitoring Locations

