AIR QUALITY ASSESSMENT
CLIFFE LANE, GOMERSAL

REC REFERENCE: AQ106623R2

REPORT PREPARED FOR: KCS DEVELOPMENT LTD

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EXECUTIVE SUMMARY

Resource and Environmental Consultants Limited was commissioned by KCS Development Limited to undertake an Air Quality Assessment in support of a proposed development at Cliffe Lane, Gomersal.

The proposals comprise the development of the site to provide 92 residential dwellings and associated infrastructure.

The proposed development site is located in proximity to the M62 which is considered a significant source of road vehicle exhaust emissions. Subsequently, there is potential for the proposals to cause impacts at nearby sensitive receptors during the construction and operational phases, as well as to expose future site users to elevated pollutant concentrations. An Air Quality Assessment is therefore required in order to determine baseline conditions at the site, assess site suitability for the proposed end-use and assess the potential impacts as a result of the proposed development.

Potential construction phase air quality impacts from fugitive dust emissions were assessed as a result of demolition, earthworks, construction and trackout activities. It is considered that the use of good practice control measures would provide suitable mitigation for a development of this size and nature and reduce potential impacts to an acceptable level.

Dispersion modelling was also undertaken in order to predict pollutant concentrations across the site, and to predict air quality impacts as a result of road vehicle exhaust emissions associated with traffic generated by the proposed development. Results were subsequently verified using monitoring data obtained from Kirklees Council.

The dispersion modelling indicated that pollutant levels across the site were below the relevant air quality standards and, as such, the location is considered suitable for the proposed end-use without the inclusion of mitigation methods. Additionally, the assessment concluded that impacts on pollutant levels as a result of operational phase pollutant emissions were predicted to be not significant at any sensitive location in the vicinity of the site. The use of robust assumptions, where necessary, was considered to provide sufficient results confidence for an assessment of this nature.

Based on the assessment results, air quality is not considered a constraint to planning consent for both phases of the proposed development.

TABLE OF CONTENTS

APPENDIX

1. INTRODUCTION

1.1 Background

Resource and Environmental Consultants (REC) Limited was commissioned KCS Development Ltd to undertake an Air Quality Assessment in support of a proposed residential development at Cliffe Lane, Gomersal.

1.2 Site Location and Context

The proposed development is located, at approximate National Grid Reference (NGR): 420290, 426330. Reference should be made to Figure 1 in Appendix I for a location plan.

The proposals comprise the development of the site to provide 92 residential dwellings and associated infrastructure.

Due to the scale of the proposed development, there is the potential for the development to introduce future site users to poor air quality. Additionally, due to the scale of the development there is potential for impacts at nearby sensitive receptor locations as a result of increased road vehicle exhaust emissions generated by the development as well as fugitive dust emissions generated by the construction phase. As such, an Air Quality Assessment was required to quantify baseline conditions, consider the suitability of the site for the proposed end-use and assess potential impacts as a result of the development. This is detailed in the following report.

1.3 Limitations

This report has been produced in accordance with REC's standard terms of engagement. REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.

2. LEGISLATION AND POLICY

2.1 European Legislation

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 (NO_x), 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.

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.

2.2 UK Legislation

The Air Quality Standards (Amendment) Regulations (2016) came into force on 31st December 2016. These Regulations amend the Air Quality Standards Regulations 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 6 pollutants.

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[1]. 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.

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

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

Table 1 Air Quality Objectives

Pollutant	Air Quality Objective	
	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

Table 2 summarises the advice provided in DEFRA guidance LAQM (TG16)[2] 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

[2] Local Air Quality Management Technical Guidance 2016 LAQM (TG16), DEFRA, 2016.

2.3 Local Air Quality Management

Under Section 82 of the Environment Act (1995) (Part IV), Local Authorities (LAs) are required to periodically review and assess air quality within their area of administration under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves considering present and likely future air quality against the AQOs. If it is predicted that levels at sensitive locations where members of the public are regularly present for the relevant averaging period are likely to be exceeded, the LA is required to declare an AQMA. For each AQMA the LA is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.4 Dust

The main requirements with respect to dust control from industrial or trade premises not regulated under the Environmental Permitting (England and Wales) Regulations (2018) are those 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."*

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.

2.5 National Planning Policy

2.5.1 National Planning Policy Framework

The National Planning Policy Framework[3] (NPPF) was published on 24th July 2018 and sets out the Government's core policies and principles with respect to land use planning, including air quality. The document includes the following considerations which are relevant to this assessment:

> *"The planning system should contribute to and enhance the natural and local environment by:*
>
> *[…]*
>
> *Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability*
>
> *"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*

[3] National Planning Policy Framework, Department for Communities and Local Government, 2018.

local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."

The implications of the NPPF have been considered throughout this assessment.

2.5.2 National Planning Practice Guidance

The National Planning Practice Guidance (NPPG) web-based resource was launched by the Department for Communities and Local Government on 6th March 2014 to support the NPPF and make it more accessible. The relevant air quality sections are highlighted below:

Paragraph 001 states that: "*Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values" and "It is important that the potential impact of new development on air quality is taken into account, where the national assessment indicates that relevant limits have been exceeded or are near the limit". The role of Local Authorities under LAQM are stated and that Air Quality Action Plans should "identify measures that will be introduced in pursuit of the objectives"*

Paragraph 005 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"*

Paragraph 007 states that *"Assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality". In terms of mitigation, it states that "Mitigation options where necessary will be location specific, will depend on the proposed development and should be proportionate to the likely impact".*

Paragraph 009 shows a flow chart highlighting how the assessment of air quality impacts should fit into the development management process. It makes it clear that air quality impact risks, AQLVs and AQOs should be considered in the decision-making process.

These were reviewed and the relevant guidance considered as necessary throughout the undertaking of this assessment.

2.6 Local Planning Policy

The Unitary Development Plan (UDP) sets out the Kirklees Council (KC) policies and proposals for the use and development of land and buildings. The plan constitutes the statutory development plan for Kirklees and previous development plans for areas within Kirklees, excluding the national park.

A review of the UDP document indicated the following saved policies in relation to air quality that are

relevant to this assessment:

> ***"BE1. All development should be of good quality design such that it contributes to a built environment which:***
>
> *[…]*
>
> *iv promotes a healthy environment including space and landscaping around buildings and avoidance of exposure to excessive noise and pollution"*

And

> ***"T1. Priority will be given to:***
>
> *[…]*
>
> *ii promoting a transport network on which it is safe to travel and which causes minimal disturbance through danger, noise and air pollution"*

KC are in the process of producing a new Local Plan. The Draft Local Plan - Strategy and Policies document was prepared in November 2016[4]. The Policies document provides a set of policies which will also provide the basis for determining detailed issues when dealing with planning applications. This document is currently at Examination.

A review of the Strategy and Policies document indicated the following draft policies in relation to air quality that are relevant to this assessment:

> **"*Policy PLP 20 – Sustainable Travel***
>
> *[…]*
>
> *The council will support demand management measures which discourage single occupancy car travel within new development and encourage the use of low emission vehicles to improve area with low level of air quality. Proposals should include measures to encourage the use of sustainable travel options, including public transport, the promotion of personal journey planning, walking, cycling, car sharing, electronic communication and home working.*"
>
> **"*Policy PLP 47 – Healthy, active and safe lifestyles***
>
> *Healthy, active and safe lifestyles will be enables by:*
>
> *[…]*
>
> *G – Ensuring that the current air quality in the district is monitored and maintained and, where required, appropriate mitigation measures included as part of new development proposals.*"
>
> **"*Policy PLP 51 – Protection and improvement of local air quality***

[4] Publication Draft Local Plan, Strategy and Policies, 2016

1. Development will be expected to demonstrate that it is not likely to result, directly or indirectly, in an increase in air pollution which would unacceptably affect or cause a nuisance to the natural and built environment or to people.
2. Proposals that have the potential to increase local air pollution either individually or cumulatively must be accompanied by evidence to show that the impact of the development has been assessed in accordance with the relevant guidance. Development which has the potential to cause levels of local air pollution to increase to unsafe levels must incorporate sustainable mitigation measures that reduce this impact to a safe level. If sustainable measures cannot be introduced the development will not be permitted.
3. Where the development introduces new receptors into Air Quality Management Areas or Areas of Concern or near other areas of relatively poor air quality, for example near roads or junctions, the development must incorporate sustainable mitigation measures that protect the new receptors from unacceptable levels of air pollution. Where sustainable mitigation measures cannot be introduced which prevent receptors from being exposed to unsafe levels of air pollution, development will not be permitted."

Reference has been made to these policies during the undertaking of this Air Quality Assessment.

The Air Quality & Emissions Technical Planning Guidance[5] was prepared to support the air quality assessment process and advise mitigation measures. This document has also been taken into consideration within this assessment.

[5] Air Quality & Emissions Technical Planning Guidance, West Yorkshire Low Emissions Group, 2014.

3. METHODOLOGY

There is the potential for the proposed development to expose future site users to elevated pollution concentrations and to cause impacts at sensitive locations during the construction and operational phases. These have been assessed in accordance with the following methodology.

3.1 Construction Phase Assessment

There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the methodology outlined within the Institute of Air Quality Management (IAQM) document 'Guidance on the Assessment of Dust from Demolition and Construction'[6].

Activities on the proposed construction site have been divided into four types to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout.

The potential for dust emissions was assessed for each activity that is likely to take place and considered three separate dust effects:

- Annoyance due to dust soiling;
- Harm to ecological receptors; and
- The risk of health effects due to a significant increase in exposure to PM_{10} and $PM_{2.5}$.

The assessment steps are detailed below.

3.1.1 Step 1

Step 1 screens the requirement for a more detailed assessment. Should human receptors be identified within 350m from the site boundary or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment should proceed to Step 2. Additionally, should ecological receptors be identified within 50m of the boundary site or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment should also proceed to Step 2.

Should sensitive receptors not be present within the relevant distances then negligible impacts would be expected and further assessment is not necessary.

3.1.2 Step 2

Step 2 assesses the risk of potential dust impacts. A site is allocated to a risk category based on two factors:

[6] Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management, 2016.

- The scale and nature of the works, which determines the magnitude of dust arising as: small, medium or large (Step 2A); and
- The sensitivity of the area to dust impacts, which can be defined as low, medium or high sensitivity (Step 2B).

The two factors are combined in Step 2C to determine the risk of dust impacts without mitigation applied. Step 2A defines the potential magnitude of dust emission through the construction phase. The relevant criteria are summarised in Table 3.

Table 3 Construction Dust - Magnitude of Emission

Magnitude	Activity	Criteria
Large	Demolition	• Total building volume greater than 50,000m^3 • Potentially dusty construction material (e.g. concrete) • On-site crushing and screening • Demolition activities greater than 20m above ground level
	Earthworks	• Total site area greater than 10,000m^2 • Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) • More than 10 heavy earth moving vehicles active at any one time • Formation of bunds greater than 8m in height • More than 100,000 tonnes of material moved
	Construction	• Total building volume greater than 100,000m^3 • On site concrete batching • Sandblasting
	Trackout	• More than 50 Heavy Duty Vehicle (HDV) trips per day • Potentially dusty surface material (e.g. high clay content) • Unpaved road length greater than 100m
Medium	Demolition	• Total building volume 20,000m^3 to 50,000m^3 • Potentially dusty construction material • Demolition activities 10m to 20m above ground level
	Earthworks	• Total site area 2,500m^2 to 10,000m^2 • Moderately dusty soil type (e.g. silt) • 5 to 10 heavy earth moving vehicles active at any one time • Formation of bunds 4m to 8m in height • Total material moved 20,000 tonnes to 100,000 tonnes
	Construction	• Total building volume 25,000m^3 to 100,000m^3 • Potentially dusty construction material (e.g. concrete) • On site concrete batching

Magnitude	Activity	Criteria
Medium	Trackout	• 10 to 50 HDV trips per day • Moderately dusty surface material (e.g. high clay content) • Unpaved road length 50m to 100m
Small	Demolition	• Total building volume under 20,000m^3 • Construction material with low potential for dust release (e.g. metal cladding or timber) • Demolition activities less than 10m above ground level • Demolition during wetter months
	Earthworks	• Total site area less than 2,500m^2 • Soil type with large grain size (e.g. sand) • Less than 5 heavy earth moving vehicles active at any one time • Formation of bunds less than 4m in height • Total material moved less than 20,000 tonnes • Earthworks during wetter months
	Construction	• Total building volume less than 25,000m^3 • Construction material with low potential for dust release (e.g. metal cladding or timber)
	Trackout	• Less than 10 HDV trips per day • Surface material with low potential for dust release • Unpaved road length less than 50m

Step 2B defines the sensitivity of the area around the development site for demolition, construction, earthworks and trackout. The factors influencing the sensitivity of the area are shown in Table 4.

Table 4 Examples of Factors Defining Sensitivity of an Area

Sensitivity	Examples	
	Human Receptors	Ecological Receptors
High	• Users expect of high levels of amenity • High aesthetic or value property • People expected to be present continuously for extended periods of time • Locations where members of the public are exposed over a time period relevant to the AQO for PM_{10} e.g. residential properties, hospitals, schools and residential care homes	• Internationally or nationally designated site e.g. Special Area of Conservation

Sensitivity	Examples	
	Human Receptors	Ecological Receptors
Medium	• Users would expect to enjoy a reasonable level of amenity • Aesthetics or value of their property could be diminished by soiling • People or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land e.g. parks and places of work	• Nationally designated site e.g. Sites of Special Scientific Interest
Low	• Enjoyment of amenity would not reasonably be expected • Property would not be expected to be diminished in appearance • Transient exposure, where people would only be expected to be present for limited periods. e.g. public footpaths, playing fields, shopping streets, playing fields, farmland, footpaths, short term car park and roads	• Locally designated site e.g. Local Nature Reserve

The guidance also provides the following factors to consider when determining the sensitivity of an area to potential dust impacts during the construction phase:

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and the receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which works will take place;
- Any conclusions drawn from local topography;
- Duration of the potential impact, as a receptor may become more sensitive over time; and
- Any known specific receptor sensitivities which go beyond the classifications given in the document.

These factors were considered in the undertaking of this assessment.

The sensitivity of the area to dust soiling effects on people and property is shown in Table 5.

Table 5 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		Less than 20	Less than 50	Less than 100	Less than 350
High	More than 100	High	High	Medium	Low
	10 - 100	High	Medium	Low	Low
	1 - 10	Medium	Low	Low	Low

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		Less than 20	Less than 50	Less than 100	Less than 350
Medium	More than 1	Medium	Low	Low	Low
Low	More than 1	Low	Low	Low	Low

Table 6 outlines the sensitivity of the area to human health impacts.

Table 6 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			Less than 20	Less than 50	Less than 100	Less than 200	Less than 350
High	Greater than 32µg/m^3	More than 100	High	High	High	Medium	Low
		10 - 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 - 32µg/m^3	More than 100	High	High	Medium	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 - 28µg/m^3	More than 100	High	Medium	Low	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	Less than 24µg/m^3	More than 100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Medium	Greater than 32µg/m^3	More than 10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	28 - 32µg/m^3	More than 10	Medium	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	24 - 28µg/m^3	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	Less than 24µg/m^3	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			Less than 20	Less than 50	Less than 100	Less than 200	Less than 350
Low	-	More than 1	Low	Low	Low	Low	Low

Table 7 outlines the sensitivity of the area to ecological impacts.

Table 7 Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	Less than 20	Less than 50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Step 2C combines the dust emission magnitude with the sensitivity of the area to determine the risk of unmitigated impacts. Table 8 outlines the risk category from earthworks and construction activities.

Table 8 Dust Risk Category from Earthworks and Construction

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

Table 9 outlines the risk category from trackout.

Table 9 Dust Risk Category from Trackout

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

3.1.3 Step 3

Step 3 requires the identification of site-specific mitigation measures within the IAQM guidance to

reduce potential dust impacts based upon the relevant risk categories identified in Step 2. For sites with **negligible** risk, mitigation measures beyond those required by legislation are not required. However, additional controls may be applied as part of good practice.

3.1.4 Step 4

Once the risk of dust impacts has been determined and the appropriate mitigation measures identified, the final step is to determine the significance of any residual impacts. For almost all construction activity, the aim should be to control effects through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'.

The determination of significance relies on professional judgement and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts. The IAQM[6] guidance suggests the provision of details of the assessor's qualifications and experience. These are provided in Appendix III.

3.2 Operational Phase Assessment – West Yorkshire Planning Guidance

The development has the potential to impact on existing air quality as a result of road traffic exhaust emissions, such as NO_2, PM_{10} and $PM_{2.5}$, associated with vehicles travelling to and from the site. An assessment was therefore undertaken using the methodology contained within the West Yorkshire (WY) Air Quality and Emissions Technical Planning Guidance[7] to determine the potential for the development to affect local air quality.

The air quality assessment process follows a three-stage process:

- Stage 1: Determining the classification of the development proposal;
- Stage 2: Assessing and quantifying the impact on local air quality; and
- Stage 3: Determining the level of mitigation required by the proposal to meet Local Development Plan requirements.

3.2.1 Stage 1 - Development Type Classification

The three levels of development classification were determined using the Department for Transport (DfT) criteria[8]. These are outlined in Table 10.

Table 10 Criteria for Development Classification

Land Use	Description	Criteria
Residential Institutions (C2)	Hospitals, nursing homes used for residential accommodation and care	> 50 beds
Residential Institutions (C2)	Boarding schools and training centres	> 150 students
Residential Institutions (C2)	Institutional hostels, homeless centres	> 400 residents

[7] West Yorkshire, Air Quality and Emissions Technical Planning Guidance
[8] http://webarchive.nationalarchives.gov.uk/20100409053417
http://www.dft.gov.uk/adobepdf/165237/202657/guidanceontaappendixb.

Land Use	Description	Criteria
Dwelling Houses (C3)	***Dwellings for individuals, families or not more than six people in a single household***	***> 50 units***
Other: 1. Any development generating 30 or more two-way vehicle movements in any hour ***2. Any developments generating 100 or more two-way vehicle movements per day*** ***3. Any development proposing 100 or more parking spaces*** 4. Any relevant development proposed in a location where the local transport infrastructure is inadequate 5. Any relevant development proposed in a location adjacent to an AQMA		

Additional Trigger Criteria for Major Developments

Table 11 Additional Trigger Criteria for Major Developments

Description
Where the proposed development falls within the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 2011 and includes air quality and/or transport as a specific likely impact;
Proposals located within an AQMA;
Proposals that could increase the existing traffic flow on roads of > 10,000 Annual Average Daily Traffic (AADT) by 5% or more;
Proposals that increase traffic 5% on road canyons with > 5,000 AADT;
Proposals that could introduce or significantly alter congestion (DfT Congestion) and includes the introduction of substantial road infrastructure changes;
Proposals that reduce average speeds by more than 10kph;
Proposals that include additional HDV movements by more than 10% of total trips; and
Where significant demolition and construction works are proposed.

The three levels of development classification are outlined in Table 12.

Table 12 Development Type Classification

Development Type Classification	Criteria
1. Minor	Development proposals that fall below the criteria detailed within Table 10
2. Medium	Development proposals that meet the requirements detailed within Table 10
3. Major	Development proposals that meet the requirements detailed within Table 10 and the additional trigger criteria for major developments

The proposed development exceeds a number of criteria listed in Table 10 *(>50 units and the development generating more than 100 two way moving vehicles per day)*. The proposed development does not satisfy any of the additional trigger criteria. In accordance with the West Yorkshire guidance[7] the proposed development is therefore classified as a **medium** proposal.

3.2.2 Stage 2 - Air Quality Impact Assessment

Minor and Medium Developments

The West Yorkshire guidance[7] requires an assessment of the likelihood of introducing additional exposure. The outcome of the exposure assessment will determine the level of mitigation required to make the development acceptable. This is determined by using the following criteria:

- The proposal is adjacent to or within an AQMA;
- The proposal is in a location 20m from roads[9] at or above the relevant national objective highlighted on the DEFRA GIS modelled maps[10];
- The proposal is one of the Land Use types:
  - C1 to C3 in Table 10;
  - C4 (Homes of Multiple Occupation); and
  - D1 in Table 10.
- The proposal is within 20m of roads with > 10,000 AADT.

Major Developments

A detailed air quality assessment will be required to determine the impact on public health and the local environment. The following are required as part of the assessment:

- The identification of the level of exposure through the change in pollutant concentrations including cumulative impacts arising from the proposal, during both demolition/construction operations and operational phases based on the requirements of the DEFRA guidance[2] and the air quality assessment protocol detailed within Appendix 2 of the West Yorkshire guidance[7];
- Mitigation measures should be identified and modelled where practicable; and
- The calculation of pollutant emissions costs from the development by utilising the most recent DEFRA Emissions Factor Toolkit[11] and the latest DEFRA IGCB Air Quality Damage Costs[12].

The proposed development is classified as C3 land use, and located within the M62 AQMA. Subsequently, the development has the potential to introduce future site users to existing levels of poor air quality.

3.2.3 Stage 3 - Mitigation

Based on the findings of Stage 2 - Air Quality Impact Assessment, the level of air quality impact has been defined as **Large** which is then used to determine the required level of mitigation to negate the potential effects of a development.

9 NO_2 Concentrations and Distance from Roads, Air Quality Consultants, 2008.
10 (http://uk-air.defra.gov.uk/data/gismapping).
11 http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html#eft.
12 https://www.gov.uk/air-quality-economic-analysis.

Minor Proposal - Type 1

If the proposal meets the exposure criteria in Stage 2, further mitigation is required to reduce the level of exposure. This will be in the form of:

- Possible short-term screening monitoring or utilising the DEFRA distance calculation[13] at the proposed location to identify the level of exposure;
- Redesigning the proposal to reduce the ingress of pollution; and
- Including a stand-off distance and/or vegetation boundary from the development.

The type specific default mitigation measures are detailed in Table 13.

Table 13 Type 1 - Minor Proposal Default Mitigation

Development	Mitigation
Residential	*1 charging point per unit (dwelling with dedicated parking) or 1 charging point per 10 spaces (unallocated parking)*
Demolition/Construction	*Adherence to the London Best Practice Guidance[14] for all demolition and construction works*

Medium Proposal - Type 2

The default mitigation measures for Medium Proposal - Type 2 include the measures detailed within Table 13 in addition to the following:

- Travel Plan including agreed mechanisms for discouraging high emission vehicle use and encouraging modal shift (i.e. public transport, cycling and walking) as well as the uptake of low emission fuels and technologies;
- Improved pedestrian links to public transport stops;
- Provision of new bus stops infrastructure including shelters, raised kerbing, information displays;
- Provision of subsidised or free ticketing (Corporate and residential Metrocards, Student Metrocards);
- Site layout to include improved pedestrian pathways to encourage walking; and
- Improved convenient and segregated cycle paths to link to local cycle network.

Major Proposal - Type 3

In order to negate the impact of a development, the required level of mitigation compensation will be determined by the pollution damage costs attributed to the proposal emission changes.

The type specific default mitigation measures are detailed in Table 14.

[13] http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html.
[14] http://legacy.london.gov.uk/mayor/environment/air_quality/docs/construction-dust-bpg.pdf.

Table 14 Type 3 - Major Proposal Default Mitigation

Aim of Mitigation	Mitigation
To reduce the need to travel	• *Alternative working practices - flexitime, teleworking, homeworking, videoconferencing, compressed work periods* • *Local sourcing of staff, products and raw materials* • *Development and use of hub distribution centres employing low emission deliveries* • *Provision of discounted on-site shopping, eating, child-care, banking facilities*
To reduce polluting motorised vehicle use	• *Development of car clubs and car sharing with financial incentives and promotion* • *Use of pooled low emission vehicles - cars, vans, taxis, bicycles* • *Support smart driving training schemes* • *Provision of dedicated low emission shuttle bus including managed pick-up and drop-off* • *Contribution to the emerging low emission vehicle refuelling infrastructure (introduction of type 1 EV charging points)* • *Contribution to site low emission waste collection services* • *Incentives for the take-up of low emission vehicle technologies and fuels* • *Minimum EU emission standard for the HGVs used at the proposed development.*
To support improved public transport	• *Provision of new or enhanced public transport services to the site* • *Shuttle services to public transport interchange, rail station or park and ride facilities* • *Support improving information systems for public transport* • *Supporting city free bus expansion schemes* • *Promoting low emission bus service provision* • *Support air quality monitoring programmes*
To promote walking and cycling	• *Improvements to district walking and cycling networks including lighting, shelters, and information points and timetables* • *Support cycle training and awareness schemes* • *Bike/e-bike hiring schemes* • *Guaranteed ride home in emergencies* • *Support secure and safe cycle parking facilities*

Aim of Mitigation	Mitigation
To promote sustainable travel plans	• *Support local travel to school and school travel plans initiatives* • *Marketing aimed at persuading a switch to sustainable modes with incentives* • *Promotion of subsidised/sponsored travel plan measures through social and other media* • *Supporting community/ local organisation groups to promote sustainable travel*

3.3 Impact Assessment

The development has the potential to expose future users to elevated pollutant levels, as well as impact on existing air quality as a result of road traffic exhaust emissions, such as NO_2 and PM_{10}, associated with vehicles travelling to and from the site. Detailed dispersion modelling was therefore undertaken to quantify NO_2, PM_{10} and $PM_{2.5}$ concentrations across the site and determine suitability for the proposed use, using the following scenarios:

- 2017 Verification;
- Opening year do-minimum (DM) (predicted traffic flows in 2022 should the proposals not proceed); and
- Opening year do-something (DS) (predicted traffic flows in 2022 should the proposals be completed).

It should be noted that air quality is predicted to improve in the future. However, in order to provide a robust assessment, emission factors for 2017 were utilised within the dispersion model. The use of 2022 traffic data and 2017 emission factors is considered to provide a worst-case scenario and therefore a sufficient level of confidence can be placed within the predicted pollution concentrations.

Reference should be made to Appendix II for assessment input data details of the verification process.

Receptors potentially sensitive to changes in NO_2, PM_{10} and $PM_{2.5}$ concentrations were identified within 200m of the affected highway network in accordance with the guidance provided within the IAQM guidance[15] on the likely limits of pollutant dispersion from road sources. LAQM (TG16)[2] provides the following examples of where annual mean AQOs should apply:

- Residential properties;
- Schools;
- Hospitals; and
- Care homes.

The sensitivity impact significance of each receptor was defined in accordance with the criteria shown in Table 15. These are based upon the guidance provided within the Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) guidance 'Land-Use Planning and Development Control: Planning for Air Quality'[15].

[15] Land-Use Planning and Development Control: Planning for Air Quality, Environmental Protection UK and Institute of Air Quality Management, 2017.

Table 15 Operational Traffic Exhaust Emissions – Assessment of Impact

Long Term Average Concentration	% Change in Concentration Relative to AQO			
	1	2-5	6-10	>10
75% or less of AQO	Negligible	Negligible	Slight	Moderate
76 - 94% of AQO	Negligible	Slight	Moderate	Moderate
95 - 102% of AQO	Slight	Moderate	Moderate	Substantial
103 - 109% of AQO	Moderate	Moderate	Substantial	Substantial
110% or more of AQO	Moderate	Substantial	Substantial	Substantial

The criteria shown in Table 15 is adapted from the EPUK and IAQM guidance 'Land-Use Planning and Development Control: Planning for Air Quality'[15] with sensitivity descriptors included to allow comparisons of various air quality impacts. It should be noted that changes of 0%, i.e. less than 0.5%, will be described as negligible in accordance with the EPUK and IAQM guidance.

Following the prediction of impacts at discrete receptor locations utilising the criteria in Table 15, the EPUK and IAQM[15] document states that this framework is to be used as a starting point to make a judgement on significance of effect but other influences might need to be accounted for. Whilst impacts might be determined as 'slight', 'moderate' or 'substantial' at individual receptors, overall effect might not necessarily be deemed as significant in some circumstances. The following factors may provide some assistance in determining the overall significance of a development:

- Number of properties affected by significant air quality impacts and a judgement on the overall balance;
- Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective will be relevant;
- The percentage change in concentration relative to the objective and the descriptions of the impacts at the receptors;
- Whether or not an exceedance of an objective is predicted to arise or be removed in the study area due to a substantial increase or decrease; and
- The extent to which an objective is exceeded e.g. an annual mean NO_2 concentration of 41µg/m^3 should attract less significance than an annual mean of 51µg/m^3.

These factors were considered and an overall significance determined for the impact of operational phase road traffic emissions. It should be noted that the determination of significance relies on professional judgement and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts.

4. BASELINE

Existing air quality conditions in the vicinity of the proposed development site were identified in order to provide a baseline for assessment. These are detailed in the following sections.

4.1 Local Air Quality Management

As required by the Environment Act (1995), KC has undertaken Review and Assessment of air quality within their area of administration. This process has indicated that annual mean concentrations of NO_2 are above the AQO within the district. As such, nine Air Quality Management Areas (AQMAs) have been declared within the vicinity of the proposed development, the closest of which is described:

> *"Kirklees AQMA 4 – The designated area includes Bradford Road (A651), Whitehall Road East (A58), Carlton Court, Grove Terrace, Swincliffe Crescent, Milford Grove, Tetley Drive and Manor Park Gardens, which is in close proximity to the M62 and A651- A58 Roundabout at Birkenshaw"*

The development is located approximately 1km from the Birkenshaw AQMA 4. Due to the distance from the proposed site, there is potential to cause impacts to air quality within this area. This has been considered within this report.

KC has concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs and as such no further AQMAs have been designated.

4.2 Air Quality Monitoring

Monitoring of pollutant concentrations is undertaken by KC using continuous and periodic methods throughout their area of administration. A review of KC's most recent Air Quality Annual Status Report[16] indicated that there are two automatic analysers within their administration. The closest of which is located approximately 6.3km away from the site at NGR: 417255, 420761. Due to the distance between the development site and automatic analyser, similar pollutant concentrations would not be expected and as such, this monitoring station has not been considered further within this assessment.

KC also utilise passive diffusion tubes to monitor NO_2 concentrations throughout the borough. A review of the most recent monitoring data available indicated that there are 14 diffusion tubes located in the vicinity of the proposed development. Recent NO_2 monitoring results from these locations are shown in Table 16. Exceedances of the AQO are shown in **bold.**

Table 16 Diffusion Tube Monitoring Results

ID	Site Name	Type	NGR (m)		Annual Mean NO_2 Concentration ($\mu g/m^3$)		
			X	Y	2015	2016	2017
13	Whitehall Road East	Roadside	420377	427871	**43.38**	36.2	36.13
15	Ainley Top 1	Other	420441	427353	38.47	N/A	34.50

[16] 2017 Air Quality Annual Status Report, Kirklees Council, 2017

ID	Site Name	Type	NGR (m)		Annual Mean NO_2 Concentration ($\mu g/m^3$)		
			X	Y	2015	2016	2017
16	Ainley Top 2	Other	420441	427353	**40.09**	N/A	**49.13**
17	Ainley Top 3	Other	420441	427353	38.51	N/A	37.16
37	Bradford Road, Birkenshaw	Roadside	420356	427810	36.36	30.00	36.06
38	Whitehall Road West	Roadside	420222	427764	38.66	36.00	36.13
61	Bradford Road, Birkenshaw	Roadside	420422	427349	N/A	N/A	35.80
62	Manor Park Gardens	Roadside	420472	427360	N/A	N/A	30.20
63	White Hall Road West 1	Roadside	419866	427561	N/A	N/A	28.09
64	Whitehall Road West 2	Other	419914	427588	N/A	N/A	**52.05**
65	Whitehall Road West 3	Roadside	419981	427623	N/A	N/A	**48.14**
66	Milford Grove - Birkenshaw	Other	420349	427434	N/A	N/A	29.40
67	Moor Lane 1 - Birkenshaw	Roadside	421132	427273	N/A	N/A	29.05
68	Moor Lane 2 - Birkenshaw	Roadside	421128	427298	N/A	N/A	24.75

As indicated in Table 16, the annual mean AQO for NO_2 was exceeded at the Whitehall Road East, Ainley Top 2, Whitehall Road West 2 and Whitehall Road West 3 diffusion tubes in recent years. This is due to their kerbside and roadside locations close to the M62. Reference should be made to Figure 2 within Appendix I for a graphical representation of the monitoring locations.

4.3 Background Pollutant Concentrations

Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist LAs in their Review and Assessment of air quality. The proposed development site is located in grid square NGR: 420500, 426500. Data for this location was downloaded from the DEFRA website[17] for the purpose of this assessment and is summarised in Table 17 for the verification year (2017) and the predicted development opening year (2022).

Table 17 Background Pollutant Concentrations

Pollutant	Predicted Background Concentration ($\mu g/m^3$)	
	2017	2022
NO_x	26.32	21.04
NO_2	18.05	14.86

[17] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html.

Pollutant	Predicted Background Concentration (µg/m^3)	
	2017	2022
PM_{10}	14.59	14.24
$PM_{2.5}$	10.36	10.02

As shown in Table 17, background pollutant concentrations do not exceed the relevant AQOs. Comparison with the monitoring results indicates the impact that vehicle exhaust emissions from the highway network have on pollutant concentrations at roadside locations.

4.4 Construction Phase Sensitive Receptors

A sensitive receptor is defined as any location which may be affected by changes in air quality as a result of a development. These have been defined for construction dust impacts in the following Sections.

4.4.1 Construction Phase Sensitive Receptors

Receptors sensitive to potential dust impacts during demolition, earthworks and construction were identified from a desk-top study of the area up to 350m from the development boundary. These are summarised in Table 18.

Table 18 Demolition, Earthworks and Construction Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Residential Receptors	Approximate Number of Ecological Receptors
Less than 20	10 – 100	0
20 - 50	10 - 100	0
50 - 100	More than 100	-
100 - 350	More than 100	-

Reference should be made to Figure 3 within Appendix I for a graphical representation of demolition, earthworks and construction dust buffer zones.

Receptors sensitive to potential dust impacts from trackout were identified from a desk-top study of the area up to 50m from the road network within 500m of the site access route. These are summarised in Table 19. The exact construction vehicle access routes were not available for the purpose of this assessment as they will depend on sourcing of materials. This is likely to be decided by the contractor. However, it was assumed that construction traffic would access the development via Cliffe Lane.

Table 19 Trackout Dust Sensitive Receptors

Distance from Site Access Route (m)	Approximate Number of Residential Receptors	Approximate Number of Ecological Receptors
Less than 20	More than 100	0
20 - 50	More than 100	0

Reference should be made to Figure 4 within Appendix I for a graphical representation of trackout dust buffer zones.

There are no ecological receptors within 50m of the site or trackout boundary. As such, ecological impacts have not been assessed further within this report.

A number of additional factors have been considered when determining the sensitivity of the surrounding area. These are summarised in Table 20.

Table 20 Additional Area Sensitivity Factors

Guidance	Comment
Whether there is any history of dust generating activities in the area	The site is located in a predominantly residential and agricultural location. There is likely to have been a history of dust generating activities due to agricultural processes and residential regeneration in the locality.
The likelihood of concurrent dust generating activity on nearby sites.	A review of the KC planning portal indicated that there are no large-scale development schemes in the locality of the site. As such, the likelihood of concurrent dust generating activity is minimal
Pre-existing screening between the source and the receptors	There is sparse vegetation present along all boundaries of the site. If retained, this could provide some natural protective screening to receptors in these directions.
Conclusions drawn from analysing local meteorological data which accurately represent the area: and if relevant the season during which works will take place	The wind direction is predominantly from the west of the development, as shown in Figure 5 within Appendix I. As such, properties to the east of the site would be most affected by dust emissions
Conclusions drawn from local topography	The topography of the area appears to be predominantly flat. As such, there are no constraints to dust dispersion
Duration of the potential impact, as a receptor may become more sensitive over time	Currently the construction phase is unknown but considering the 2022 opening year it is likely to extend over 1 year.
Any known specific receptor sensitivities which go beyond the classifications given in the document.	No specific receptor sensitivities identified during the baseline

Based on the criteria shown in Table 4, the sensitivity of the receiving environment to potential dust impacts was considered to be **high**. This was because users would expect to enjoy a reasonable level of amenity, aesthetics or value of their property could be diminished by soiling and people would be expected to be present for extended periods of time e.g. residential properties.

The sensitivity of the receiving environment to specific potential dust impacts, based on the criteria shown in Section 3.1.2, is shown in Table 21.

Table 21 Sensitivity of the Surrounding Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	High
Human Health	Low	Low	Low	Medium

4.4.2 Operational Phase Sensitive Receptors

A desk-top study was undertaken in order to identify any sensitive receptor locations in the vicinity of the site that require specific consideration during the assessment. These were modelled at a height of 1.5m in order to represent ground floor level and are summarised in Table 22.

Table 22 Existing Sensitive Human Receptors

Receptor		NGR (m)	
		X	Y
R1	11a Whitehall Road West	420251	427759
R2	Whitehall Road West	420309	427795
R3	620 Bradford Road	420362	427817
R4	576 Bradford Road	420406	427637
R5	381A Bradford Road	420412	427458
R6	4 Dewsbury Road	420511	427145
R7	636 Bradford Road	420347	427888
R8	672A Bradford Road	420319	428024
R9	483 Bradford Road	420252	428184
R10	351 Whitehall Road	419021	426741
R11	2A Tetley Drive	420419	427876
R12	Kingsley Drive	420595	427986

Receptor		NGR (m)	
		X	Y
R13	105 Whitehall Road	420794	428140
R14	Cliffe Lane	420226	426236
R15	1 Fern View	420478	426262
R16	290 Cliffe Lane	420553	426312
R17	352 A651	420782	426437
R18	27 Grove Lane	420687	426345
R19	237 Oxford Road	420955	425990
R20	75 Church Lane	421237	425935
R21	236 Oxford Road	421055	425776
R22	28 Burnley's Mill Road	420687	425975
R23	41 St Peg Lane	419275	425256
R24	2 Peaseland Road	418646	425187
R25	Bradford Road	419123	425617
R26	35 Balme Road	418920	425988
R27	25 Cliffe Lane	419260	426174
R28	12 Fairfield Terrace	419209	425068
R29	210 Spen Lane	419874	425702
R30	Gomersal First School	420795	426359
R31	Woodlands Road	420282	426217

The sensitive receptors identified in Table 22 represent worst-case locations. However, this is not an exhaustive list and there may be other locations within the vicinity of the site that may experience air quality impacts as a result of the proposed development that have not been individually identified above. Reference should be made to Figure 8 within Appendix I for a graphical representation of operational phase emission sensitive human receptor locations.

5. ASSESSMENT

There is the potential for air quality impacts as a result of the construction and operation of the proposed development in addition to the exposure of future site users to elevated pollution levels. These are assessed in the following Sections.

5.1 Construction Phase Assessment

5.1.1 Step 1

The undertaking of activities such as excavation, ground works, cutting, construction, concrete batching and storage of materials has the potential to result in fugitive dust emissions throughout the construction phase. Vehicle movements both on-site and on the local road network also have the potential to result in the re-suspension of dust from haul road and highway surfaces.

The potential for impacts at sensitive locations depends significantly on local meteorology during the undertaking of dust generating activities, with the most significant effects likely to occur during dry and windy conditions.

The desk-study undertaken to inform the baseline identified a number of sensitive receptors within 350m of the site boundary. As such, a detailed assessment of potential dust impacts was required.

5.1.2 Step 2

Demolition

Demolition will involve the removal of the existing residential unit on the site. It is anticipated that the volume of building to be demolished is likely to be under 20,000m^3. As such, the magnitude of potential dust emissions from demolition activities is **small**, in accordance with the criteria outlined in Table 3.

Table 21 indicates the sensitivity of the area to dust soiling effects on people and property is **high**. In accordance with the criteria outlined in Table 8, the development is considered to be a **medium** risk site for dust soiling as a result of demolition activities.

Table 21 indicates the sensitivity of the area to human health impacts is **low**. In accordance with the criteria outlined in Table 8, the development is considered to be a **negligible** risk site for human health impacts as a result of demolition activities.

Earthworks

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling, as well as site levelling and landscaping. Information on soil type was not available for the purpose of this assessment. As such, the soil type was considered to be potentially dusty in order to provide a worst-case scenario.

The proposed development site is estimated to cover a total area greater than 10,000m^2. In accordance with the criteria outlined in Table 3, the magnitude of potential dust emissions from earthworks is therefore **large**.

Table 21 indicates the sensitivity of the area to dust soiling effects on people and property is **high**. In accordance with the criteria outlined in Table 8, the development is considered to be a **high** risk site for dust soiling as a result of earthworks activities.

Table 21 indicates the sensitivity of the area to human health impacts is **low**. In accordance with the criteria outlined in Table 8, the development is considered to be a **low** risk site for human health impacts as a result of earthwork activities.

Construction

Due to the size of the development the total building volume is likely to between 25,000m^3 to 100,000m^3. In accordance with the criteria outlined in Table 3, the magnitude of potential dust emissions from construction is therefore **medium.**

Table 21 indicates the sensitivity of the area to dust soiling effects on people and property is **high**. In accordance with the criteria outlined in Table 8, the development is considered to be a **medium** risk site for dust soiling as a result of construction activities.

Table 21 indicates the sensitivity of the area to human health impacts is **low**. In accordance with the criteria outlined in Table 8, the development is considered to be a **low** risk site for human health impacts as a result of construction activities.

Trackout

Information on the number of HDV trips to be generated during the construction phase of the development was not available at the time of assessment. Similarly, the surface material and unpaved road length was not known at this stage of the project.

Based on the site area, it is anticipated that the unpaved road length is likely to be greater than 100m. In accordance with the criteria outlined in Table 3, the magnitude of potential dust emissions from trackout is therefore **large**.

Table 21 indicates the sensitivity of the area to dust soiling effects to people and property is **high**. In accordance with the criteria outlined in Table 9, the development is considered to be a **high** risk site for dust soiling as a result of trackout activities.

Table 21 indicates the sensitivity of the area to human health impacts is **medium**. In accordance with the criteria outlined in Table 9, the development is considered to be a **medium** risk site for human health impacts as a result of trackout activities.

Summary of the Risk of Dust Effects

A summary of the risk from each dust generating activity is provided in Table 23.

Table 23 Summary of Potential Unmitigated Dust Risks

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	High	Medium	High
Human Health	Negligible	Low	Low	Medium

As indicated in Table 23, the potential risk of dust soiling is **high** for earthworks and trackout activities and **medium** for demolition and construction activities. The potential risk of human health impacts is **medium** for trackout activities, **low** for earthworks and construction, and **negligible** for demolition activities.

It should be noted that the potential for impacts depends significantly on the distance between the dust generating activity and receptor location. Risk was predicted based on a worst-case scenario of works being undertaken at the site boundary closest to each sensitive area. Therefore, actual risk is likely to be lower than that predicted during the majority of the construction phase.

5.1.3 Step 3

The IAQM guidance[6] provides a number of potential mitigation measures to reduce impacts during the construction phase. These measures have been adapted for the development site as summarised in Table 24. The mitigation measures outlined in Table 24 can be reviewed prior to the commencement of construction works incorporated into the existing strategies as applicable.

Table 24 Fugitive Dust Mitigation Measures

Issue	Control Measure
Communications	• Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary • Develop and implement a stakeholder communications plan that includes community engagement • 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 LA
Site Management	• Record all dusty and air quality complaints and make the complaints log available to the LA when asked • Record any exceptional incidents that cause dust/or air emissions, and the action taken to resolve the situation • Make complaints log available to LA when asked • Hold regular liaison meetings with other high-risk construction sites that are within 500m of the site boundary. Ensuring plans are co-ordinated and dust and particulate matter emission are minimised
Monitoring	• Undertake daily on-site and off-site inspection where receptors are nearby to monitor dust • Carry out regular site inspections to monitor compliance with the DMP

Issue	Control Measure
	• Increase frequency of site inspections when activities with a high potential to produce dust are being carried out
Preparing and Maintaining the Site	• Plan site layout so that machinery and dust causing activities are located away from receptors • Fully enclose site or specific operations where there is a high potential for dust production and the site actives are for an extensive period • 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 • Cover, seed or fence stockpiles to prevent wind whipping Use water as dust suppressant where applicable
Operating Vehicle/ Machinery and Sustainable Travel	• All vehicles to switch off engines - no idling vehicles • Avoid the use of diesel or petrol powered generators where practicable • Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph in unsurfaced haul roads • Produce a Construction Logistics Plan to manage sustainable deliveries • Implement a Travel Plan that supports and encourages sustainable travel
Operations	• Cutting equipment to use water as dust suppressant or suitable local extract ventilation • Ensure adequate water supply on the site for effective dust/particulate matter suppression/mitigation • Use enclosed chutes and covered skips • Minimise drop heights • Ensure equipment is readily available on site to clean any spillages
Waste Management	• Avoid bonfires and burning of waste material
Demolition	• Soft strip inside buildings before demolition • Ensure effective water suppression is used during demolition operations • Bag and remove any biological debris before demolition
Earthworks and Construction	• Re-vegetate earthworks and exposed areas • Use Hessian, mulches or trackifiers where it is not possible to re-vegetate • Only remove the cover in small areas during work and not all at once • Avoid scabbling • Ensure sand and other aggregates are stored and not able to dry out, unless it is required for a specific process • Ensure bulk cement and other fine powder materials are delivered and stored to prevent escape
Trackout	• Use water-assisted dust sweeper on the access and local roads • Avoid dry sweeping of large areas • Ensure vehicles entering and leaving sites are covered to prevent escape of

Issue	Control Measure
	materials • Inspect on-site routes for integrity, instigate necessary repairs and record in site log book • Install hard surfaced haul routes which are regularly damped down • Implement a wheel washing system at a suitable location near site exit • 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

5.1.4 Step 4

Assuming the relevant mitigation measures outlined in Table 24 are implemented, the residual effect from all dust generating activities is predicted to be **negligible**, in accordance with the IAQM guidance[6].

5.2 Operational Phase Assessment

Additional vehicle movements associated with the operation of the proposed development will generate exhaust emissions, such as NO_2, PM_{10} and $PM_{2.5}$, on the local and regional road networks. An assessment was therefore undertaken using dispersion modelling in order to quantify potential changes in pollutant concentrations at sensitive locations in the vicinity of the site.

The assessment considered the following scenarios:

- 2017 Verification;
- 2022 DM Opening year; and
- 2022 DS Opening year.

The DM (i.e. without development) scenarios are representative of anticipated traffic data for 2022. The DS (i.e. with development) scenarios are representative of anticipated traffic data for 2022, with the addition of predicted variations in traffic flow patterns as a result of the proposals.

For the purpose of this assessment traffic data was supplied for 2022, the proposed development opening year. Air quality is predicted to improve in the future. However, in order to provide a robust assessment, emission factors for 2017 were utilised within the dispersion model. The use of 2022 traffic data and 2017 emission factors is considered to provide a worst-case scenario and therefore a sufficient level of confidence can be placed within the predicted pollution concentrations.

Reference should be made to Appendix II for full assessment input details.

5.2.1 Nitrogen Dioxide

Predicted Concentrations at the Development Site

Annual mean NO_2 concentrations were predicted across the development for the 2022 DS scenario at a height of 1.5m to represent exposure across the ground floor level, as shown in Figure 6 within Appendix I.

Predicted annual mean NO_2 concentrations across the development site during the DS scenario are summarised in Table 25.

Table 25 Modelling Results - Annual Mean NO_2

Floor Level	Predicted 2022 Annual Mean NO_2 Concentration Range ($\mu g/m^3$)
Ground (1.5m)	18.84 – 20.17

The predicted concentrations shown in Table 25 indicate that there were no exceedances of the AQO throughout the modelling area. As such, it is considered that annual mean NO_2 levels at the development site should not be viewed as a constraint to development.

Background NO_2 concentrations are likely to be lower at elevated heights due to increased distance from emission sources, such as roads. Therefore, predicted concentrations at heights above ground floor level across the residential aspects of the developments are considered acceptable in regards to

future exposure and have not been assessed further.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for residential use without the implementation of mitigation techniques to protect future site users from elevated NO_2 concentrations.

Predicted Concentrations at Sensitive Receptors

Annual mean NO_2 concentrations were predicted for 2022 DM and DS scenarios and are summarised in Table 26.

Table 26 Predicted Annual Mean NO_2 Concentrations

Sensitive Receptor		Predicted Annual Mean NO_2 Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	11a Whitehall Road West	31.23	31.24	0.01
R2	Whitehall Road West	30.51	30.51	0.00
R3	620 Bradford Road	32.27	32.30	0.03
R4	576 Bradford Road	32.54	32.55	0.01
R5	381A Bradford Road	36.86	36.87	0.01
R6	4 Dewsbury Road	30.01	30.03	0.02
R7	636 Bradford Road	30.36	30.37	0.01
R8	672A Bradford Road	24.03	24.04	0.01
R9	483 Bradford Road	21.91	21.91	0.00
R10	351 Whitehall Road	20.00	20.01	0.01
R11	2A Tetley Drive	30.56	30.57	0.01
R12	Kingsley Drive	29.32	29.33	0.01
R13	105 Whitehall Road	22.45	22.45	0.00
R14	Cliffe Lane	19.20	19.35	0.15
R15	1 Fern View	19.43	19.47	0.04
R16	290 Cliffe Lane	19.36	19.39	0.03
R17	352 A651	21.36	21.37	0.01
R18	27 Grove Lane	19.22	19.24	0.02
R19	237 Oxford Road	23.07	23.11	0.04
R20	75 Church Lane	20.06	20.09	0.03

Sensitive Receptor		Predicted Annual Mean NO_2 Concentration ($\mu g/m^3$)		
		DM	DS	Change
R21	236 Oxford Road	20.18	20.20	0.02
R22	28 Burnley's Mill Road	19.65	19.68	0.03
R23	41 St Peg Lane	20.96	20.97	0.01
R24	2 Peaseland Road	22.91	22.91	0.00
R25	Bradford Road	22.59	22.60	0.01
R26	35 Balme Road	20.87	20.88	0.01
R27	25 Cliffe Lane	19.19	19.22	0.03
R28	12 Fairfield Terrace	19.59	19.59	0.00
R29	210 Spen Lane	19.44	19.45	0.01
R30	Gomersal First School	20.88	20.89	0.01
R31	Woodlands Road	19.30	19.35	0.05

As indicated in Table 26, annual mean NO_2 concentrations were below the relevant AQO at all sensitive receptor locations.

Predicted impacts on annual mean NO_2 concentrations are summarised in Table 27.

Table 27 Predicted NO_2 Impacts

Sensitive Receptor		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	11a Whitehall Road West	0.02	76-94% of the AQO	Negligible
R2	Whitehall Road West	0.00	76-94% of the AQO	Negligible
R3	620 Bradford Road	0.07	76-94% of the AQO	Negligible
R4	576 Bradford Road	0.02	76-94% of the AQO	Negligible
R5	381A Bradford Road	0.02	76-94% of the AQO	Negligible
R6	4 Dewsbury Road	0.05	75% or Less of the AQO	Negligible
R7	636 Bradford Road	0.03	75% or Less of the AQO	Negligible
R8	672A Bradford Road	0.02	75% or Less of the AQO	Negligible

Sensitive Receptor		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R9	483 Bradford Road	0.00	75% or Less of the AQO	Negligible
R10	351 Whitehall Road	0.03	75% or Less of the AQO	Negligible
R11	2A Tetley Drive	0.03	76-94% of the AQO	Negligible
R12	Kingsley Drive	0.02	75% or Less of the AQO	Negligible
R13	105 Whitehall Road	0.00	75% or Less of the AQO	Negligible
R14	Cliffe Lane	0.38	75% or Less of the AQO	Negligible
R15	1 Fern View	0.10	75% or Less of the AQO	Negligible
R16	290 Cliffe Lane	0.08	75% or Less of the AQO	Negligible
R17	352 A651	0.03	75% or Less of the AQO	Negligible
R18	27 Grove Lane	0.05	75% or Less of the AQO	Negligible
R19	237 Oxford Road	0.10	75% or Less of the AQO	Negligible
R20	75 Church Lane	0.08	75% or Less of the AQO	Negligible
R21	236 Oxford Road	0.05	75% or Less of the AQO	Negligible
R22	28 Burnley's Mill Road	0.08	75% or Less of the AQO	Negligible
R23	41 St Peg Lane	0.02	75% or Less of the AQO	Negligible
R24	2 Peaseland Road	0.00	75% or Less of the AQO	Negligible
R25	Bradford Road	0.03	75% or Less of the AQO	Negligible
R26	35 Balme Road	0.02	75% or Less of the AQO	Negligible
R27	25 Cliffe Lane	0.07	75% or Less of the AQO	Negligible
R28	12 Fairfield Terrace	0.00	75% or Less of the AQO	Negligible
R29	210 Spen Lane	0.02	75% or Less of the AQO	Negligible
R30	Gomersal First School	0.03	75% or Less of the AQO	Negligible
R31	Woodlands Road	0.13	75% or Less of the AQO	Negligible

As indicated in Table 27, impacts on annual mean NO_2 concentrations as a result of road vehicle exhaust emissions associated with the development were predicted to be **negligible** at all 31 receptor locations considered. Section 5.2.4 discusses the overall significance of the predicted impacts.

5.2.2 Particulate Matter (PM_{10})

Predicted Concentrations at the Development Site

Annual mean PM_{10} concentrations were predicted across the development for the 2022 DS scenario at a height of 1.5m to represent exposure across the ground floor level, as shown in Figure 8 within Appendix I. Predicted annual mean PM_{10} concentrations across the development site during the DS scenario are summarised in Table 28.

Table 28 Modelling Results - Annual Mean PM_{10}

Floor Level	Predicted 2022 Annual Mean PM_{10} Concentration Range ($\mu g/m^3$)
Ground	14.69 – 14.93

The predicted concentrations shown in Table 28 indicate that there were no exceedances of the AQO throughout the modelling area. As such, it is considered that annual mean PM_{10} levels at the development site should not be viewed as a constraint to development.

Similar to NO_2 concentrations, background PM_{10} levels are likely to be lower at elevated heights due to increased distance from emission sources, such as roads. Therefore, predicted concentrations at heights above ground floor level across the residential aspects of the developments are considered acceptable in regards to future exposure and have not been assessed further.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for residential use without the implementation of mitigation techniques to protect future site users from elevated PM_{10} concentrations.

Predicted Concentrations at Sensitive Receptors

Annual mean PM_{10} concentrations were predicted for 2022 DM and DS scenarios and are summarised in Table 29.

Table 29 Predicted Annual Mean PM_{10} Concentrations

Sensitive Receptor		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	11a Whitehall Road West	17.76	17.76	0.00
R2	Whitehall Road West	17.70	17.71	0.01
R3	620 Bradford Road	18.01	18.02	0.01
R4	576 Bradford Road	17.95	17.96	0.01
R5	381A Bradford Road	18.32	18.33	0.01
R6	4 Dewsbury Road	17.70	17.71	0.01

Sensitive Receptor		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R7	636 Bradford Road	17.75	17.75	0.00
R8	672A Bradford Road	16.08	16.08	0.00
R9	483 Bradford Road	15.77	15.77	0.00
R10	351 Whitehall Road	15.09	15.09	0.00
R11	2A Tetley Drive	17.81	17.81	0.00
R12	Kingsley Drive	17.70	17.70	0.00
R13	105 Whitehall Road	15.89	15.89	0.00
R14	Cliffe Lane	14.76	14.78	0.02
R15	1 Fern View	14.80	14.80	0.00
R16	290 Cliffe Lane	14.78	14.79	0.01
R17	352 A651	15.09	15.09	0.00
R18	27 Grove Lane	14.75	14.75	0.00
R19	237 Oxford Road	15.03	15.03	0.00
R20	75 Church Lane	14.59	14.60	0.01
R21	236 Oxford Road	14.60	14.60	0.00
R22	28 Burnley's Mill Road	14.68	14.69	0.01
R23	41 St Peg Lane	14.97	14.98	0.01
R24	2 Peaseland Road	15.59	15.59	0.00
R25	Bradford Road	15.19	15.19	0.00
R26	35 Balme Road	15.26	15.26	0.00
R27	25 Cliffe Lane	14.97	14.97	0.00
R28	12 Fairfield Terrace	14.77	14.77	0.00
R29	210 Spen Lane	14.78	14.78	0.00
R30	Gomersal First School	15.01	15.01	0.00
R31	Woodlands Road	14.77	14.78	0.01

As indicated in Table 29, annual mean PM_{10} concentrations were below the relevant AQO at all sensitive receptor locations.

Predicted impacts on annual mean PM_{10} concentrations are summarised in Table 30.

Table 30 Predicted PM_{10} Impacts

Sensitive Receptor		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	11a Whitehall Road West	0.00	75% or Less of the AQO	Negligible
R2	Whitehall Road West	0.03	75% or Less of the AQO	Negligible
R3	620 Bradford Road	0.02	75% or Less of the AQO	Negligible
R4	576 Bradford Road	0.03	75% or Less of the AQO	Negligible
R5	381A Bradford Road	0.02	75% or Less of the AQO	Negligible
R6	4 Dewsbury Road	0.03	75% or Less of the AQO	Negligible
R7	636 Bradford Road	0.00	75% or Less of the AQO	Negligible
R8	672A Bradford Road	0.00	75% or Less of the AQO	Negligible
R9	483 Bradford Road	0.00	75% or Less of the AQO	Negligible
R10	351 Whitehall Road	0.00	75% or Less of the AQO	Negligible
R11	2A Tetley Drive	0.00	75% or Less of the AQO	Negligible
R12	Kingsley Drive	0.00	75% or Less of the AQO	Negligible
R13	105 Whitehall Road	0.00	75% or Less of the AQO	Negligible
R14	Cliffe Lane	0.05	75% or Less of the AQO	Negligible
R15	1 Fern View	0.00	75% or Less of the AQO	Negligible
R16	290 Cliffe Lane	0.02	75% or Less of the AQO	Negligible
R17	352 A651	0.00	75% or Less of the AQO	Negligible
R18	27 Grove Lane	0.00	75% or Less of the AQO	Negligible
R19	237 Oxford Road	0.00	75% or Less of the AQO	Negligible
R20	75 Church Lane	0.02	75% or Less of the AQO	Negligible
R21	236 Oxford Road	0.00	75% or Less of the AQO	Negligible
R22	28 Burnley's Mill Road	0.02	75% or Less of the AQO	Negligible
R23	41 St Peg Lane	0.02	75% or Less of the AQO	Negligible
R24	2 Peaseland Road	0.00	75% or Less of the AQO	Negligible
R25	Bradford Road	0.00	75% or Less of the AQO	Negligible
R26	35 Balme Road	0.00	75% or Less of the AQO	Negligible

Sensitive Receptor		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R27	25 Cliffe Lane	0.00	75% or Less of the AQO	Negligible
R28	12 Fairfield Terrace	0.00	75% or Less of the AQO	Negligible
R29	210 Spen Lane	0.00	75% or Less of the AQO	Negligible
R30	Gomersal First School	0.00	75% or Less of the AQO	Negligible
R31	Woodlands Road	0.02	75% or Less of the AQO	Negligible

As indicated in Table 30, impacts on annual mean PM_{10} concentrations as a result of road vehicle exhaust emissions associated with the development were predicted to be **negligible** at all receptor locations. It is therefore considered that the overall impacts as a result of the proposed development are **not significant.** Further justifications are discussed in Section 5.2.4.

5.2.3 Particulate Matter ($PM_{2.5}$)

$PM_{2.5}$ has not been modelled within the assessment as the predicted concentrations relating to annual mean PM_{10} remain below the AQO for $PM_{2.5}$ (25 µg/m^3).

Since PM_{10} contains all particulate matter with an aerodynamic diameter of less than 10µm, $PM_{2.5}$ is effectively accounted for within these predictions; and at worst could be considered that $PM_{2.5}$ concentrations would be equal to the predicted PM_{10} concentrations.

5.2.4 Impact Significance

The overall significance of operational phase road traffic emission impacts for 2022 was determined as **not significant**. This was based on the predicted impacts at discrete receptor locations and the considerations outlined in Section 5.2. Further justifications are provided in
Table 31.

Table 31 Overall Road Emissions Impact Significance

Guidance	Comment
Number of properties affected by slight, moderate or substantial air quality impacts and a judgement on the overall balance	Impacts on annual mean NO_2 and PM_{10} concentrations were predicted to be **negligible** at all 31 sensitive receptors locations considered. The sensitive locations represent worst-case locations and therefore it is unlikely that any other receptors would be significantly affected by the proposed development.
Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant	The proposed development will not result in any new exposure to pollutant concentrations above the AQOs at sensitive locations and as such no new exposure has been introduced.

Guidance	Comment
The percentage change in concentration relative to the objective and the descriptions of the impacts at the receptors	The maximum changes in annual mean NO_2, and PM_{10} concentrations relative to their respective AQOs were predicted: ▶ 0.38% for NO_2: and ▶ 0.05% for PM_{10} As such, resultant impacts on annual mean NO_2 and PM_{10} concentrations were predicted to be **negligible** at all sensitive receptor locations
Whether or not an exceedance of an objective is predicted to arise or be removed in the study area due to a substantial increase or decrease	There were no exceedances of the annual mean AQOs for NO_2, PM_{10} and $PM_{2.5}$ at any location within the modelling extent
The extent to which an objective is exceeded e.g. an annual mean NO_2 concentration of 41µg/m^3 should attract less significance than an annual mean of 51µg/m^3	There were no exceedances of the annual mean AQOs for NO_2, PM_{10} and $PM_{2.5}$ at any sensitive receptor location within the modelling extent

5.3 West Yorkshire Planning Guidance

5.3.1 Stage 1 - Development Type Classification

The proposals comprise the development of the site to provide 92 residential units and associated infrastructure. According to the criteria detailed in Table 10 and Table 11 the proposal meets the criteria for a **Medium** development under land use C3.

5.3.2 Stage 2 - Air Quality Impact Assessment

As indicated in Table 17 background pollutant concentrations in the vicinity of the site are predicted to be below the relevant AQOs. The proposals would categorise as a C3, **Medium** classified development with more than 50 units and the development generating more than 100 two way moving vehicles per day.

5.3.3 Stage 3 - Mitigation

Based on the recommendations of the West Yorkshire technical planning guidance[7] there are a number of air quality mitigation options available to off-set impacts associated with a **Medium** classified development. However, all techniques have financial implications and may therefore affect scheme viability. As such, they should only be included if necessary.

The Stage 2 exposure assessment for a **Medium** development indicated that in order to negate the impact of a development, the required level of mitigation compensation will be determined by type specific default mitigation measures suggested by the guidance to reduce emissions associated with the development. This would include the implementation of those presented in Table 13 in section 3.2.3 as well as those specific to a **Medium** development.

6. CONCLUSION

REC Ltd was commissioned by KCS Development Ltd to undertake an Air Quality Assessment in support of a proposed mixed-use development at Cliffe Lane, Gomersal.

The proposals comprise the development of the site to provide 92 residential units and associated infrastructure.

During the construction phase of the development there is the potential for air quality impacts as a result of fugitive dust emissions from the site. These were assessed in accordance with the IAQM methodology. Assuming good practice dust control measures are implemented, the residual significance of potential air quality impacts from dust generated by demolition, earthworks, construction and trackout activities was predicted to be **not significant**.

An assessment was undertaken in accordance with the West Yorkshire Technical Planning guidance to determine the potential for the development to affect local air quality. This indicated that the development is considered to be classified as Type 2 - **Medium** development.

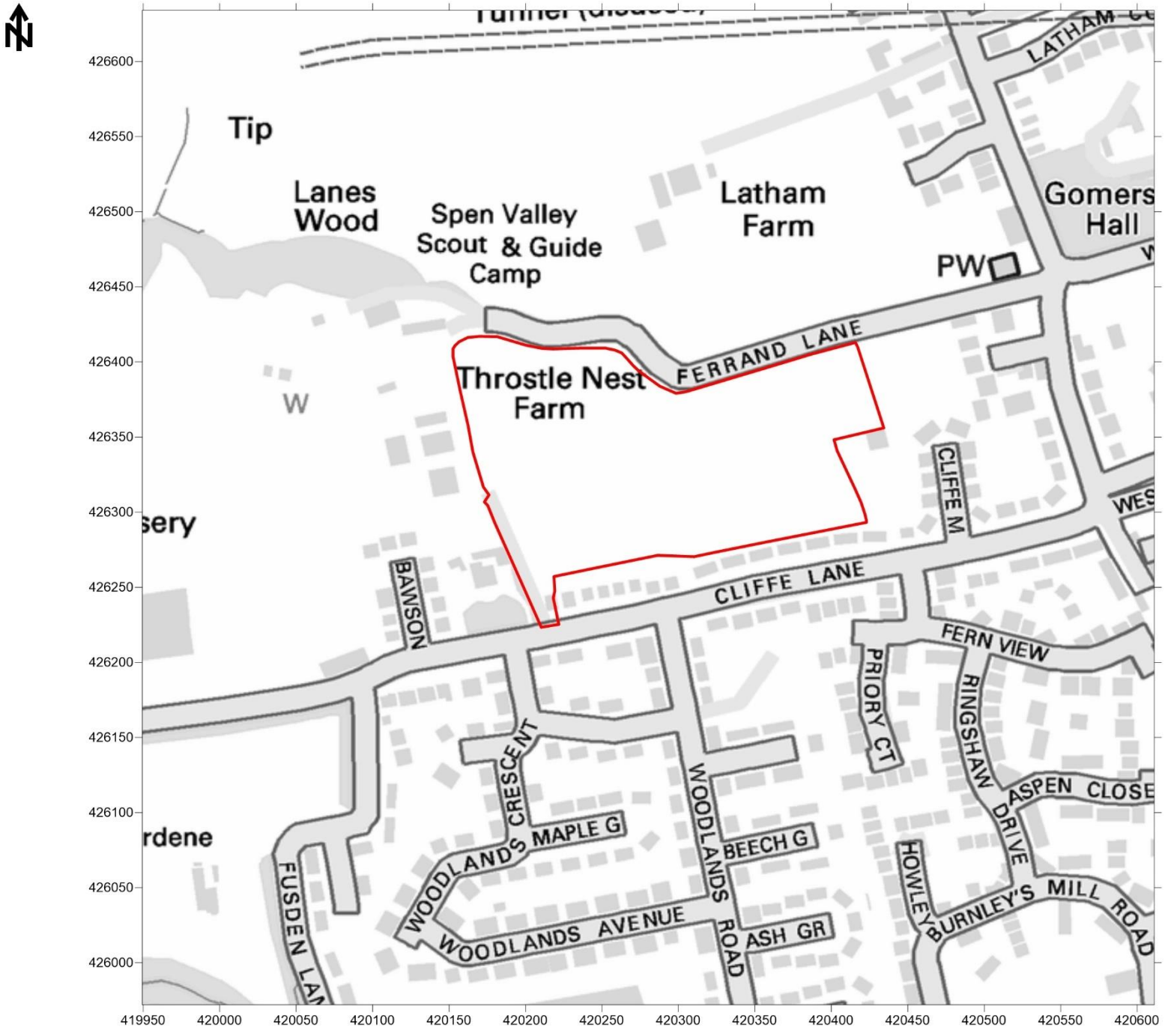
The dispersion modelling results indicated that pollutant levels at sensitive locations across the site were below the relevant AQOs. The location is therefore considered suitable for residential use without the inclusion of mitigation methods to protect future users from poor air quality. Predicted impacts on NO_2, PM_{10} and $PM_{2.5}$ concentrations as a result of operational phase exhaust emissions were predicted to be **negligible** at all 31 sensitive receptor locations considered. The overall significance of potential impacts was therefore determined to be **not significant**, in accordance with the WY, EPUK and IAQM guidance.

Based on the assessment results, air quality is not considered a constraint to planning consent for all phases of the proposed development.

7. ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADM	Atmospheric Dispersion Modelling
AQAP	Air Quality Action Plan
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objectives
AQS	Air Quality Strategy
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMP	Dust Management Plan
DMRB	Design Manual for Roads and Bridges
EPUK	Environmental Protection UK
EU	European Union
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
KC	Kirklees Council
LA	Local Authority
LAQM	Local Air Quality Management
NGR	National Grid Reference
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5µm
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10µm
REC	Resource and Environmental Consultants
TEMPRO	Trip End Model Presentation Program
z_0	Roughness Length

APPENDIX I - FIGURES



Legend

Site Boundary

Title

Figure 1

Site Location

Project

Air Quality Assessment
Cliffe Lane, Gomersal

Project Number

AQ106623

Client

KCS Development Ltd

REC
Resource and Environmental Consultants Ltd
Osprey House, Broadway, Manchester M50 2UE
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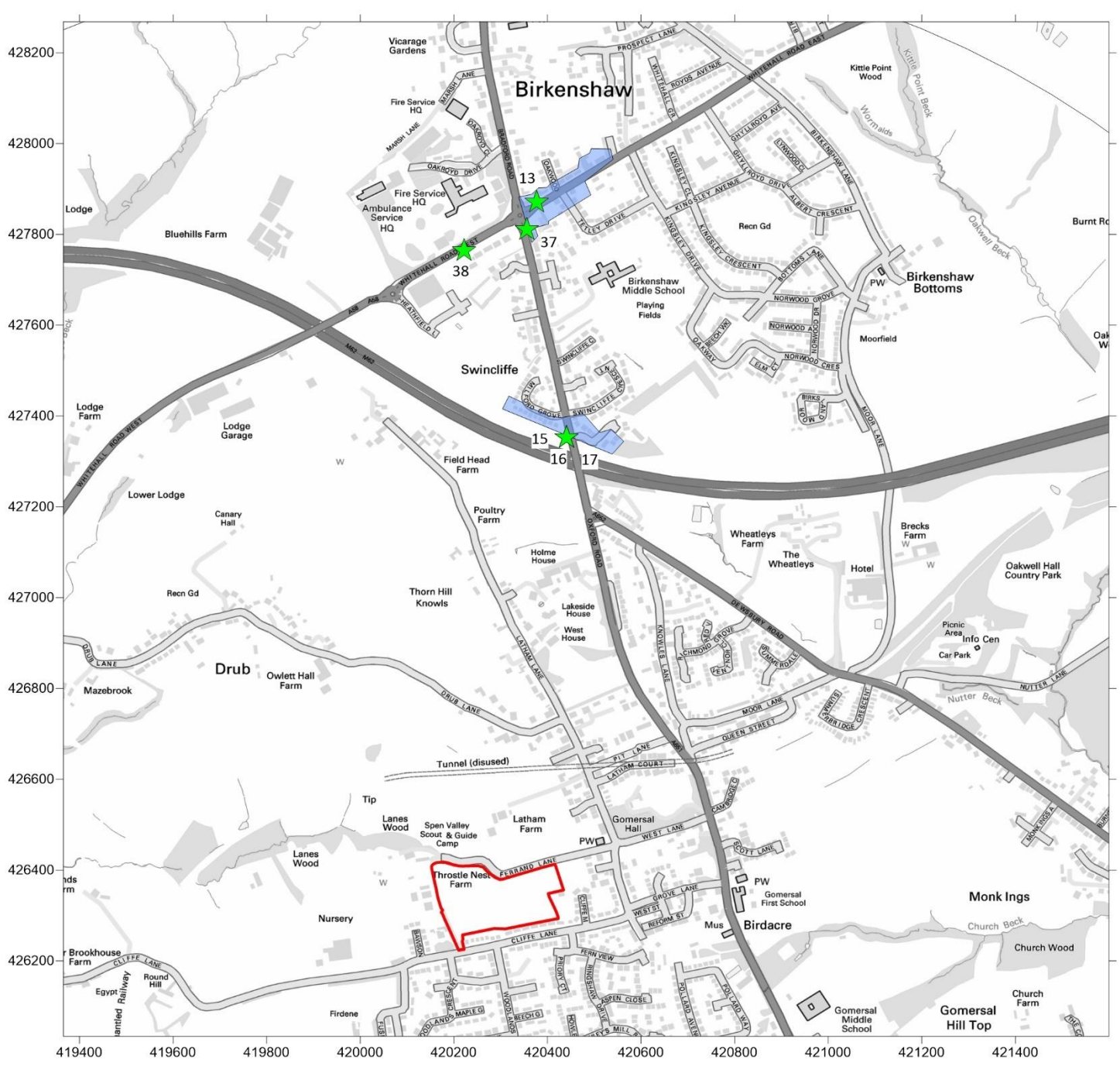

Legend

- Site Boundary
- Air Quality Management Area
- Diffusion Tube Monitoring Locations

Title

Figure 2

Diffusion Tube Monitoring Locations

Project

Air Quality Assessment
Cliffe Lane, Gomersal

Project Number

AQ106623

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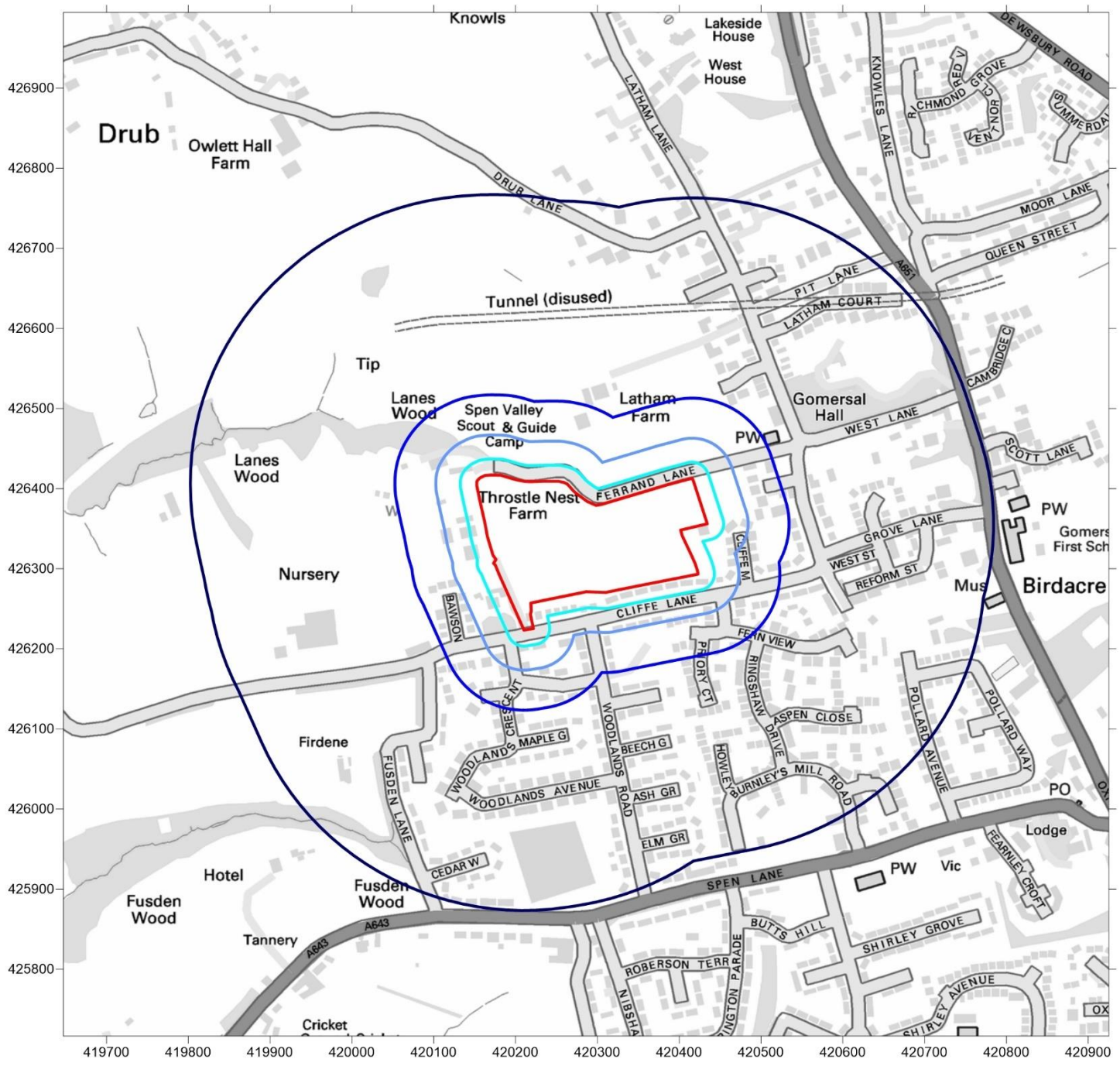

Legend

- Site Boundary
- 20m from Site Boundary
- 50m from Site Boundary
- 100m from Site Boundary
- 350m from Site Boundary

Title

Figure 3

Demolition, Earthworks and Construction Dust Buffer Zones

Project

Air Quality Assessment
Cliffe Lane, Gomersal

Project Number

AQ106623

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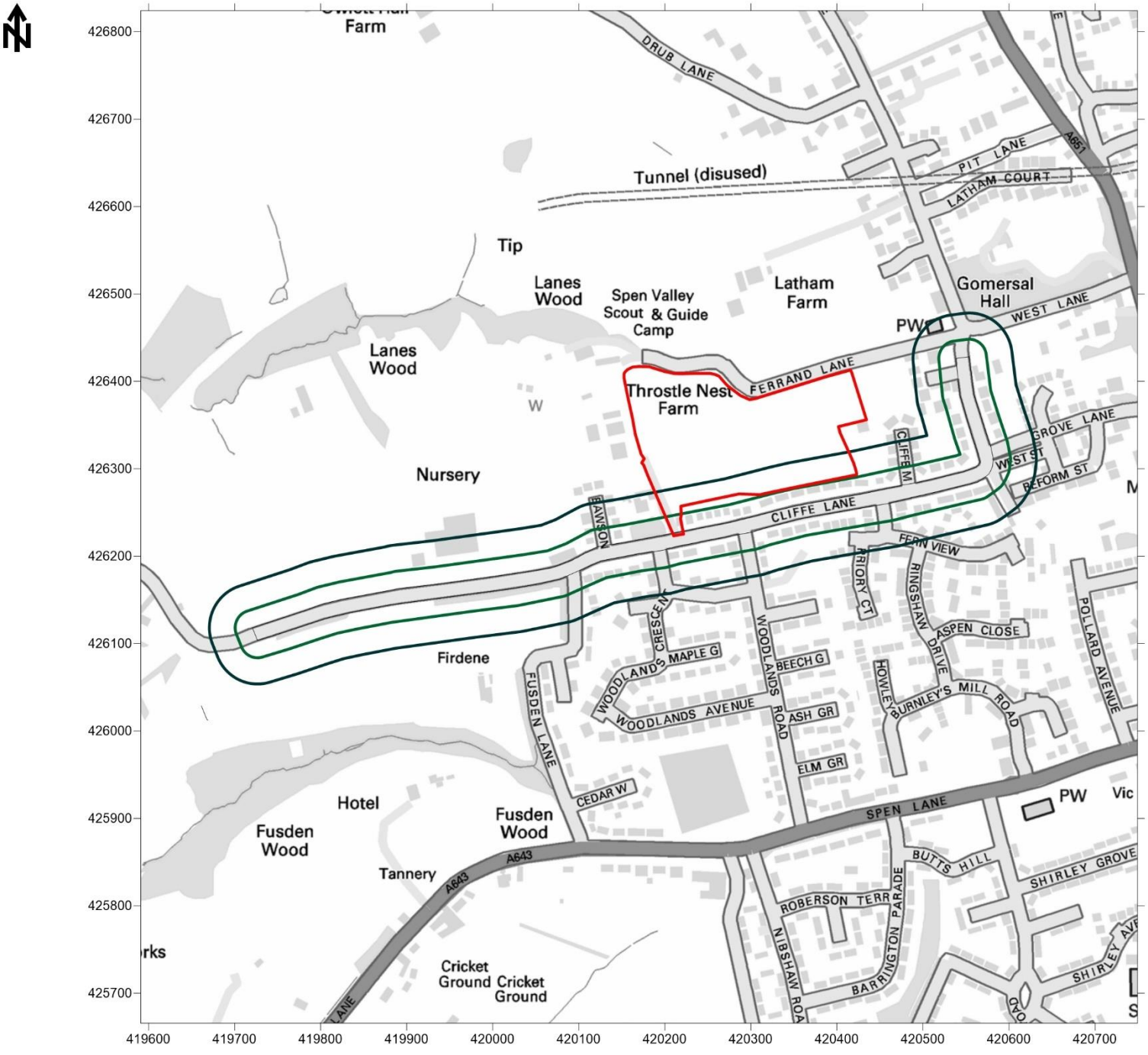

Legend

- Site Boundary
- 20m from Site Access Route
- 50m from Site Access Route

Title

Figure 4

Trackout Dust Buffer Zones

Project

Air Quality Assessment
Cliffe Lane, Gomersal

Project Number

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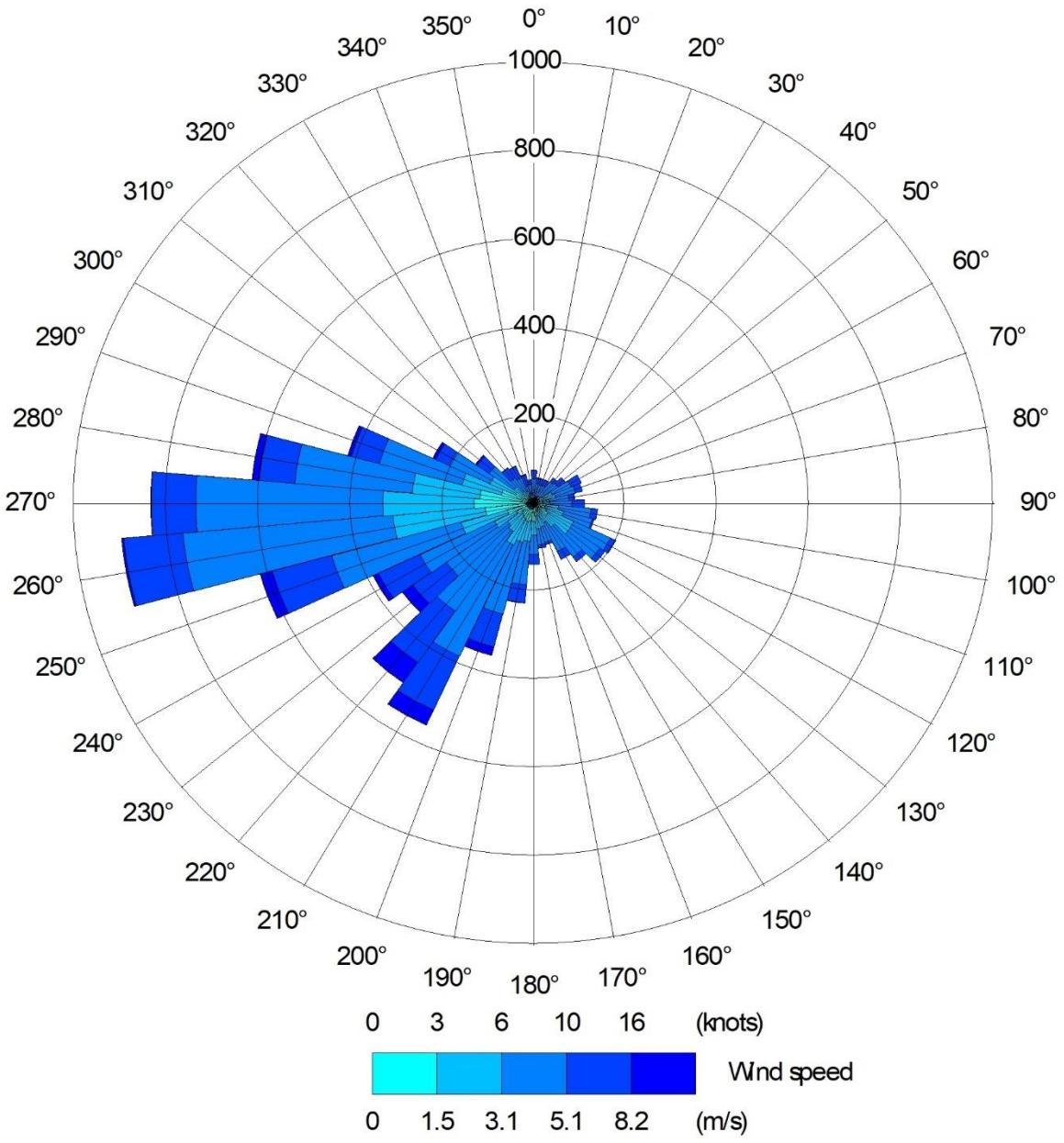

Title

Figure 5

Wind Rose
Bingley Meteorological Station 2017

Project

Air Quality Assessment
Cliffe Lane, Gomersal

Project Number

AQ106623

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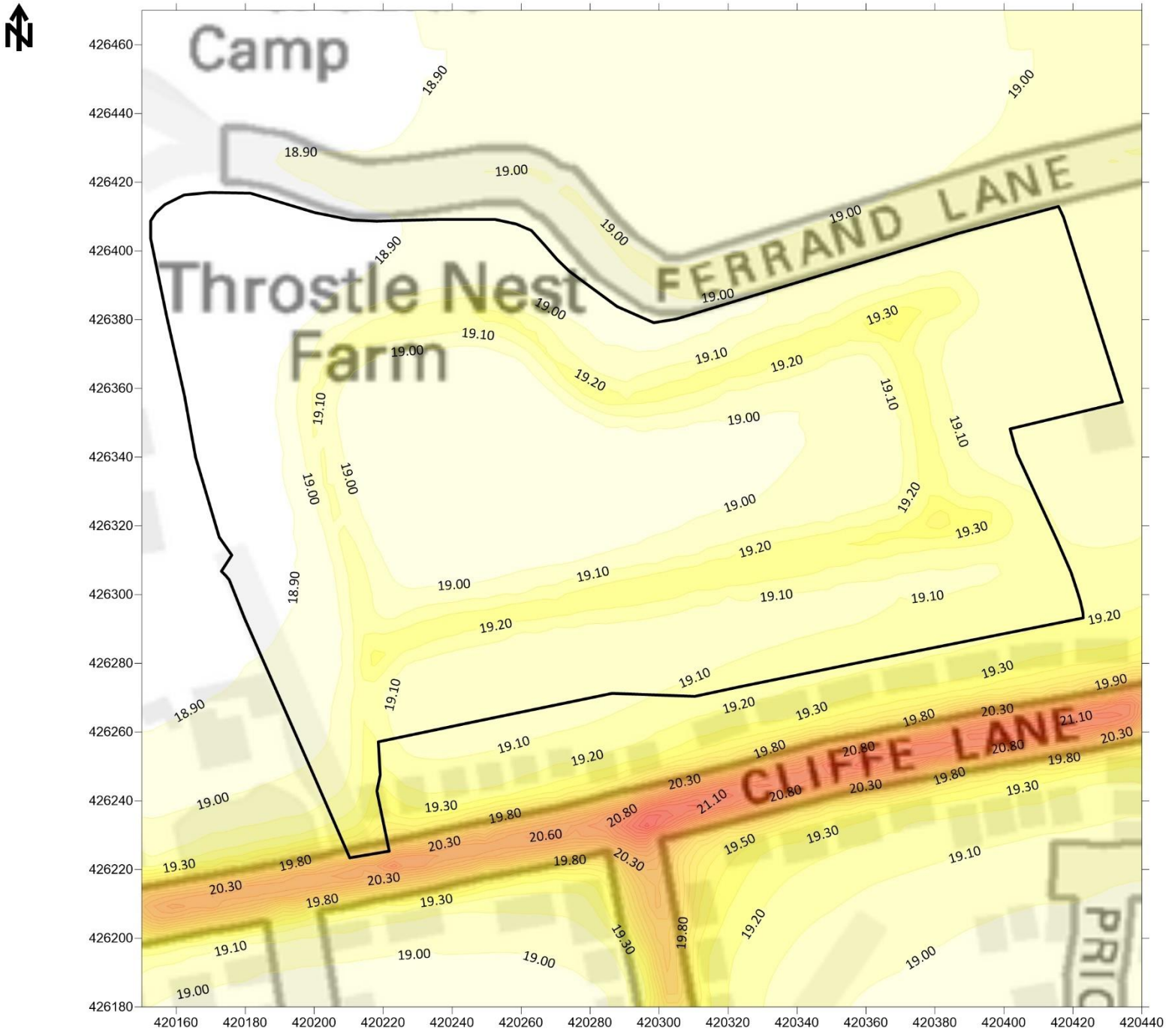

Legend

Site Boundary

Predicted Annual Mean NO_2 Concentration (µg/m³)

21.6
21.4
21.2
21.0
20.8
20.6
20.4
20.2
20.0
19.8
19.6
19.4
19.2
19.0
18.8

Title

Figure 6

Predicted Annual Mean NO_2 Concentrations (µg/m³) 2022 DS

Project

Air Quality Assessment
Cliffe Lane, Gomersal

Project Number

AQ106623

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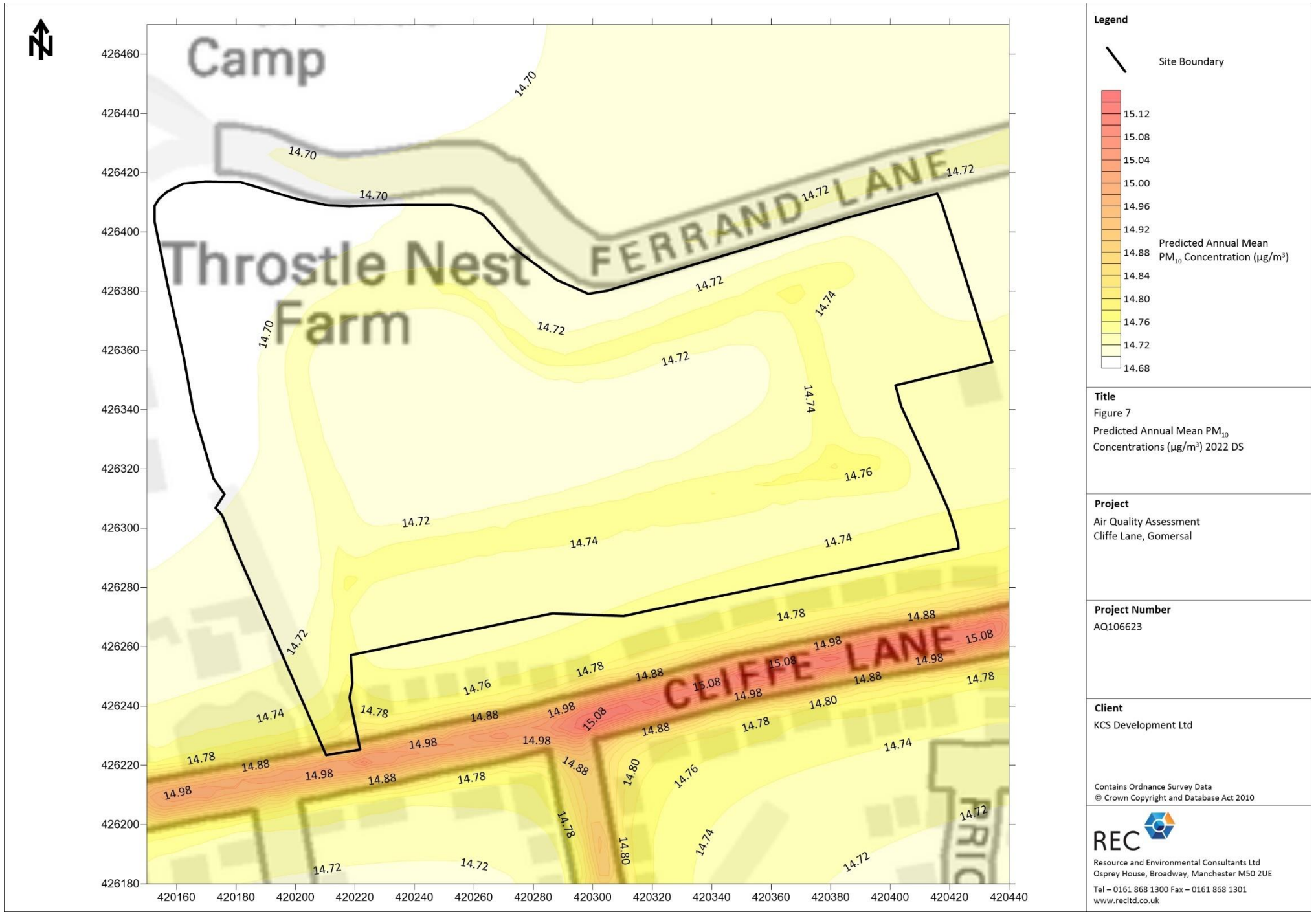

Legend

Site Boundary

15.12
15.08
15.04
15.00
14.96
14.92
14.88
14.84
14.80
14.76
14.72
14.68

Predicted Annual Mean PM_{10} Concentration (µg/m³)

Title

Figure 7

Predicted Annual Mean PM_{10} Concentrations (µg/m³) 2022 DS

Project

Air Quality Assessment
Cliffe Lane, Gomersal

Project Number

AQ106623

Client

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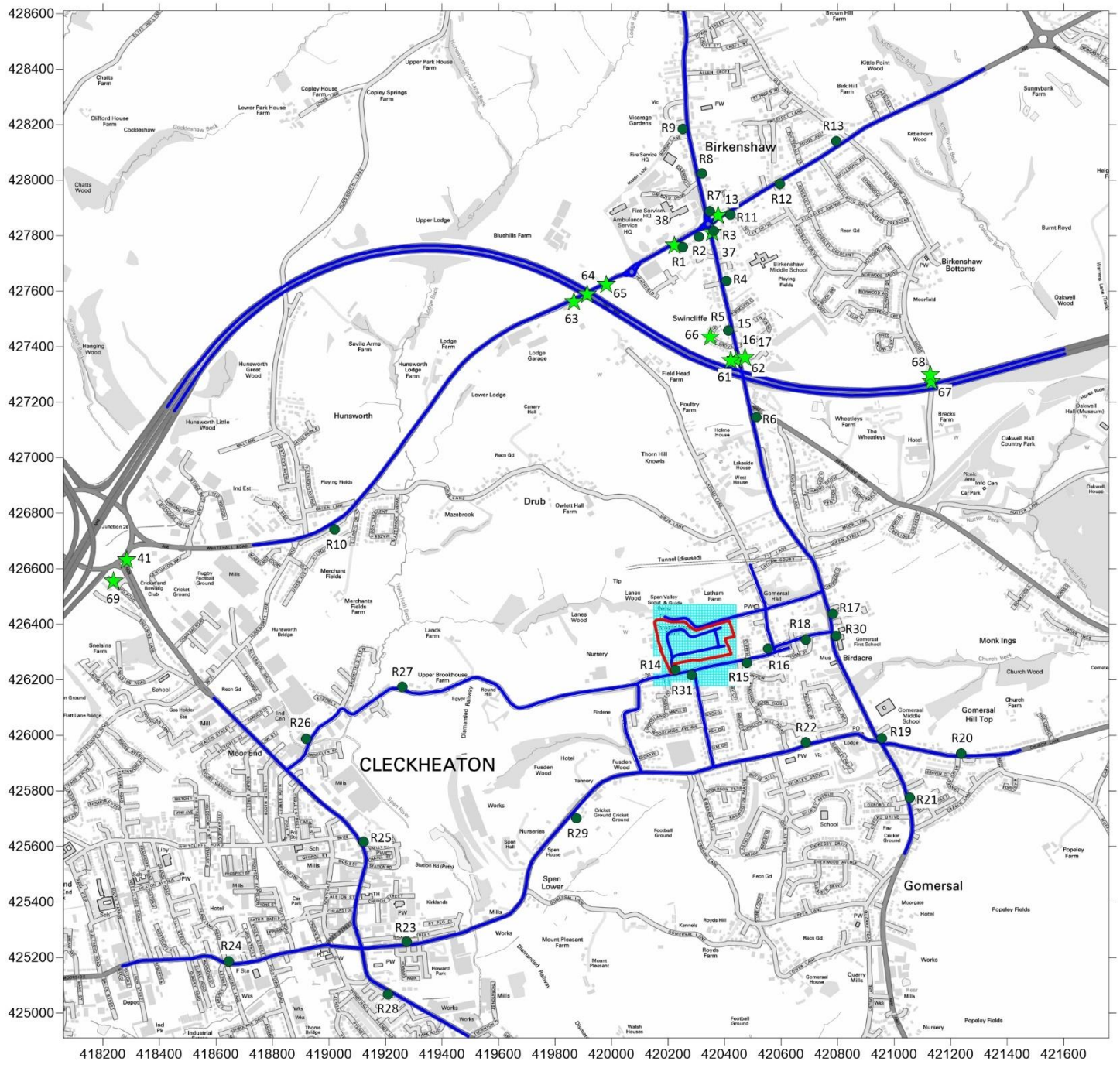

Legend

- Site Boundary
- Modelled Road Link
- Cartesian Grid
- Diffusion Tube Monitoring Locations
- Sensitive Receptor Locations

Title

Figure 8

ADMS-Roads Input

Project

Air Quality Assessment
Cliffe Lane, Gomersal

Project Number

AQ106623

Client

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APPENDIX II - ASSESSMENT INPUTS

Assessment Inputs

The proposed development has the potential to introduce future site users to poor air quality, as well as the potential to cause impacts during the construction and operational phases of the development. Dispersion modelling using ADMS Roads was therefore undertaken to predict NO_2, PM_{10} and $PM_{2.5}$ concentrations across the site and at sensitive locations both with and without the development in place, to consider potential impacts and assess site suitability for the proposed end-use.

The model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length; and
- Monin-Obukhov length.

Assessment inputs are described in the following subsections.

Dispersion Model

Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 4.0.1.0). ADMS-Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

Assessment Area

Ambient concentrations were predicted over the proposed development site and surrounding highway network. One Cartesian grid was included in the model over the area NGR: 420150, 426180 to 420440, 426470 at height of 1.5m to represent the ground floor level.

Results were subsequently used to produce contour plots within the Surfer software package.

It should be noted that although the grid only covered the proposed site, road links were extended in order to ensure the impact of all relevant vehicle emissions in the vicinity of the development were considered.

Reference should be made to Figure 8 within Appendix I for a graphical representation of the assessment grid extents.

Traffic Flow Data

Traffic data for use in the assessment, including development flows, was provided by Bryan G Hall Ltd, the appointed Transport Consultants for the scheme.

The provided data did not include baseline flows for the M62. As such, 24-hour flows and fleet composition were downloaded from the Department for Transport (DfT) Matrix. The DfT Matrix web tool enables the user to view and download traffic flows on every link of the A-road and motorway network in Great Britain for the years 1999 to 2017. It should be noted that the DfT matrix is referenced in DEFRA guidance LAQM (TG16)[2] as being a suitable source of data for air quality assessments and is therefore considered to provide a good representation of traffic flows in the vicinity of the site.

Growth factors provided by the Trip End Model Presentation Program (TEMPRO) software package were utilised to allow for conversion from the obtained 2017 traffic flow to 2022 which was used to represent the future year scenario. Vehicle speeds were estimated based on the free flow potential of each link and local speed limits. Road widths were estimated from aerial photography and UK highway design standards.

Reference should be made to Figure 8 within Appendix I for a graphical representation of the road link locations.

A summary of the traffic data used in the verification scenarios is provided in Table AII.1.

Table AII.1 2017 Traffic Data

Road Link		Road Width (m)	Height (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
L1a	Cliffe Lane -East of Site	6.8	0	3,315	1.7	48
L1b	Cliffe Lane West of Woodlands Road	6.8	0	4,525	2.3	48
L1c	Lantham Lane	6.8	0	4,478	2.4	48
L2	Lantham Lane - Slowdown	9.7	0	4,401	2.2	16
L3a	Ferrand Lane - Slowdown	8.6	0	68	15.4	8
L3b	Ferrand Lane	2.9	0	68	15.4	32
L4	West Lane	5.6	0	5,824	2.5	48
L5	West Lane - Slowdown	8.1	0	5,824	2.5	16
L6	Lantham Lane North of Site	5.4	0	3,299	1.7	48
L7a	Oxford Road South of West Lane	6.9	0	9,528	3.9	40
L7b	Oxford Road South of Grove Lane	8.4	0	9,731	3.5	40
L7c	Oxford Road South of West Lane - Slowdown	8.5	0	9,596	3.5	16
L8a	Spen Lane Slowdown to Oxford Road	8.9	0	7,222	3.7	16
L8b	Spen Lane East of Woodlands Road	6.8	0	7,601	3.9	48
L8c	Spen Lane West of Woodlands Road	8.0	0	7,087	4.8	48

Road Link		Road Width (m)	Height (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
L8d	Spen Lane East of Fusden Lane	7.1	0	7,248	4.2	48
L8e	Spen Lane West of Fusden Lane	7.4	0	7,715	3.9	48
L9	Spen Lane - A638 Slowdown	8.2	0	7,715	4.3	16
L10	A638 - Slowdown	8.5	0	11,269	6.3	8
L11a	A638 South of Balme Road	7.7	0	13,461	6.3	32
L11b	A638 North of Balme Road	8.7	0	12,994	6.6	48
L12	Balme Road Slowdown	9.5	0	3,481	2.5	16
L13a	Balme Road	6.1	0	2,546	2.2	48
L13b	Cliffe Lane (West of Site)	6.1	0	3,237	1.8	48
L14	Dewsbury Road Slowdown	6.5	0	11,643	7.0	8
L15	Dewsbury Road	8.2	0	11,643	7.0	32
L16	A643 Slowdown	7.7	0	9,949	4.1	16
L17	A643	7.4	0	9,949	4.1	40
L18	Roundabout - A58 Whitehall Road West/ Heathfield Lane	9.7	0	13,780	3.1	32
L19	A58 Whitehall Road- East of Heathfield Lane (Junction Slowdown - Eastbound)	3.2	0	6,890	3.1	40
L20	A58 Whitehall Road- East of Heathfield Lane (Junction Slowdown - Westbound)	4.4	0	6,890	3.1	24
L21	A58 Whitehall Road- East of Heathfield Lane	8.6	0	13,780	3.1	48
L22	A58 Whitehall Road West - (Eastbound Junctinon Slowdown)	5.7	0	6,890	3.1	24
L23	A58 Whitehall Road West - (Westbound Junction Slowdown)	5.7	0	6,890	3.1	40
L24	Roundabout - A651/ A58	9.4	0	12,352	3.3	32
L25	A651 Bradford Road (North) - Northbound Junction Slowdown	3.9	0	5,053	2.8	40
L26	A651 Bradford Road (North) - Southbound Junction Slowdown	5.8	0	5,053	2.8	24
L27	A651 Bradford Road (North)	10.9	0	10,106	2.8	48

Road Link		Road Width (m)	Height (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
L28	A58 Whitehall Road - West of Heathfield Roundabout (Junction Slowdown Eastbound)	5.7	0	6,890	3.1	24
L29	A58 Whitehall Road - West of Heathfield Roundabout (Junction Slowdown Westbound)	4.5	0	6,890	3.1	40
L30	A58 Whitehall Road - West of Heathfield Roundabout	8.7	0	13,780	3.1	48
L31	Bradford Road - South of Whitehall Road West - Junction Slowdown (Northbound)	6.9	0	6,190	3.4	24
L32	Bradford Road - South of Whitehall Road West - Junction Slowdown (Southbound)	6.4	0	6,190	3.4	40
L33	Bradford Road - South of Whitehall Road West	10.8	0	12,381	3.4	48
L34	Whitehall Road East - East of Bradford Road - Junction Slowdown (Eastbound)	5.6	0	6,571	3.8	40
L35	Whitehall Road East - East of Bradford Road - Junction Slowdown (Westbound)	5.6	0	6,571	3.8	24
L36	Whitehall Road East - East of Bradford Road	9.4	0	13,141	3.8	48
L37	M62 - Eastbound	14.0	-8	75,890	15.4	113
L38	M62 - Westbound	14.0	-8	75,890	15.4	113
L39	West Street	5.7	0	130	8.0	32
L40	Grove Lane	4.2	0	301	6.9	32
L41	Grove Lane Slowdown	5.6	0	426	6.1	8
L42	Fusden Lane - South Slowdown	8.7	0	1,382	1.5	16
L43	Fusden Lane	7.0	0	1,382	1.5	48
L44	Fusden Lane - North Slowdown	8.1	0	1,314	1.6	16
L45	Woodlands Road - South Slowdown	9.5	0	2,302	2.7	16
L46	Woodlands Road	5.9	0	2,302	2.7	48
L47	Woodlands Road - North Slowdown	13.2	0	2,083	3.0	16
L48	Site Access to North	5.5	0	31	0.0	16
L49	Site Access to South	5.5	0	31	0.0	16
L50	North to South Connection	5.5	0	31	0.0	16

Road Link		Road Width (m)	Height (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
L51	Church Lane Slowdown	7.4	0	8,141	3.2	16
L52	Church Lane	7.3	0	8,141	3.2	48
L53	Oxford Road- South A643 -Slowdown	7.2	0	7,720	3.0	16
L54	Oxford Road- South A643	7.9	0	7,720	3.0	40

The road width, height and mean vehicle speed shown in Table AII.1 remained the same for the 2022 scenarios.

A summary of the 2022 traffic data is shown in Table AII.2.

Table AII.2 2022 Traffic Data

Road Link		DM		DS	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
L1a	Cliffe Lane -East of Site	3,512	1.7	3,801	1.6
L1b	Cliffe Lane West of Woodlands Road	4,795	2.3	4,901	2.2
L1c	Lantham Lane	4,745	2.4	4,852	2.4
L2	Lantham Lane - Slowdown	4,663	2.2	4,769	2.2
L3a	Ferrand Lane - Slowdown	72	15.4	72	15.4
L3b	Ferrand Lane	72	15.4	72	15.4
L4	West Lane	6,171	2.5	6,278	2.5
L5	West Lane - Slowdown	6,171	2.5	6,278	2.5
L6	Lantham Lane North of Site	3,496	1.7	3,496	1.7
L7a	Oxford Road South of West Lane	10,135	3.9	10,135	3.9
L7b	Oxford Road South of Grove Lane	10,350	3.5	10,350	3.5
L7c	Oxford Road South of West Lane - Slowdown	10,207	3.5	10,207	3.5
L8a	Spen Lane Slowdown to Oxford Road	7,929	3.6	8,085	3.5
L8b	Spen Lane East of Woodlands Road	8,334	3.8	8,487	3.7

Road Link		DM		DS	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
L8c	Spen Lane West of Woodlands Road	7,789	4.6	7,814	4.6
L8d	Spen Lane East of Fusden Lane	7,948	4.0	7,973	4.0
L8e	Spen Lane West of Fusden Lane	8,443	3.8	8,469	3.8
L9	Spen Lane - A638 Slowdown	8,439	4.2	8,463	4.2
L10	A638 - Slowdown	12,479	6.0	12,501	6.0
L11a	A638 South of Balme Road	14,802	6.1	14,824	6.1
L11b	A638 North of Balme Road	14,307	6.3	14,426	6.3
L12	Balme Road Slowdown	3,688	2.5	3,829	2.4
L13a	Balme Road	2,698	2.2	2,836	2.1
L13b	Cliffe Lane (West of Site)	3,430	1.8	3,568	1.7
L14	Dewsbury Road Slowdown	13,179	6.5	13,182	6.5
L15	Dewsbury Road	13,179	6.5	13,182	6.5
L16	A643 Slowdown	10,816	4.0	10,836	4.0
L17	A643	10,816	4.0	10,836	4.0
L18	Roundabout - A58 Whitehall Road West/ Heathfield Lane	14,283	3.1	14,319	3.1
L19	A58 Whitehall Road- East of Heathfield Lane (Junction Slowdown - Eastbound)	7,141	3.1	7,159	3.1
L20	A58 Whitehall Road- East of Heathfield Lane (Junction Slowdown - Westbound)	7,141	3.1	7,159	3.1
L21	A58 Whitehall Road- East of Heathfield Lane	14,283	3.1	14,319	3.1
L22	A58 Whitehall Road West - (Eastbound Junctinon Slowdown)	7,141	3.1	7,159	3.1
L23	A58 Whitehall Road West - (Westbound Junction Slowdown)	7,141	3.1	7,159	3.1
L24	Roundabout - A651/ A58	12,803	3.3	12,856	3.3
L25	A651 Bradford Road (North) - Northbound Junction Slowdown	5,237	2.8	5,255	2.8

Road Link		DM		DS	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
L26	A651 Bradford Road (North) - Southbound Junction Slowdown	5,237	2.8	5,255	2.8
L27	A651 Bradford Road (North)	10,475	2.8	10,510	2.8
L28	A58 Whitehall Road - West of Heathfield Roundabout (Junction Slowdown Eastbound)	7,141	3.1	7,159	3.1
L29	A58 Whitehall Road - West of Heathfield Roundabout (Junction Slowdown Westbound)	7,141	3.1	7,159	3.1
L30	A58 Whitehall Road - West of Heathfield Roundabout	14,283	3.1	14,319	3.1
L31	Bradford Road - South of Whitehall Road West - Junction Slowdown (Northbound)	6,416	3.4	6,469	3.4
L32	Bradford Road - South of Whitehall Road West - Junction Slowdown (Southbound)	6,416	3.4	6,469	3.4
L33	Bradford Road - South of Whitehall Road West	13,157	3.3	13,264	3.3
L34	Whitehall Road East - East of Bradford Road - Junction Slowdown (Eastbound)	6,810	3.8	6,828	3.8
L35	Whitehall Road East - East of Bradford Road - Junction Slowdown (Westbound)	6,810	3.8	6,828	3.8
L36	Whitehall Road East - East of Bradford Road	13,621	3.8	13,656	3.8
L37	M62 - Eastbound	78,659	15.4	78,659	15.4
L38	M62 - Westbound	78,659	15.4	78,659	15.4
L39	West Street	138	8.0	138	8.0
L40	Grove Lane	319	6.9	319	6.9
L41	Grove Lane Slowdown	451	6.1	451	6.1
L42	Fusden Lane - South Slowdown	1,464	1.5	1,464	1.5
L43	Fusden Lane	1,464	1.5	1,464	1.5
L44	Fusden Lane - North Slowdown	1,393	1.6	1,393	1.6
L45	Woodlands Road - South Slowdown	2,439	2.7	2,618	2.5

Road Link		DM		DS	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
L46	Woodlands Road	2,439	2.7	2,618	2.5
L47	Woodlands Road - North Slowdown	2,208	3.0	2,390	2.8
L48	Site Access to North	33	-	458	-
L49	Site Access to South	33	-	458	-
L50	North to South Connection	33	-	458	-
L51	Church Lane Slowdown	8,822	3.1	8,937	3.1
L52	Church Lane	8,822	3.1	8,937	3.1
L53	Oxford Road- South A643 -Slowdown	8,224	3.0	8,264	3.0
L54	Oxford Road- South A643	8,224	3.0	8,264	3.0

Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 8.0.1) released in 2017, which incorporates updated COPERT 5 vehicle emissions factors for NO_x and vehicle fleet information.

There is current uncertainty over NO_2 concentrations within the UK, with roadside levels not reducing as previously expected due to the implementation of new vehicle emission standards. Therefore, 2017 emission factors have been utilised for the prediction of pollution levels for all scenarios in preference to the development opening year in order to provide a robust assessment

Emission factors for the 2022 DM and DS scenarios were calculated using the CURED (version V3A). This calculator gives realistic, worst case emission factors for diesels for future years which utilise recent real-world emissions test data. This calculator was used exclusively for the future year 2022 DM and DS scenarios for NO_x.

It should be noted that PM_{10} emission factors were calculated using the Emission Factor Toolkit (version 8.0.1) for the 2017 Verification scenario and the 2022 DM and DS scenarios.

Meteorological Data

Meteorological data used in this assessment was taken from Bingley meteorological station over the period 1st January 2017 to 31st December 2017 (inclusive). Bingley meteorological station is located at approximate NGR: 408651, 435982, which is approximately 15km north west of the proposed development.

All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling

(ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 5 within Appendix I for a wind rose of utilised meteorological data.

Roughness Length

A roughness length (z_0) of 0.5m was used in this dispersion modelling study. This value of z_0 is considered appropriate for the morphology of the assessment area and is suggested within ADMS-Roads as being suitable for 'parkland, open suburbia'.

A z_0 of 0.3m was utilised to represent the morphology of the meteorological station location and is suggested as being suitable for 'agricultural areas (max)'

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m was used in this dispersion modelling study. This value is considered appropriate for the nature of the assessment area and meteorological station location and is suggested within ADMS-Roads as being suitable for 'cities and large towns'.

A Monin-Obukhov length of 10m was used to represent the meteorological station location and is suggested within ADMS-Roads as being suitable for 'small towns <50,000'.

Background Concentrations

Background Concentrations as predicted by DEFRA, as detailed in Table 17, have been used in the dispersion modelling assessment to represent annual mean background concentrations in the vicinity of the site.

Table AII.3 displays the specific background concentrations as predicted by DEFRA, utilised to represent the condition at the monitoring locations used within the verification process.

Table AII.3 Predicted Background Pollutant Concentrations for diffusion Tubes

KC Monitoring Location		DEFRA Grid Square	Pollutant	2017 Predicted Background Concentration (µg/m^3)
13	Whitehall Road East	420377, 427871	NO_x	34.84
			NO_2	23.09
15,16,17	Ainley Top 1, 2 and 3	420441, 427353	NO_x	34.84
			NO_2	23.09
37	Bradford Road, Birkenshaw	420359, 427810	NO_x	34.84
			NO_2	23.09
38	Whitehall Road West	420222, 427764	NO_x	34.84
			NO_2	23.09

Table AII.4 displays the predicted background concentrations by DEFRA used in the operational phase assessment for the sensitive receptor locations.

Table AII.4 Predicted Background Pollutant Concentrations for Receptors

Receptor Grid Square	Receptors	Pollutant	2017 Predicted Background Concentration (µg/m^3)
420500, 427500	R1 - R7, R11-R12	NO_x	34.84
		NO_2	23.09
		PM_{10}	16.83
		$PM_{2.5}$	11.55
420500, 428500	R8- R9, R13	NO_x	27.40
		NO_2	18.69
		PM_{10}	15.41
		$PM_{2.5}$	10.42
419500, 426500	R10, R27	NO_x	26.35
		NO_2	18.07
		PM_{10}	14.80
		$PM_{2.5}$	10.48
420500, 426500	R14- R18, R30-R31	NO_x	26.32
		NO_2	18.05
		PM_{10}	14.59
		$PM_{2.5}$	10.36
420500, 425500	R19, R22	NO_x	25.45
		NO_2	17.50
		PM_{10}	14.34
		$PM_{2.5}$	10.26
421500, 425500	R20- R21	NO_x	25.21
		NO_2	17.35
		PM_{10}	14.16
		$PM_{2.5}$	10.12
419500, 425500	R23, R25, R28- R29	NO_x	26.36
		NO_2	18.06

Receptor Grid Square	Receptors	Pollutant	2017 Predicted Background Concentration (µg/m^3)
		PM_{10}	14.56
		$PM_{2.5}$	10.38
418500, 425500	R24, R26	NO_x	29.30
		NO_2	19.77
		PM_{10}	15.10
		$PM_{2.5}$	10.70

Similar to emission factors, background concentrations for 2017 were utilised in preference to predicted background concentrations for the development opening years. This provided a robust assessment and is likely to overestimate actual pollutant concentrations during the operation of the proposals.

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO_2 concentrations using the spreadsheet provided by DEFRA, which is the method detailed within LAQM (TG16)[2].

Verification

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and
- Uncertainties associated with monitoring data, including locations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

For the purpose of this assessment model verification was undertaken for 2017, using traffic data, meteorological data and monitoring results from this year.

KC undertakes monitoring of NO_2 concentrations at 6 locations suitable for verification purposes within the assessment extents. It should be noted that diffusion tube 64 was located at 0.1m from the road and was considered a kerbside location and therefore was not included in the verification process. Furthermore, diffusion tubes 62, 67, 68 were removed from the verification process as traffic data for the roads they are located on were not available for this assessment.

The road contribution to total NO_x concentration was calculated from the monitored NO_2 result for use in the verification process. This was undertaken following the methodology contained within DEFRA guidance LAQM (TG16)[2].

The dispersion model was run with the traffic input data previously detailed for 2017 to predict the NO_x concentration at the monitoring locations. The results are shown in Table AII.5.

Table AII.5 NO_x Verification Results

KC ID	Monitoring Location	Modelled Road NO_x Concentration (µg/m^3)	Monitored Road NO_x Concentration (µg/m^3)	Difference (%)
13	Whitehall Road East	12.64	26.82	52.88%
15	Ainley Top 1	30.70	23.27	-31.93%
16	Ainley Top 2	30.70	57.30	46.42%
17	Ainley Top 3	30.70	29.08	-5.57%
37	Bradford Road, Birkenshaw	14.03	26.66	47.37%
38	Whitehall Road West	14.80	26.82	44.83%

The monitored and modelled NO_x road contribution concentrations were graphed and the equation of the trendline based on the linear progression through zero was calculated, as shown in Graph 1. This indicated that a verification factor of **1.3153** was required to be applied to all NO_x modelling results.

Graph 1 - NO_x Verification Factor

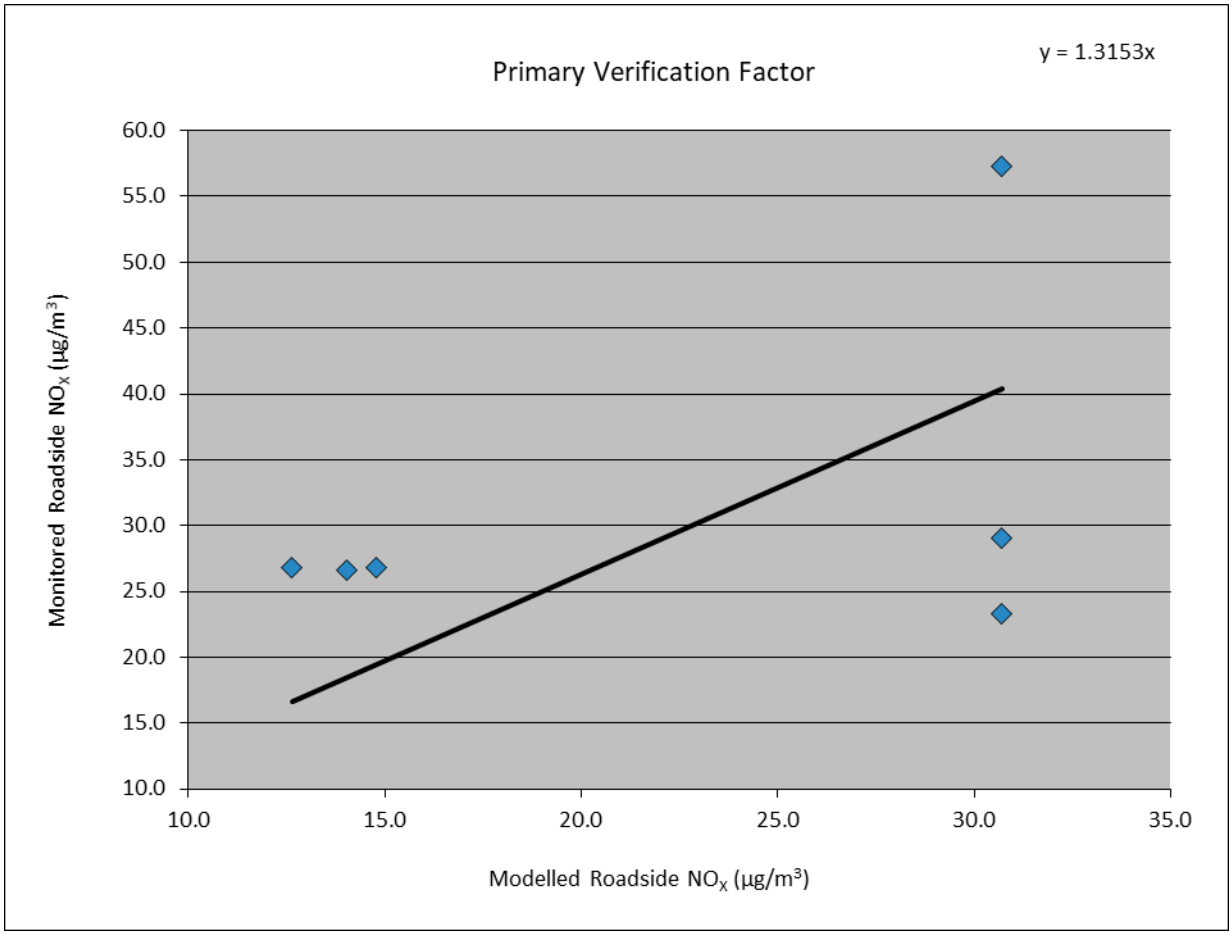

Table AII.6 presents the monitored annual mean NO_x concentrations and the adjusted modelled total NO_2 concentration based on the above verification factor. Exceedances of the relevant AQO are highlighted in **bold.**

Table AII.6 2017 NO_2 Monitoring Results

KC ID	Monitoring Location	Monitored NO_2 Concentration (µg/m³)	Adjusted Modelled Total NO_2 Concentration (µg/m³)	Difference (%)
13	Whitehall Road East	36.13	31.37	13.19%
15	Ainley Top 1	34.50	42.14	-22.13%
16	Ainley Top 2	**49.13**	42.14	14.24%
17	Ainley Top 3	37.16	42.14	-13.39%

KC ID	Monitoring Location	Monitored NO_2 Concentration ($\mu g/m^3$)	Adjusted Modelled Total NO_2 Concentration ($\mu g/m^3$)	Difference (%)
37	Bradford Road, Birkenshaw	36.06	32.24	10.60%
38	Whitehall Road West	36.13	32.72	9.45%

As PM_{10} monitoring is not undertaken within the assessment extents, the NO_x adjustment factor of **1.3153** was utilised to adjust model predictions of particulate matter in accordance with the guidance provided within LAQM (TG16)[2].

APPENDIX III - ASSESSOR'S CURRICULUM VITAE

CONAL KEARNEY

Head of Noise and Air

BEng(Hons), MSc, MIAQM, MIEnvSc

KEY EXPERIENCE:

Conal is Head of Noise and Air with specialist experience in the air quality and odour sector. His key capabilities include:

- Advanced atmospheric air dispersion modelling of road vehicle and industrial emissions using ADMS-ROADS and AIRVIRO.
- Preparation of factual and interpretative Air Quality Assessment reports and Air Quality Environmental Statement chapters in the vicinity of proposed schemes and developments in accordance with DEFRA, Environment Agency and Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) methodologies.
- Management and delivery of project work on key, land development and urban regeneration projects.
- Assessment of road vehicle exhaust emissions using the Design Manual for Roads and Bridges (DMRB) calculation spreadsheet.
- Assessment of dust impacts from construction sites to the Institute of Air Quality Management (IAQM) methodology.
- Dust and Odour impact assessments from minerals and waste sites
- Representing clients at public enquiries and planning hearings.

QUALIFICATIONS:

- Bachelor of Engineering
- Master of Science
- Member of Institute of Air Quality Management
- Member of the Institute of Environmental Science (IES)

SELECT PROJECTS SUMMARY:

Industrial Developments

Buck Park, Denholme - AQA and dust assessment for proposed mineral extraction and site restoration project.

Messingham Quarry, North Lincolnshire - AQA and dust impacts for proposed new sand extraction site.

Arden Quarry, Derbyshire - AQA for proposed mineral extraction and site restoration

Calder Brick Works, Yorkshire - AQA for proposed site restoration plan

Coopers Moss, St Helens AQA and dust assessment for materials import and site restoration.

Clayton Hall Landfill, Chorley - AQA and odour assessment for proposed landfill extension and mineral extraction.

Highways Developments

Alderley Edge Bypass, Cheshire - AQA for major new road scheme.

South Heywood – EIA for new link road and mixed use joint development

Residential Developments

Beck's Mill, Silsden – AQA and emissions calculation for proposed residential development

Bredbury Curve, Stockport - AQA assessment for proposed residential development in AQMA.

Hollin Lane, Middlewich – AQA for large scale residential development.

Friars School, Southwark, London. School development for mixed use education and residential building in AQMA.

Abbotsford House, Bearsden, Scotland – AQA and dust assessment for residential development

Kelvedon Street, Newport, South Wale – AQA for new housing development

Westcraig, Edinburgh - EIA for residential development

Public Sector

Technical advisor on Manchester Airport Consultative Committee - advise members on environmental technical matters in relation to the airport's operations.

Cheshire County Council - compile AQ chapters for Local Transport Plan

Cheshire East Council - specialist AQ advice on highways, minerals and waste projects

Local Air Quality Management

Broughton Gyratory, Chester - dispersion model for City Centre detailed assessment report

Congleton town centre - dispersion modelling assessment for detailed and further assessment reports.

Disley - dispersion modelling assessment for detailed and further assessments

Holmes Chapel - dispersion modelling assessment for detailed and further assessment reports for road and rail sources.

Crewe - town centre dispersion modelling for detailed and further assessment reports.

Commercial Developments

Granta Park Daycare Centre, Oxfordshire. AQA for new build daycare centre adjacent to major road.

Curzon Cinema, Colchester. Air quality assessment for town centre new build cinema.

Newfoundland Circus, Bristol - AQA for hotel development in city centre

Salesians School, Chertsey - AQA for school extension near M25