AIR QUALITY ASSESSMENT

FOR

WESTGATE, CLECKHEATON

AQ109055-1

28/06/2021

Prepared For

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EXECUTIVE SUMMARY

Ensafe Consultants were commissioned by Strata Homes Limited to undertake an Air Quality Assessment in support of a proposed residential development at Westgate, Cleckheaton.

The proposed development comprises the redevelopment of the site to provide 194 residential units alongside associated infrastructure and parking.

Due to the scale of the development, there is potential for the proposals to cause impacts at sensitive receptors during the construction and operational phases. Additionally, given the proximity to the A643 there is potential 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 undertaken in order to predict annual mean pollutant concentrations across the application site and to predicted impacts as a result of additional road vehicle exhaust emissions associated with the proposed development. Results were subsequently verified using local monitoring results provided by Kirklees Council.

The dispersion modelling results indicated that annual mean pollutant levels across the application site were **below the relevant air quality objectives**. The location is therefore considered suitable for the proposed end-use without the implementation of protective mitigation techniques.

The assessment concluded that overall impacts on pollutant levels as a result of operational phase pollutant emissions were predicted to be **not significant** within the vicinity of the site. This is based on the completion of additional sensitivity analysis and the implementation of offsetting mitigation measures guided by damage cost analysis.

Based on the assessment results, air quality issues are not considered a constraint to planning consent for the proposed development subject to the inclusion of off-setting mitigation measures.

1.0 INTRODUCTION

1.1 Background

Ensafe Consultants has been commissioned by Strata Homes Limited, hereafter referred to as "the Client" to undertake an Air Quality Assessment in support of a proposed development, comprising of the circa 194 residenital units, herein after referred to as the "Proposed Development".

1.2 Site Location and Context

The application site is located at Westgate, Cleckheaton at approximate National Grid Reference (NGR) 418400, 425000. Reference should be made to Figure 1 within Appendix A for a location plan.

The application site is located adjacent to A643, which is considered a notable source of road traffic emissions including nitrogen dioxide (NO_2) and particulate matter (PM). Subsequently, the Proposed Development has the potential to introduce future site users into an area of existing poor air quality.

Additionally, due to the scale of the Proposed Development, there is potential to cause impacts upon existing NO_2 and Particulate Matter (PM_{10} and $PM_{2.5}$) concentrations as a result of additional road vehicle exhaust emission generated during operation. Fugitive dust impacts may also arise as a result of construction phase activities.

For validation of the planning application, an Air Quality Baseline Assessment (AQ109055) has been produced to determine the baseline conditions, assess any potential constraints to development and identify any further work required to support a planning application for the site. This assessment provides further detail to assess potential impacts as a result of the Proposed Development and to quantify annual mean NO_2 and Particular Matter (PM) concentrations across the site and at nearby sensitive receptors, in order to consider suitability for the proposed end-use.

The assessment will be undertaken in accordance with the requirements of the National Planning Policy Framework (NPPF) and the Environmental Protection UK and Institute of Air Quality Management guidance.

1.3 Limitations

This report has been produced in accordance with Ensafe Consultants standard terms of engagement. Ensafe Consultants 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 Ensafe Consultants; a charge may be levied against such approval.

2.0 LEGISLATION, GUIDANCE AND POLICY

The following legislation, guidance and policy will be considered and adhered to during the preparation of the Air Quality Assessment:

- European Union (EU) Directive 2008/50/EC;
- The National Planning Policy Framework (NPPF), updated on 19th February 2019);
- The National Planning Practice Guidance (NPPG), relevant chapters produced on 1st November 2019;
- Section 82 of the Environment Act (1995) (Part IV);
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007).
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs, 2007[1]
- The Air Quality Standards (Amendment) Regulations (2016);
- Local Air Quality Management Technical Guidance 2016 LAQM.TG(16), DEFRA, 2018[2];
- Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management (IAQM), v1.1, June 2016[3];
- Land-Use Planning and Development Control: Planning for Air Quality, Environmental Protection UK and IAQM, January 2017[4].
- Air Quality & Emissions technical Planning Guidance, West Yorkshire Low Emissions Strategy (WYLES)[5]

2.1 UK Legislation and Guidance

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 DEFRA and published in July 2007[1]. The AQS sets out Air Quality Objectives (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.

Table 1: Air Quality Objectives

Pollutant	Air Quality Objectives	
	Concentration (µg/m³)	Averaging Periods
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

1 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA, 2007
2 Local Air Quality Management Technical Guidance 2016 LAQM.TG(16), DEFRA, February 2018.
3 Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management, 2016.
4 Land-Use Planning and Development Control: Planning for Air Quality, EPUK and IAQM, January 2017.
5 Air Quality & Emissions technical Planning Guidance, West Yorkshire Low Emissions Strategy

Table 2 summarises the advice provided in DEFRA guidance LAQM.TG(16)2 on where the AQOs for pollutants considered within this report apply.

Table 2: Examples of Where the Air Quality Objectives Apply

Averaging Periods	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

The results of the dispersion modelling assessment will also be compared against the relevant AQOs detailed in Table 1 to determine significance.

2.2 Local Planning Policy

2.2.1 Kirklees Council (KC) Local Plan

The Kirklees Local Plan[6] was adopted on 27th February 2019 and sets out the policies necessary to achieve the strategy and how much new development there should be in the district and where it will go. A review of the local plan indicates the following policy text relevant to this assessment:

- ***Policy LP20: 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 areas with low levels 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.

[6] Kirklees Local Plan Strategy and Policies, February 2019, Kirklees Council

- ***Policy LP47: Healthy, active and safe lifestyles***

  The council will, with its partners, create an environment which supports healthy, active and safe communities and reduces inequality.

  Healthy, active and safe lifestyles will be enabled 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 LP51: Protection and improvement of local air quality***

  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 have an unacceptable impact on 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 must incorporate sustainable mitigation measures that reduce the level of this impact. 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.

- ***Policy LP52: Protection and the improvement of environmental quality***

  Proposals which have the potential to increase pollution from noise, vibration, light, dust, odour, shadow flicker, chemicals and other forms of pollution or to increase pollution to soil or where environmentally sensitive development would be subject to significant levels of pollution, must be accompanied by evidence to show that the impacts have been evaluated and measures have been incorporated to prevent or reduce the pollution, so as to ensure it does not reduce the quality of life and well-being of people to an unacceptable level or have unacceptable impacts on the environment.

  Such developments which cannot incorporate suitable and sustainable mitigation measures which reduce pollution levels to an acceptable level to protect the quality of life and well-being of people or protect the environment will not be permitted.

  Where possible, all new development should improve the existing environment.

Reference has been made to these policies during the undertaking of this Air Quality Assessment by assessing the impacts of road vehicle exhaust emissions on future site users and on nearby existing sensitive locations.

3.0 METHODOLOGY

There is the potential for the to expose future site users to elevated NO_2 and PM concentrations, as well as to cause impacts at sensitive locations during the construction and operational phases. This has been assessed in accordance with the following methodology, as agreed with the Environmental Health Officer (EHO) at KC on 07/02/2021.

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 IAQM document 'Guidance on the Assessment of Dust from Demolition and Construction'[3].

Reference should be made to Appendix D for details of the relevant IAQM construction phase assessment criteria, which were utilised in conjunction with site specific information.

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

- Demolition
- Earthworks
- Construction
- 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
- 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.

A desk top survey will be undertaken to identify human and ecological receptors within the relevant assessment buffers specified by the IAQM guidance[3]. Should sensitive receptors not be present within the relevant distances then negligible impacts would be expected and further assessment is not necessary.

Following the identification of sensitive receptors a site is then allocated a risk category which is assigned to each activity, based on the scale and nature of the works, as well as the the sensitivity of the area to dust impacts.

The assigned magnitude and sensitivity will then determine the overall risk and appropriate mitigation measures to be employed during construction phase activities.

The IAQM guidance[3] is provided in Appendix D, with the details of the assessor's qualifications and experience. provided in Appendix E.

3.2 Operational Phase Assessment

As stated previously, the Proposed Development has the potential to expose future site users to elevated pollutant levels, such as NO_2, PM_{10} and $PM_{2.5}$. An assessment was undertaken using the methodology contained within the WY Air Quality and Emissions Technical Planning Guidance[5] to determine the suitability for the proposed use.

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[7]. These are outlined in Table 3.

Table 3: 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
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		

Table 4: 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.

[7] http://webarchive.nationalarchives.gov.uk/20100409053417 / http://www.dft.gov.uk/adobepdf/165237/202657/guidanceontaappendixb.

The three levels of development classification are outlined in Table 5.

Table 5: Development Type Classification

Development Type Classification	Criteria
1. Minor	Development proposals that fall below the criteria detailed within Table 3.
2. Medium	Development proposals that meet the requirements detailed within Table 3.
3. Major	Development proposals that meet the requirements detailed within Table 3 and the additional trigger criteria for major developments and detailed within Table 4.

The proposed development exceeds a number of criteria listed in Table 3 (>50 units, provides more than 100 parking spaces and generates 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 WY guidance[6] 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 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[8] at or above the relevant national objective highlighted on the DEFRA GIS modelled maps[9] ;
- The proposal is one of the Land Use types:
    - C1 to C3 in **Table 3**;
    - C4 (Homes of Multiple Occupation); and
    - D1 in **Table 3**.

The Proposed Development provides C3 land use. Subsequently, the development has the potential to introduce future site users to existing levels of poor air quality. Detailed dispersion modelling was therefore undertaken to quantify NO_2 and PM_{10} concentrations across the application site in order determine suitability for the proposed use.

3.2.3 Stage 3 – Mitigation

Based on the findings of Stage 2 - Air Quality Impact Assessment, the level of air quality impact is identified as **Medium**, which is then used to determine the required level of mitigation to negate the potential effects of the Proposed Development.

[8] NO2 Concentrations and Distance from Roads, Air Quality Consultants, 2008.
[9] (http://uk-air.defra.gov.uk/data/gismapping).

3.2.4 Road Vehicle Exhaust Impact Assessment

The Proposed Development has potential to cause impacts upon existing pollution levels at nearby sensitive receptors as a result of additional road vehicle exhaust emissions (NO_2 and PM) generated during the operational phase.

Impacts have been defined by predicting pollutant concentrations at sensitive locations with and without the Proposed Development in place using dispersion modelling and the following assessment scenarios:

- 2019 as baseline year for verification against latest ratified data;
- Opening year do-minimum (DM) (predicted traffic flows in 2026 should the proposals not proceed); and
- Opening year do-something (DS) (predicted traffic flows in 2026 should the proposals be completed, with the addition of traffic generated by the Proposed Development).

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 2019 were utilised within the dispersion model. The use of 2026 traffic data and 2019 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.

3.2.5 EPUK and IAQM Impact Significant Criteria

Receptors potentially sensitive to changes in pollutant concentrations were identified within the assessment extents. LAQM.TG(16)[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 6. These are based upon the guidance provided within the EPUK and IAQM guidance[4].

Table 6: EPUK and IAQM Assessment Significance Criteria

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

The criteria shown in Table 6 is adapted from the EPUK and IAQM guidance[4] 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[4].

Following the prediction of impacts at discrete receptor locations utilising the criteria in Table 6 the EPUK and IAQM guidance[4] 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.

Reference should be made to Appendix B for full assessment input details, and Appendix C for details of the full assessment results.

Emission Factors

In light of expected emission improvements to the national vehicle fleet, and application of the WYLES, it would be unrealistic not to assume a reduction to vehicle emission factors in future years.

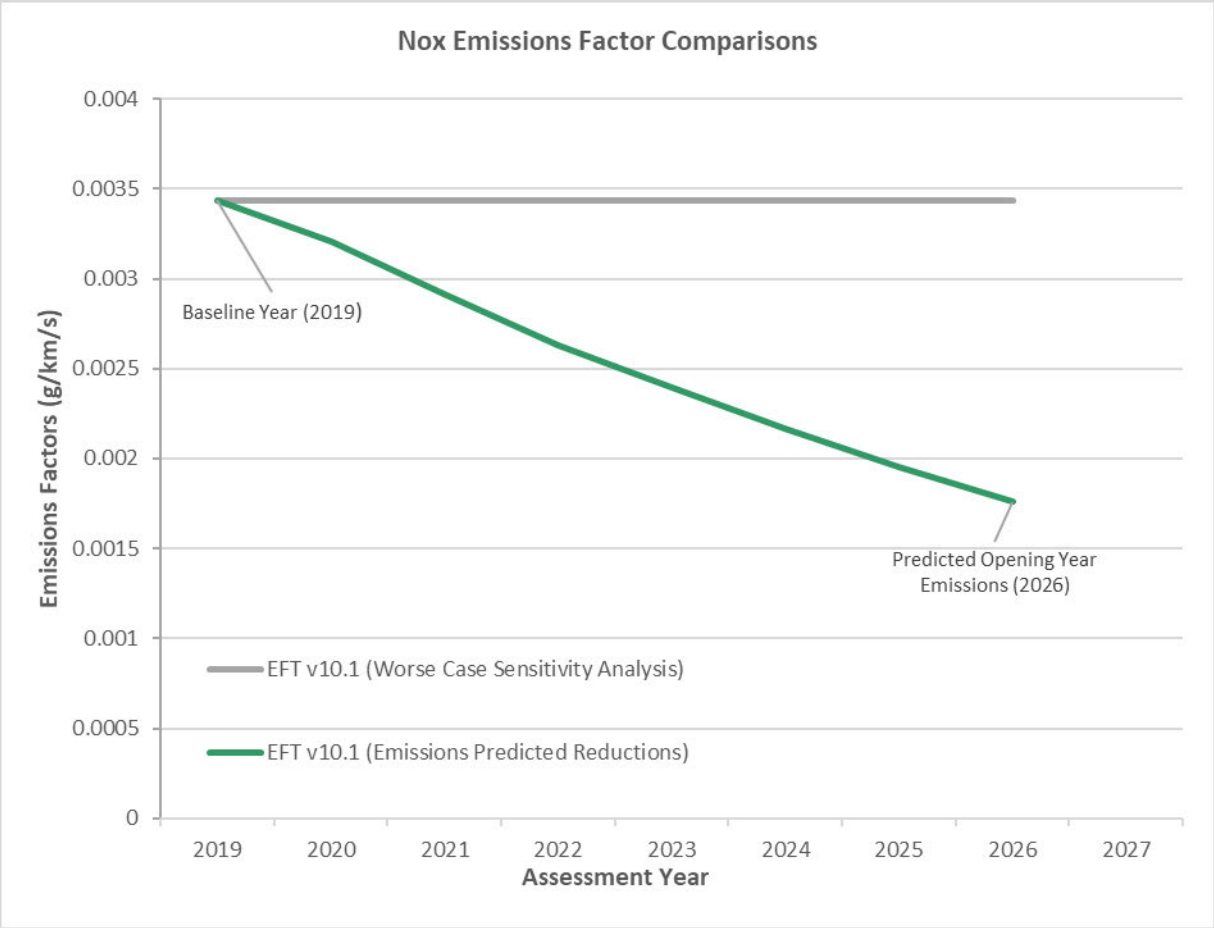
Given the anticipated development year of 2026, sensitivity analysis has been undertaken to assess associated road vehicle exhaust emissions impacts based on the use of 2026 traffic data with both 2019 and 2026 emission factors obtained from the Emission Factor Tool Kit (Eft v10.1) produced by DEFRA.

The 2019 base year scenario assumes that vehicle emission factors will not improve in line with current predictions or predicted improvements achieved by the WYLES, and future emission factors will remain consistent with those predicted for the baseline year of 2019.

The 2026 scenario assumes an emission drop off based on assumptions provided by the EfT v10.1. The EfT assumes future reduction to road vehicle exhaust emissions supported by the uptake of low emission vehicles and government incentives and targets concerning fleet proportions by 2030. The scenario is further supported by the actions set out by the WYLES which aims to promote the use of cleaner transport technology and better transport choices.

As detailed in Graph 1, the worst case 2019 base year emission assessment (assuming no future reduction to emission factors) accounts for a 49% increase when compared to 2026 future year emission assessment (which follow DEFRA predictions on future reductions to emission factors).

Graph 1 – NOx Emission Factor Comparisons



* Based on 1,000 AADT, 48kph and 0% HDV%

3.2.6 Future Exposure

The Proposed Development is located within proximity to A643. Subsequently, the proposals have potential to introduce new receptors into an area of elevated NO_2, PM_{10} and $PM_{2.5}$ concentrations.

Detailed dispersion modelling was therefore undertaken to quantify annual mean pollutant concentrations across the site and determine suitability for the proposed use. The following modelling scenarios were utilised during the future exposure assessment:

- Opening year do-something (DS) (predicted traffic flows in 2026 should the proposals be completed, with the addition of traffic generated by the Proposed Development)

The results of the dispersion modelling assessment will be compared against the relevant AQOs detailed in Table 1 to determine exposure significance. Full details of data used for the modelling assessment are presented in Appendix B of this report.

4.0 BASELINE

Existing air quality conditions in the vicinity of the application 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 their administration. As such, 10 AQMAs have been declared, the closest being described as:

- *Kirklees AQMA No.7 - The designated area incorporates Huddersfield Road (A62), Bradford Road (A638), Wakefield Road (A638), Wormald Street and Well Street, which is in Liversedge.*

The application site is located 2.5km north-west of the AQMA. As such there is low potential for the Proposed Development to cause air quality impacts within the AQMA during the construction and operational phases. This has been considered within this report.

KC has also declared AQMA No 2 for 24-hour mean PM_{10}, located 6.4km south-east of the proposed development. Due to the distance between the site and the AQMA very low potential for the development to cause impacts on air quality within these areas.

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 passive methods throughout their areas of administration. A review of KC's most recent Air Quality Monitoring Data[10] indicated that there are currently 2 automatic analysers operated by KC, the closest of which is RS3 Bradley located approximately 4.5km north of the site, at the NGR: 417255, 420761.

Due to contrasting urban environments and distance between the development site and automatic analyser, similar pollutant concentrations would not be expected. This monitoring station has not been considered further within this assessment.

KC also monitor NO_2 concentrations across the borough using passive diffusion tubes. A review of the most recent air quality monitoring data indicated 4 diffusion tubes located within the vicinity of the application site, presented in Table 7.

Table 7: Diffusion Tube Monitoring Results

ID	Site Name	Type	NGR (m)		Dist' to Site (m)	Annual Mean Concentration (µg/m³)		
			X	Y		2017	2018	2019
K33	Wakefield Rd / Huddersfield Rd	Roadside	420727	423668	2,701	**42.7**	34.3	31.1
K34	Frost Hill Liversedge	Roadside	420845	423770	2,755	39.5	38.4	33.6
K35	Leeds Road Liversedge	Roadside	420853	423866	2,719	**46.2**	**44.4**	**45.3**
K48	Flush Liversedge	Roadside	421039	423673	2,972	**47.3**	36.1	36.1

[10] Kirklees Council 2020 Air Quality Annual Status Report, June 2020, Kirklees Council

As indicated in Table 7, there were exceedances of annual mean AQO for NO_2 at these diffusion tube locations in recent years. This is due to their roadside location within an AQMA. Reference should be made to Figure 2 within Appendix A for a graphical representation of the monitoring locations.

4.3 Background Pollutant Concentrations

The total concentration of a pollutant is comprised of explicit local emission sources (such as roads and industrial sources) and the background component. The background component consists of indeterminate sources which are transported into an area from further away by meteorological conditions. Background pollutant concentrations are therefore the ambient level of pollution that is not affected by local sources of pollution.

In reality, it is not usually practical to obtain a true representation of background levels in urban areas due to corruption by local sources; background levels used in assessments may contain a mixture of both sources.

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 across grid squares:

- NGR: 418500, 424500
- NGR: 418500, 425500

Data for this location was downloaded from the DEFRA website[11]. For the purpose of this assessment, an average of these background concentrations are summarised in Table 8 for the verification year (2019) and the predicted development opening year (2026).

Table 8: Predicted Background Pollutant Concentrations

Pollutant	Predicted Background Concentration (µg/m³)	
	2019	2026
NO_x	22.59	16.77
NO_2	16.28	12.46
PM_{10}	12.74	11.93
$PM_{2.5}$	8.75	8.14

As indicated in Table 8, background pollutant concentrations of NO_2 and PM are below the relevant AQOs detailed in Table 1.

It should be noted that pollutant background concentrations from the respective assessment years have been used throughout the assessment, with 2019 background concentrations (Table 8) for the Future Year DS scenario and modelled scenario and 2026 background concentration data for sensitivity analysis scenario.

4.4 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

There are no nationally or European designated ecological receptors within 50m of the Site boundary, or within 50m from a route used by construction vehicles on the public highway (up to 500m from the Site

11 https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

entrance). Therefore, the risk of dust effects at a nationally or European designated ecological receptor site from construction impacts have not been considered further in this assessment.

Human 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 Proposed Development boundary. These are summarised in Table 9.

Table 9: Demolition, Earthworks and Construction Dust Sensitive Receptors

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

Reference should be made to Figure 3 within Appendix A 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 10. 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 egress the Proposed Development via A643, to ensure a worst case trackout assessment is undertaken.

Table 10: Trackout Dust Sensitive Receptors

Distance from Trackout Routes (m)	Approximate Number of Human Receptors
Less than 20	More than 100
20 – 50	More than 100

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

A number of additional factors have been considered when determining the sensitivity of the surrounding area. These are summarised in Table 11.

Table 11: Additional Area Sensitivity Factors

Guidance	Comment
Whether there is any history of dust generating activities in the area	The site is located in a mixed industrial/residential area. There is likely to have been a history of dust generating activities due to commuting and industrial processes 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 planning applications within the vicinity of the site.

Guidance	Comment
Pre-existing screening between the source and the receptors	There is no dense vegetation present along the development boundaries. Hence, there is no level of natural protective screening in any 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 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 duration of the construction phase is unknown.
Any known specific receptor sensitivities which go beyond the classifications given in the document.	No specific receptor sensitivities identified during the baseline.

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 and are summarised Table 12.

Table 12: Existing Sensitive Human Receptors

Potential Impact		NGR (m)		Height (m)
		X	Y	
R1	4 Brick Street	418189.9	425129.4	1.5
R2	150 Westgate	418155.1	425155.4	1.5
R3	133 Westgate	418153.3	425127.7	1.5
R4	28 Moorside Rise	418034.7	425129.9	1.5
R5	1 School Street	417992.7	425105.9	1.5
R6	36 Westcliffe Road	418347.5	425284.5	1.5
R7	37 Westcliffe Road	418310.7	425365.1	1.5
R8	75 Westcliffe Road	418259.7	425599.8	1.5
R9	8 Kenmore Road	418278.7	425666.1	1.5
R10	2 Kenmore Crescent	418256.8	425756.7	1.5
R11	34 Kenmore Road	418227.7	425931.8	1.5
R12	182 Whitechapel Road	418166.4	425993.7	1.5
R13	74 Whitechapel Road	418286.0	426107.3	1.5
R14	22 Whitechapel Road	418476.3	426150.5	1.5
R15	104 Westgate	418415.2	425199.9	1.5
R16	85 Westgate	418441.7	425188.1	1.5
R17	59 Westgate	418542.8	425192.5	1.5
R18	6 Peaseland Road	418616.8	425193.7	1.5

Potential Impact		NGR (m)		Height (m)
		X	Y	
R19	21 Westgate	418850.7	425211.2	4.5
R20	29 Dewsbury Road	419131.6	425202.3	1.5
R21	2 Central Parade	419082.3	425312.7	1.5
R22	7 Cleckheaton	419082.6	425349.3	4.5
R23	43 Dewsbury Road	419183.8	425111.2	1.5
R24	10 Dewsbury Road	419197.8	425078.8	1.5
R25	103 Bradford Road	418854.2	425861.4	1.5
R26	82 Bradford Road	418822.5	425912.8	1.5
R27	267 Bradford Road	418486.4	426244.3	1.5
R28	319 Bradford Road	418399.3	426356.8	1.5

Additional receptors were plotted onsite at proposed residential units and are summarised in Table 13.

Table 13: Existing Sensitive Human Receptors

Potential Impact		NGR (m)		Height (m)
		X	Y	
P1	Proposed Development	418356.0	425150.1	1.5
P2	Proposed Development	418369.9	425154.6	1.5
P3	Proposed Development	418379.2	425121.1	1.5
P4	Proposed Development	418367.2	425081.2	1.5
P5	Proposed Development	418383.9	425067.2	1.5

Receptors modelled at 1.5m to represent the average UK "breathing height" above ground level. Reference should be made to Figure 6 within Appendix A for a graphical representation of operational phase emission sensitive human receptor locations.

5.0 ASSESSMENT

5.1 Construction Phase Assessment

5.1.1 Step 1 – Screening

The desk-study detailed in Section 4.4.1 identified a number of receptors with a high classification of sensitivity within 350m of the site boundary, and within 50m of the anticipated trackout routes. As such, a detailed assessment of potential dust impacts was required, and summarised in the below sections.

5.1.2 Step 2A – Magnitude

The scale and nature of the works was determined to assess the magnitude of dust arising from each construction phase activity. The determination of magnitude was based upon the criteria detailed in Appendix D, with the outcome of Step 2A is summarised below in Table 14.

Demolition

The Proposed Development will involve the demolition of the existing buildings on the site. The volume of buildings to be demolished is therefore likely to be between 20,000m^3 and 50,000m^3. With this considered the magnitude of potential dust emissions related to demolition activities is considered **medium**.

Earthworks

The Proposed Development site is estimated to cover an area of approximately 62,000m^2. The magnitude of potential dust emissions related to earthwork activities is therefore considered **large**.

Construction

The proposals comprise the construction of circa 194 residential units, given the scale of the Proposed Development the total building and infrastructure volume is anticipated to be greater than 100,000m^3. The magnitude of potential dust emissions related to construction activities is therefore considered **large**.

Trackout

Information on the number of HDV trips to be generated during the construction phase of the Proposed 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^2. The magnitude of potential dust emissions from trackout is therefore considered **large**.

Table 14: Dust Emission Magnitude

Magnitude of Activities			
Demolition	**Earthworks**	**Construction**	**Trackout**
Medium	Large	Large	Large

5.1.3 Step 2B – Sensitivity

The next step (Step 2B) is to determine the sensitivity of the surrounding area, based on general principles such as amenity and aesthetics, as well as human exposure sensitivity.

Dust Soiling

As shown in Section 4.4.1 and Table 10, the desk top study indicated are approximately **more than 100** sensitive receptors within 350m of the Proposed Development boundary and **more than 100** within 50m of the anticipated trackout routes.

Based on the assessment criteria detailed in Appendix B, the sensitivity of the receiving environment to potential dust soiling impacts was considered to be **high** for all construction phase activities. This is because the site is situated in a predominantly residential area and the people or property would reasonably be expected to be present here for extended periods of time.

Human Health

The annual mean concentration of PM_{10} is **12.74µg/m³** as detailed in Section 4, based on the receptor counts provided above, the area is considered to be of **low** sensitivity for demolition, earthworks and construction activities and medium for trackout activities.

The sensitivity of the receiving environment to specific potential dust impacts, based on the criteria detailed in Appendix D is summarised in Table 15.

Table 15: 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

5.1.4 Step 2C – Risk

Both the magnitude and sensitivity factors are combined in Step 2C to determine the risk of dust impacts without the application of best practice mitigation measures. A summary of the risk from each dust generating activity is provided in Table 16.

Table 16: Summary of Potential Unmitigated Dust Risks

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

5.1.5 Step 3 – Mitigation

The IAQM guidance[3] provides a number of potential mitigation measures to reduce impacts during the construction phase. These measures have been adapted for the Proposed Development site as summarised in Table 17.

Table 17: Fugitive Dust Mitigation Measures

Issue	Control Measure
Communications	• Develop and implement a stakeholder communications plan that includes community engagement before work commences on site. • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager. • Display the head or regional office contact information • Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority.
Site Management	• Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken. • Make the complaints log available to the local authority when asked • Record any exceptional incidents that cause dust and/or air emissions, either on- or off- site, and the action taken to resolve the situation in the log book. • Hold regular liaison meetings with other high-risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.
Monitoring	• Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary, with cleaning to be provided if necessary. • Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked • Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
Preparing & Maintaining Site	• Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible. • Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site. • Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive time 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, unless being re-used on site. If they are being re-used on-site cover as described below. • Cover, seed or fence stockpiles to prevent wind whipping.

Issue	Control Measure
Operating Vehicle/Machinery & Sustainable Travel	• Ensure all vehicles switch off engines when stationary - no idling vehicles. • Avoid the use of diesel- or petrol-powered powered generators and use mains electricity or battery powered equipment where practicable. • Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un- surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate) • Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials • Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)
Operations	• Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. • Use enclosed chutes and conveyors and covered skips. • Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate. • Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Waste Management	• Avoid bonfires and burning of waste materials
Demolition	• Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust). • Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground. • Avoid explosive blasting, using appropriate manual or mechanical alternatives. • Bag and remove any biological debris or damp down such material before demolition
Earthworks & Construction	• Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable. • Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable • Only remove the cover in small areas during work and not all at once • Avoid scabbling (roughening of concrete surfaces) if possible

Issue	Control Measure
	• Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place. • Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery. • For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.
Trackout	• Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use. • Avoid dry sweeping of large areas. • Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport. • Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable. • Record all inspections of haul routes and any subsequent action in a site log book. • Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned. • Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable). • Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits. • Access gates to be located at least 10 m from receptors where possible

5.1.6 Step 4 – Residual Impacts

Assuming the relevant mitigation measures outlined in Table 17 are implemented, the residual effect from all dust generating activities is predicted to be negligible and therefore **not significant** in accordance with the IAQM guidance[3].

5.2 Operational Phase Assessment

The assessment was undertaken in accordance with the methodology detailed in Section 3.2.4.

5.2.1 Future Exposure

Annual mean NO_2 and PM concentrations were predicted across the Proposed Development for the 2026 DS scenario at a height of 1.5m to represent exposure across the ground floor level, as shown in Figures 7 to 12 (2019 and 2026 Emissions) within Appendix A. Pollutant background concentrations from the respective assessment years have been utilised throughout the assessment as detailed in Table 8.

Background NO_2 and 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 are considered acceptable in regards to future exposure and have not been assessed further.

Nitrogen Dioxide (NO_2)

Predicted annual mean NO_2 concentrations across the Proposed Development site during the DS scenario are summarised in Table 18.

Table 18: Modelling Results - Annual Mean NO_2 at Proposed Sensitive Use

Floor Level	Predicted Annual Mean NO_2 Concentration (µg/m³)	
	2019 Emission Factors	2026 Emission Factors
Ground (1.5m)	16.98 – 26.01	13.11 – 22.50

The predicted concentrations shown in Table 18 indicate that there were no exceedances of the annual mean AQO at sensitive locations across ground floor areas of the proposed development. As such, it is considered that annual mean NO_2 levels at the Proposed Development site should not be viewed as a constraint to development.

Predictions of 1-hour NO_2 concentrations were not produced as part of the dispersion modelling assessment. LAQM.(TG16)[2] states if annual mean NO_2 concentrations are below 60µg/m³ then it is unlikely that the 1-hour AQO will be exceeded. As such, based on the results in Table 18, it is not predicted that on-site concentrations will exceed the 1-hour mean AQO for NO_2.

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.

Particulate Matter (PM_{10} & $PM_{2.5}$)

Predicted annual mean PM concentrations across the Proposed Development site during the DS scenario are summarised in Table 19.

Table 19: Modelling Results - Annual Mean PM at Proposed Sensitive Use

Floor Level	Predicted Annual Mean Concentration (µg/m³)			
	PM_{10}		$PM_{2.5}$	
	2019 Emission Factors	2026 Emission Factors	2019 Emission Factors	2026 Emission Factors
Ground (1.5m)	12.86 – 15.09	12.03 – 14.15	8.82 – 10.10	8.19 – 9.40

The predicted concentrations shown in Table 19 indicate that there were no exceedances of the annual mean AQOs for PM_{10} or $PM_{2.5}$ throughout the modelling area. As such, it is considered that annual mean PM levels at the Proposed Development site should not be viewed as a constraint to development.

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

5.2.2 Proposed Onsite Receptor Concentrations

Annual mean NO_2 and PM concentrations were predicted for 2026 DM and DS scenarios utilising both base year 2019 emission factors and future year 2026 emission factors at Proposed onsite sensitive receptor locations.

2019 Emissions

Annual mean pollutant concentrations were predicted for 2026 proposed on-site receptor locations for the DS scenarios and are summarised in Table 20.

Table 20: Predicted Annual Mean Pollutant Concentrations – 2019 Emissions

Potential Impact		Predicted Annual Mean Pollutant Concentration (µg/m³)		
		NO_2	PM_{10}	$PM_{2.5}$
R1	4 Brick Street	21.09	13.87	9.51
R2	150 Westgate	23.29	14.24	9.73
R3	133 Westgate	20.78	13.79	9.46
R4	28 Moorside Rise	19.66	13.59	9.35
R5	1 School Street	20.00	13.64	9.38

As indicated in Table 20, annual mean NO_2 and PM concentrations were below the relevant annual mean AQO at all receptor locations considered.

2026 Emissions

Annual mean pollutant concentrations were predicted for 2026 proposed on-site receptor locations for the DS scenarios and are summarised in Table 21.

Table 21: Predicted Annual Mean Pollutant Concentrations – 2026 Emissions

Potential Impact		Predicted Annual Mean Pollutant Concentration (µg/m³)		
		NO_2	PM_{10}	$PM_{2.5}$
R1	4 Brick Street	15.12	12.99	8.84
R2	150 Westgate	16.23	13.34	9.04
R3	133 Westgate	14.97	12.92	8.80
R4	28 Moorside Rise	14.42	12.73	8.70
R5	1 School Street	14.59	12.78	8.73

As indicated in Table 21, annual mean NO_2 and PM concentrations were below the relevant annual mean AQOs at all receptor locations considered.

5.2.3 Impact Assessment - Predicted Concentrations at Exisiting Sensitive Use

Based on data from the appointed traffic consultant, Andrew Moseley Associates, it is expected that there will be 1,062 AADT trips generated by the Proposed Development. Based on the anticipated AADT trip generation a dispersion modelling assessment was undertaken in order to quantify potential changes in pollutant concentrations at sensitive locations in the vicinity of the site.

Annual mean NO_2 and PM concentrations were predicted for 2026 DM and DS scenarios utilising both base year 2019 emission factors and future year 2026 emission factors at sensitive receptor locations across the local road network.

The overall significance of potential impacts was determined to be **not significant** in accordance with the EPUK and IAQM guidance. The use of robust assumptions, in the form of worse-case road vehicle emission factors, was considered to provide sufficient results confidence for an assessment of this nature.

Full assessment results and commentary can be found in Appendix C, further discussion on the overall impact significance is provided in Table 22.

5.2.4 Impact Significance

The overall significance of operational phase road traffic emission impacts for 2026 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 22.

Table 22: 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 concentrations were predicted to be **negligible** at 23 receptor locations and **slight** at 5 locations, in the base year 2019 emissions scenario. These locations represent a number of properties and the significance of impacts can be considered as **slight adverse**. It should be noted that associated impacts were also based on worst case sensitivity analysis in the form of robust emission factor assumptions. The use of 2026 operational traffic data, together with 2019 emission factors does not consider future improvements (due to the current shift towards a greater production and uptake low emission vehicles) and significantly overestimate actual pollutant concentrations within the modelling domain. It is critical to note that this worse case emission scenario does not consider any improvement to Air Quality set out by the WYLES. Further sensitivity analysis using 2026 emission factors, which consider future year emission improvements, indicated **negligible** impacts throughout all receptor locations. Therefore, a sufficient level of confidence can be placed that impacts are to be **not significant** during 2026. The overall balance on air quality impacts as a result of the Proposed Development is therefore deemed **not significant**. Impacts on PM concentrations were predicted to be negligible and therefore **not significant** at all sensitive receptors in both scenarios.

Guidance	Comment
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 results in no new exposure to annual mean NO_2 pollutant concentrations above the AQOs.
The percentage change in concentration relative to the objective and the descriptions of the impacts at the receptors	The change in concentration relative to the AQO was predicted to range from during the 2019 emission factor analysis: • 0.25% to 1.95% for NO_2, • 0.05% to 0.40% for PM_{10}; and • 0.4% to 0.40% for $PM_{2.5}$. Resultant impacts were subsequently predicted to range from **negligible** to slight in the 2019 base year. During the 2026 emission factor analysis the change in concentration relative to the AQO was predicted to range from: • 0.13% to 1.00% for NO_2, • 0.05% to 0.37% for PM_{10}; and • 0.4% to 0.36% for $PM_{2.5}$. Resultant impacts were subsequently predicted to be **negligible** for all pollutant species for the future year scenario.
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 predicted exceedances of the annual mean AQO for NO_2, PM_{10} or $PM_{2.5}$ at any sensitive location throughout the assessment extents.
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	As stated above, there were no predicted exceedances of the AQO for NO_2 and as a result impact significance is reduced

It should also be noted that the combined use of 2026 traffic data and 2019 emissions factors is considered to provide a worst-case scenario, which may lead to overestimations of actual pollutant concentrations during the operation of the proposals, which resulted in slight adverse impacts.

Following further sensitivity analysis of a more realist emission factor approach use of 2026 traffic data and 2006 emission factors, the overall significance of operational phase road traffic emission impacts on annual mean NO_2 and PM concentrations was determined **negligible** and therefore **not significant.**

The assessment was undertaken in accordance with the methodology detailed in Section 3.2 and full impact assessment results can be found in Appendix C.

5.3 West Yorkshire Planning Guidance

5.3.1 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 development.

The Stage 2 (impact Assessment) indicated the requirement for mitigation measures in order to negate the impact of a development. The type specific default mitigation measures suggested by the guidance and listed in Table 11 and will contribute towards the reduction of emissions associated with the development.

Table 23 West Yorkshire Planning Guidance Mitigation

Development	Mitigation
Residential	• 1 charging point per unit (dwelling with dedicated parking) or 1 charging point per 10 spaces (unallocated parking); • Travel Plan including agreed mechanisms for discouraging high emission vehicle use and encouraging modal shift as well as the uptake of low emission fuels and technologies; • All gas-fired boilers to meet a minimum of 40mg NO_x/kWh; • Improved pedestrian Links to public transport stops • Site layout to include improved pedestrian pathways to encourage walking.

The above techniques are to be fully discussed with KC prior to the commencement of the Proposed Development. If deemed appropriate and can be suitably implemented into the scheme, this will further reduce and offset the slight and negligible impacts associated with the Proposed Development.

5.4 Emissions Strategy

Although associated impacts are considered **slight adverse** during the 2019 emission factor scenario and **negligible** during the 2026 emission factors scenario, the Proposed Development will implement a comprehensive mitigation strategy to offset additional road vehicle exhaust emissions.

The offsetting measures are therefore proposed and will be implemented within the design of the Proposed Development and supports compliance with requirements of the DEFRA damage cost assessment.

It is considered that the above measures are proportional to the nature and scale of the Proposed Development, and will secure a reduction in development associated road vehicle exhaust emissions. Furthermore, the significant offsetting investments, primarily those relating to EV charging, will future proof the scheme and reduce associated impacts over time with the increased uptake of low emission vehicles.

An Emission Mitigation Statement has been completed under AQ109055-2 and should be read in conjunction with this report. The Emission Mitigation Statement provides an offsetting strategy proportional to the impact of the Proposed Development and has been prepared in accordance with the WYLES guidance[5]..

6.0 CONCLUSION

Ensafe Consultants were commissioned by the Client to undertake an Air Quality Assessment in support of a proposed residential development at Westgate, Cleckheaton.

During the construction phase of the Proposed 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 potential air quality impacts from dust generated by construction, earthworks and trackout activities was predicted to be **not significant**.

Dispersion modelling was undertaken to quantify annual mean NO_2 and PM_{10} concentrations across the application to assess suitability for proposed use. Modelling results were subsequently verified using KC local monitoring data.

The dispersion modelling results indicated that annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations across the application site were below the relevant AQOs at the proposed sensitive use.

Predicted impacts on annual mean NO_2 concentrations as a result of the 2019 operational phase exhaust emissions were predicted to be **negligible** at 23 receptor locations, **slight** at 5 receptor locations. This indicated that the impact significance as a result of increases to pollutant concentrations was deemed **slight adverse**.

Given the time period between the baseline year of 2019 and future year of 2026, a more realistic assessment scenario utilising 2026 emission factors was undertaken. This realistic scenario considers an improvement to future emissions in supported by the uptake of low emission vehicles and government incentives and targets concerning fleet proportions by 2030. The scenario is further supported by the actions set out by the WYLES which aims to promote the use of cleaner transport technology and better transport choices.

The result of the additional sensitivity analysis indicated predicted impacts on annual mean concentrations as a result of operational phase exhaust emissions were to be **negligible** and therefore **not significant.**at all sensitive receptor locations within the vicinity of the site.

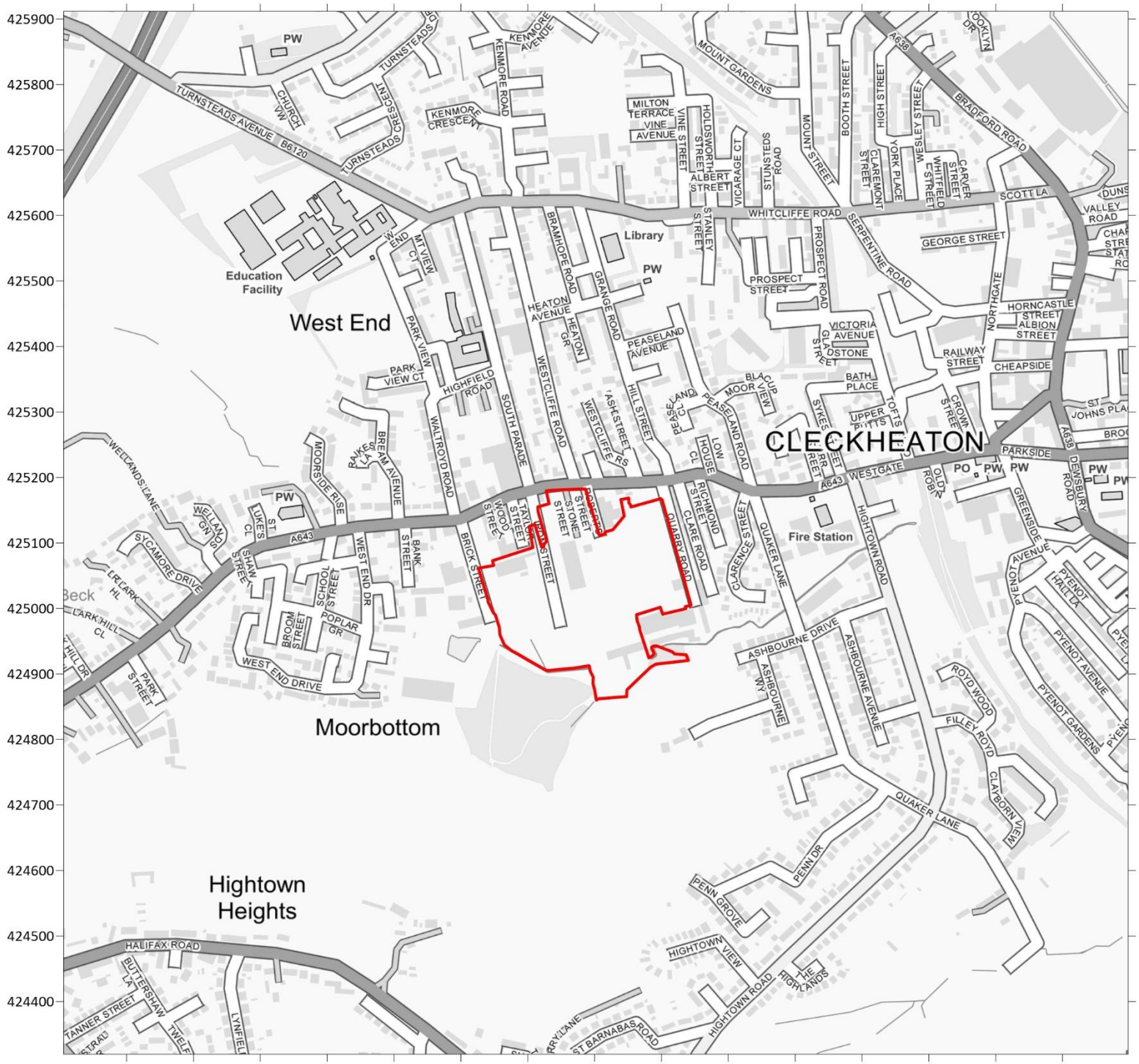
Based on the assessment results, air quality is not considered a constraint to planning consent subject to the inclusion of mitigation measures.

7.0 ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADM	Atmospheric Dispersion Modelling
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
DS	Do Something
DMP	Dust Management Plan
EPUK	Environmental Protection UK
EU	European Union
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
KC	Kirklees Council
LAQM	Local Air Quality Management
LA	Local Authority
LDV	Light Duty Vehicle
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
TEMPRO	Trip End Model Presentation Program
WYLES	West Yorkshire Low Emission Strategy
z_0	Roughness Length

END OF REPORT

APPENDIX A - FIGURES



Legend

Site Boundary

Title

Figure 1

Site Location

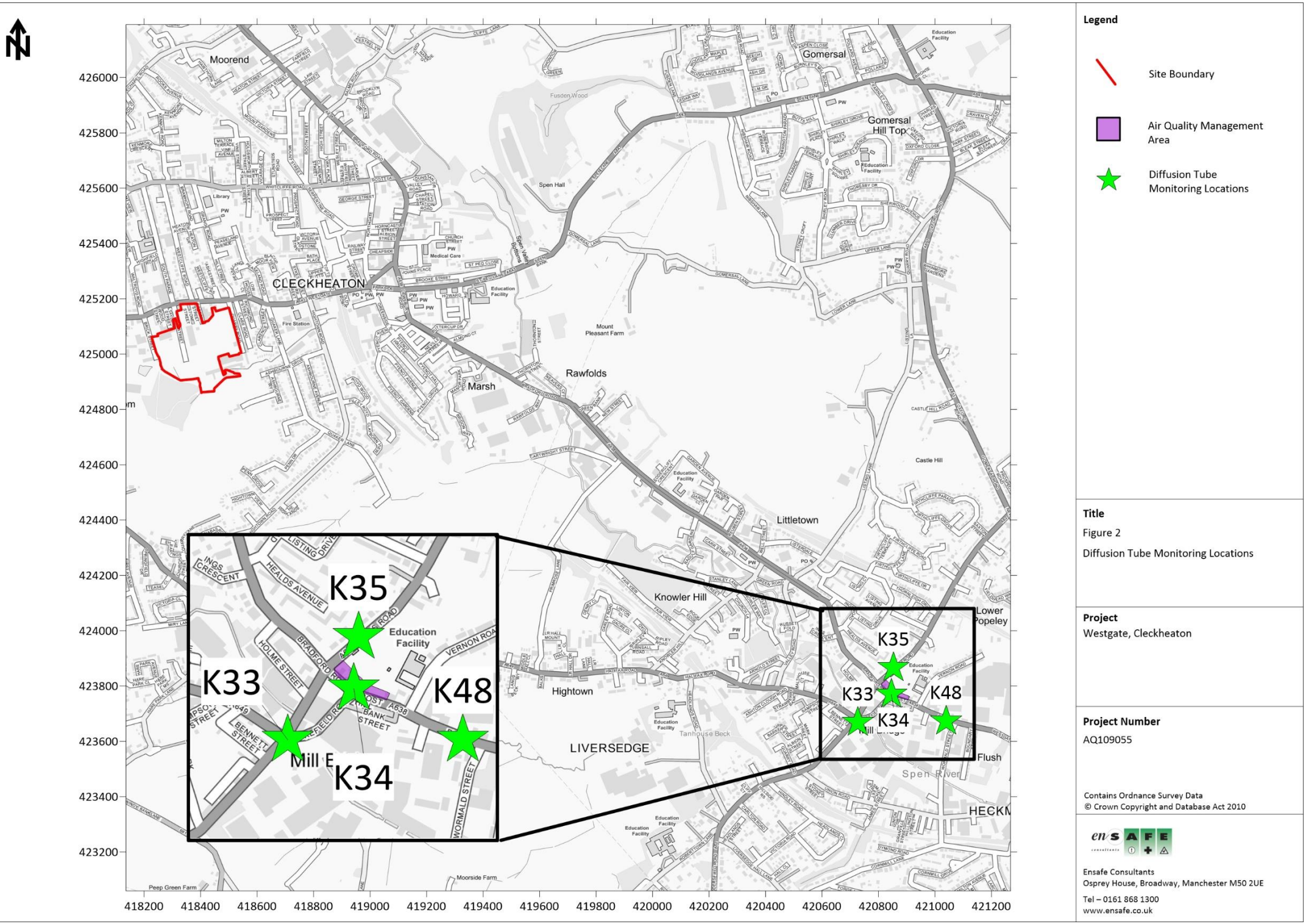
Project

Westgate, Cleckheaton

Project Number

AQ109055

Ensafe Consultants
Osprey House, Broadway, Manchester M50 2UE
Tel – 0161 868 1300
www.ensafe.co.uk



Legend

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

Title

Figure 2

Diffusion Tube Monitoring Locations

Project

Westgate, Cleckheaton

Project Number

AQ109055

Ensafe Consultants
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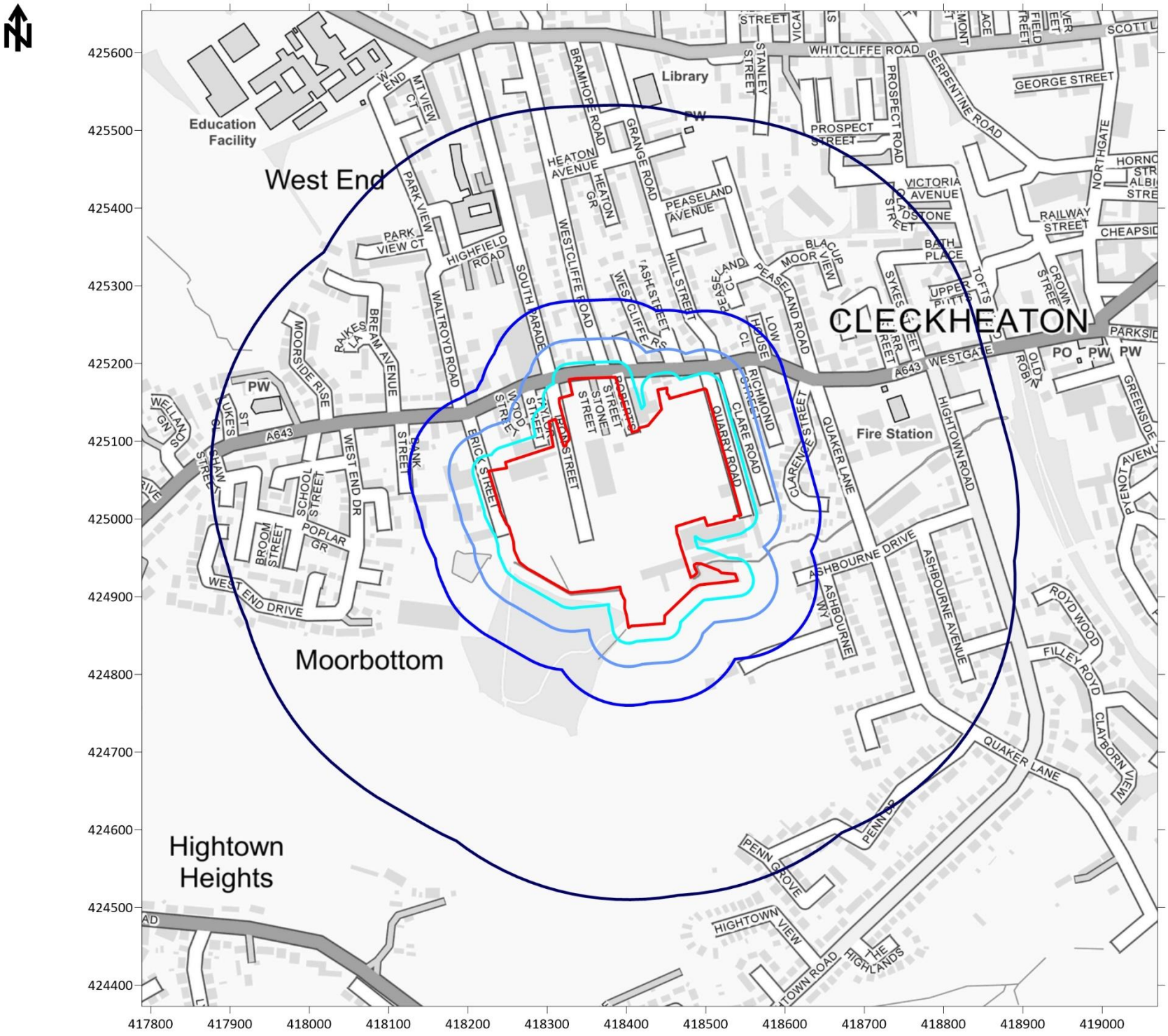

Legend

- 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

Westgate, Cleckheaton

Project Number

AQ109055

Ensafe Consultants
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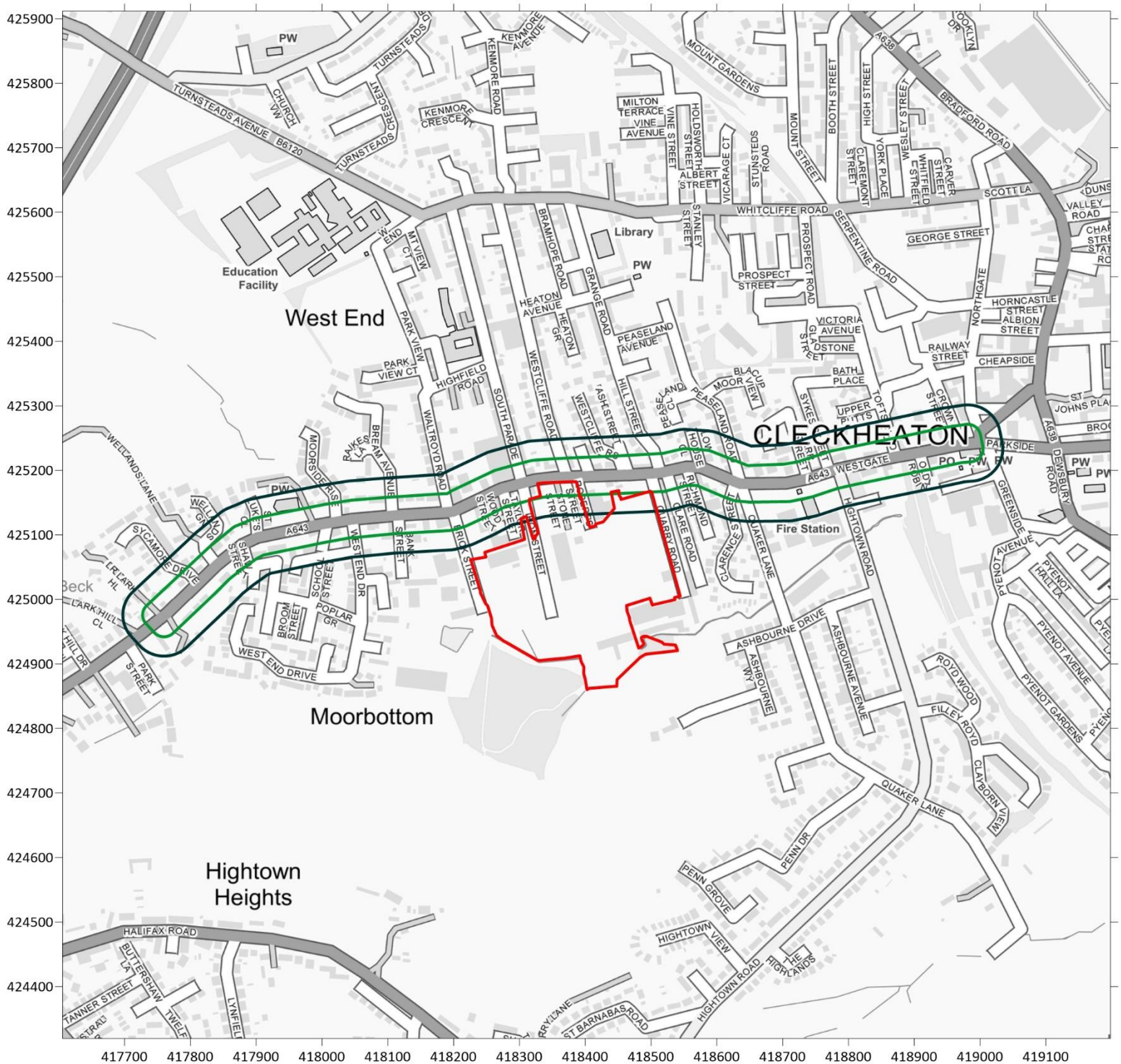
Tel – 0161 868 1300
www.ensafe.co.uk



Legend

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

Title

Figure 4

Trackout Dust Buffer Zones

Project

Westgate, Cleckheaton

Project Number

AQ109055

Ensafe Consultants
Osprey House, Broadway, Manchester M50 2UE
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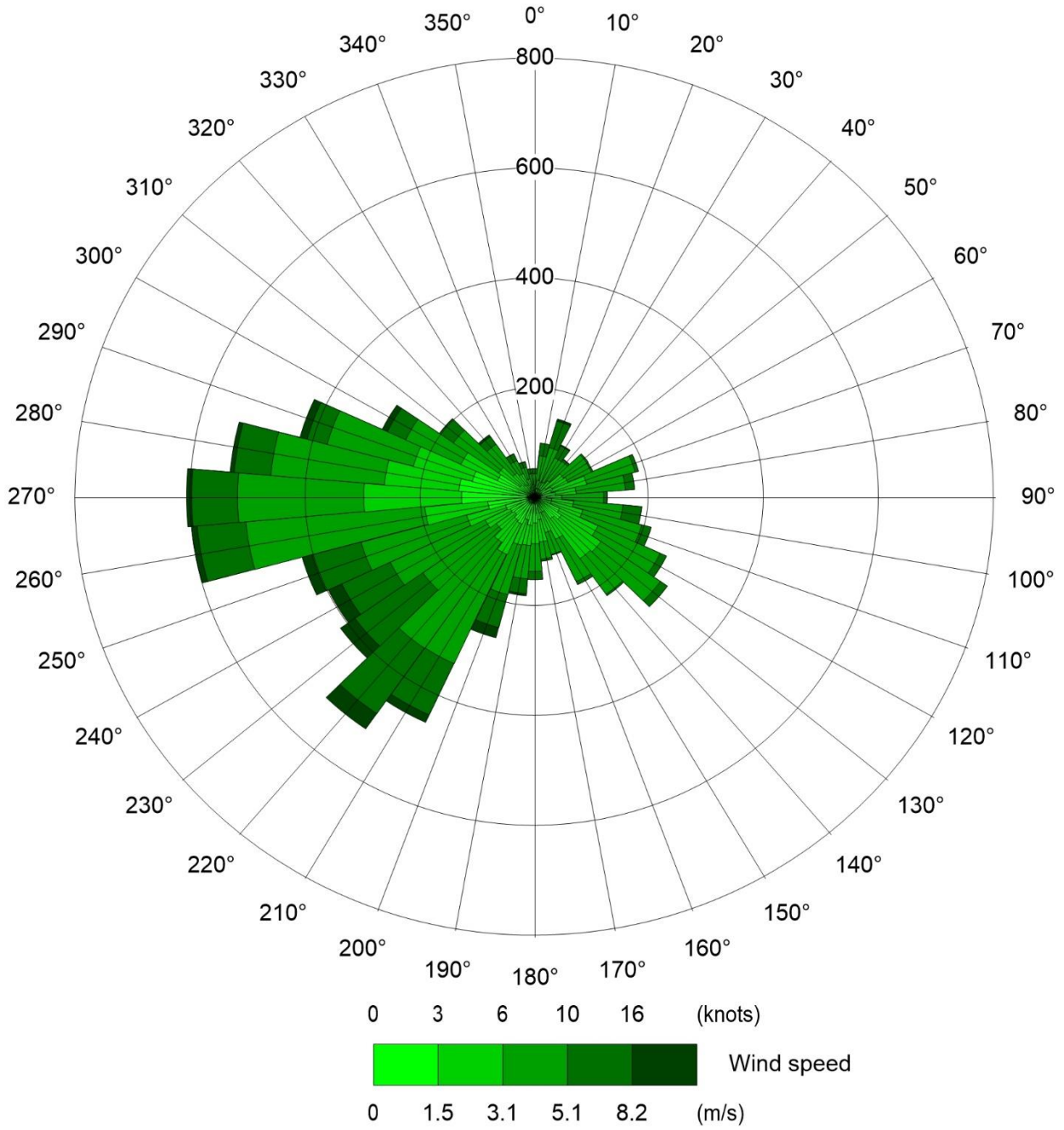

Title

Figure 5

Wind Rose 2019 Bingley Meteorological Station

Project

Westgate, Cleckheaton

Project Number

AQ109055

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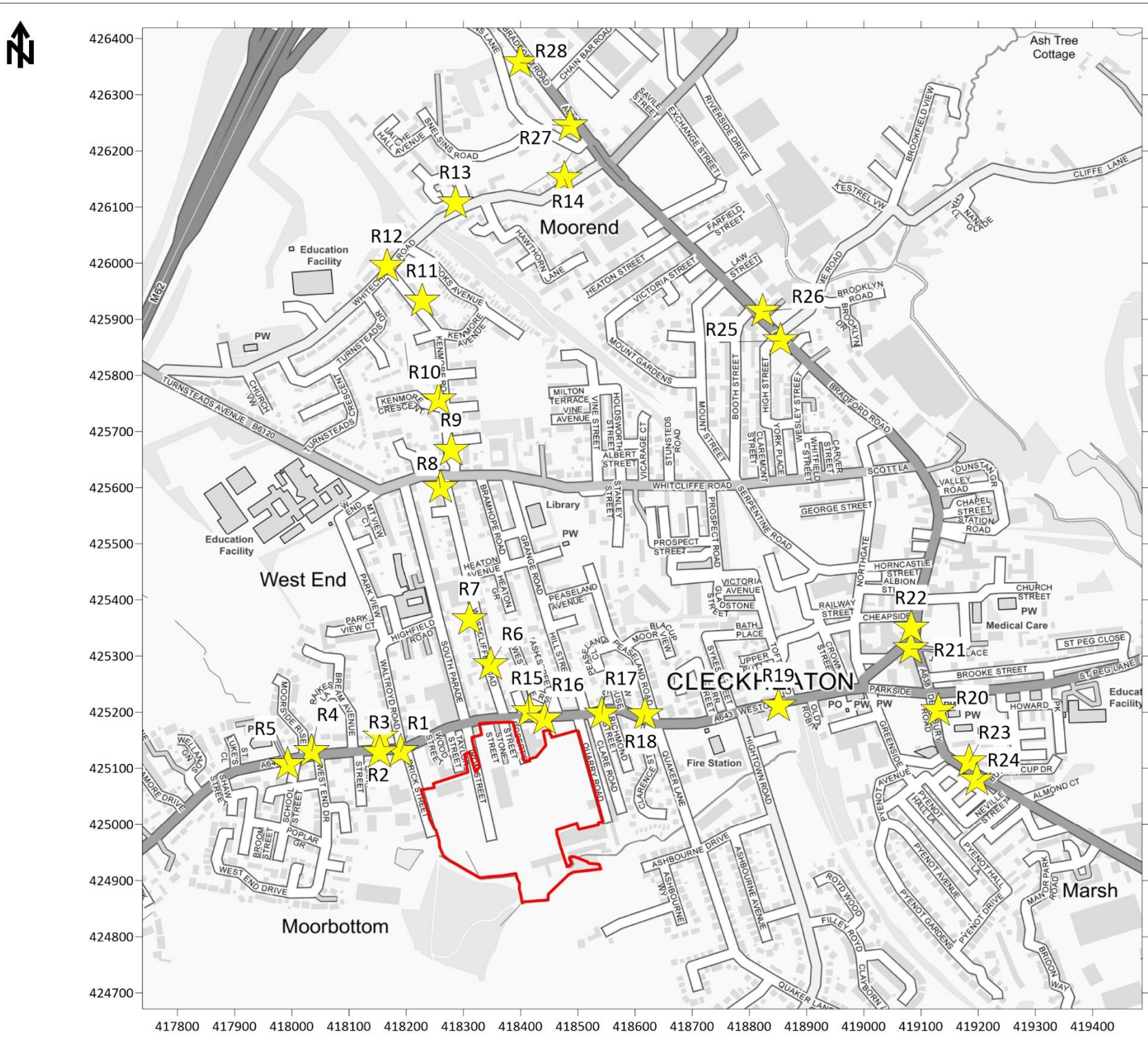

Legend

Site Boundary

Sensitive Receptor Locations

Title

Figure 6

Traffic Exhaust Emissions
Sensitive Receptor Locations

Project

Westgate, Cleckheaton

Project Number

AQ109055

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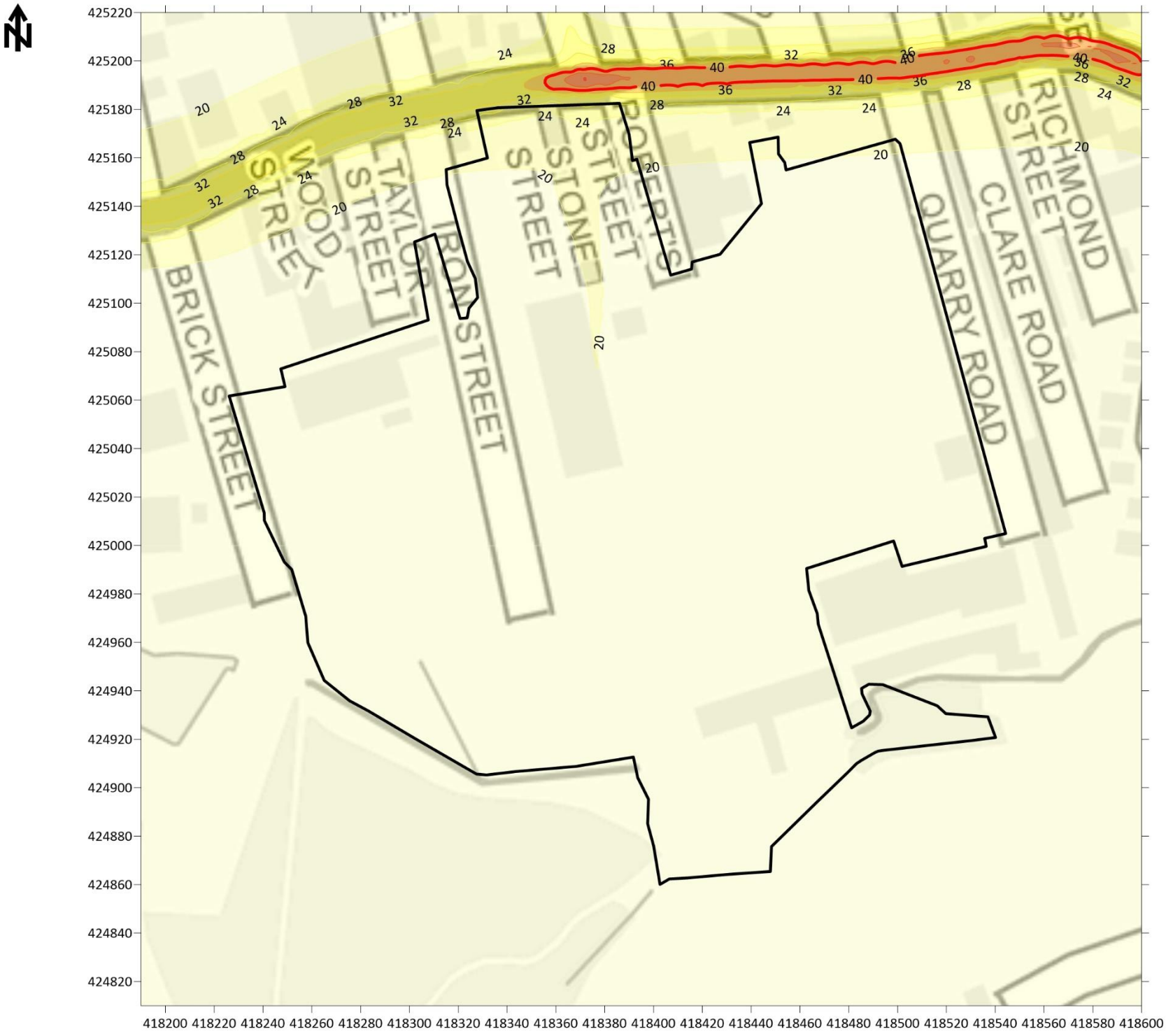

Legend

Site Boundary

Predicted Annual Mean NO_2 Concentration (µg/m³)

48
44
40
36
32
28
24
20
16

Title

Figure 7

Predicted Annual Mean NO_2 Concentrations (µg/m³) 2026 DS

2019 Emission Factors

Project

Westgate, Cleckheaton

Project Number

AQ109055

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Legend

Site Boundary

41
40
37
33
29
25
21
17
13

Predicted Annual Mean NO_2 Concentration (µg/m³)

Title

Figure 8

Predicted Annual Mean NO_2 Concentrations (µg/m³) 2026 DS

2026 Emission Factors

Project

Westgate, Cleckheaton

Project Number

AQ109055

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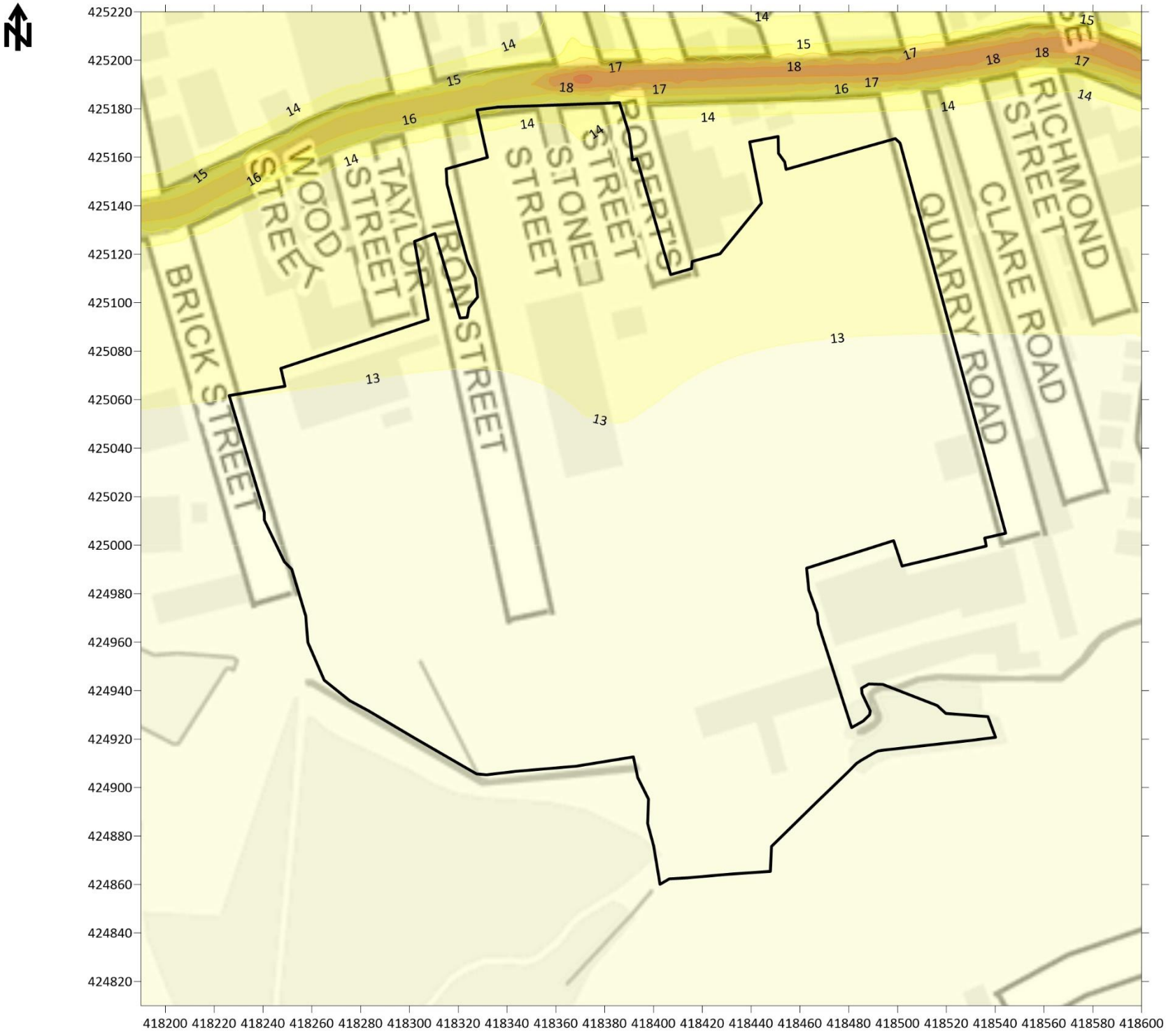

Legend

Site Boundary

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

19
18
17
16
15
14
13
12

Title

Figure 9

Predicted Annual Mean PM_{10} Concentrations (µg/m³) 2026 DS

2019 Emission Factors

Project

Westgate, Cleckheaton

Project Number

AQ109055

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Tel – 0161 868 1300
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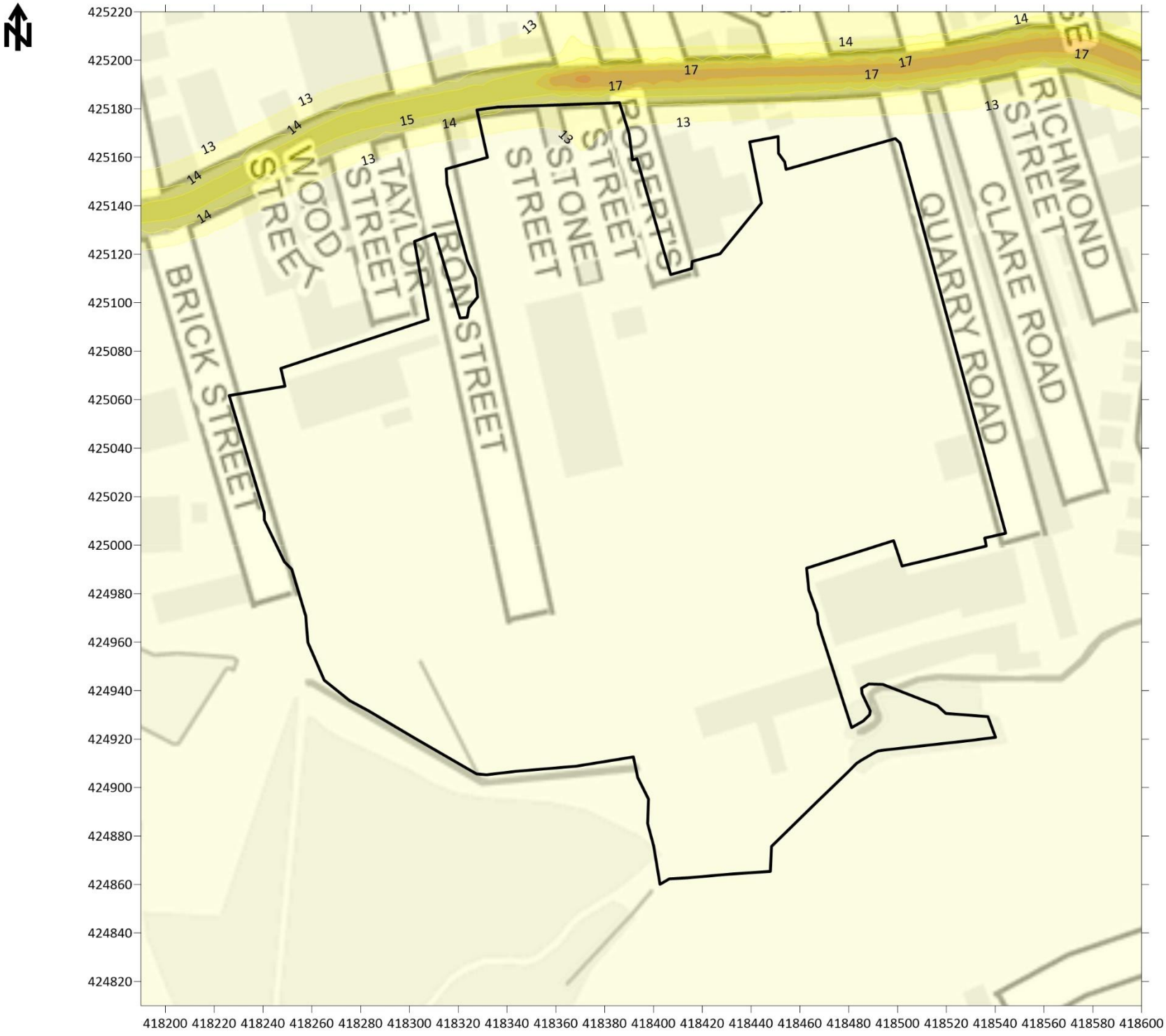

Legend

Site Boundary

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

18
17
16
15
14
13
12

Title

Figure 10

Predicted Annual Mean PM_{10} Concentrations (µg/m³) 2026 DS

2026 Emission Factors

Project

Westgate, Cleckheaton

Project Number

AQ109055

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Osprey House, Broadway, Manchester M50 2UE
Tel – 0161 868 1300
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Legend

Site Boundary

Predicted Annual Mean $PM_{2.5}$ Concentration (µg/m³)

- 12.3
- 11.8
- 11.3
- 10.8
- 10.3
- 9.8
- 9.3
- 8.8

Title

Figure 11

Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m³) 2026 DS

2019 Emission Factors

Project

Westgate, Cleckheaton

Project Number

AQ109055

Ensafe Consultants
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Tel – 0161 868 1300
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Legend

Site Boundary

Predicted Annual Mean $PM_{2.5}$ Concentration (µg/m³)

11.2
10.7
10.2
9.7
9.2
8.7
8.2

Title

Figure 12

Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m³) 2026 DS

2026 Emission Factors

Project

Westgate, Cleckheaton

Project Number

AQ109055

Ensafe Consultants
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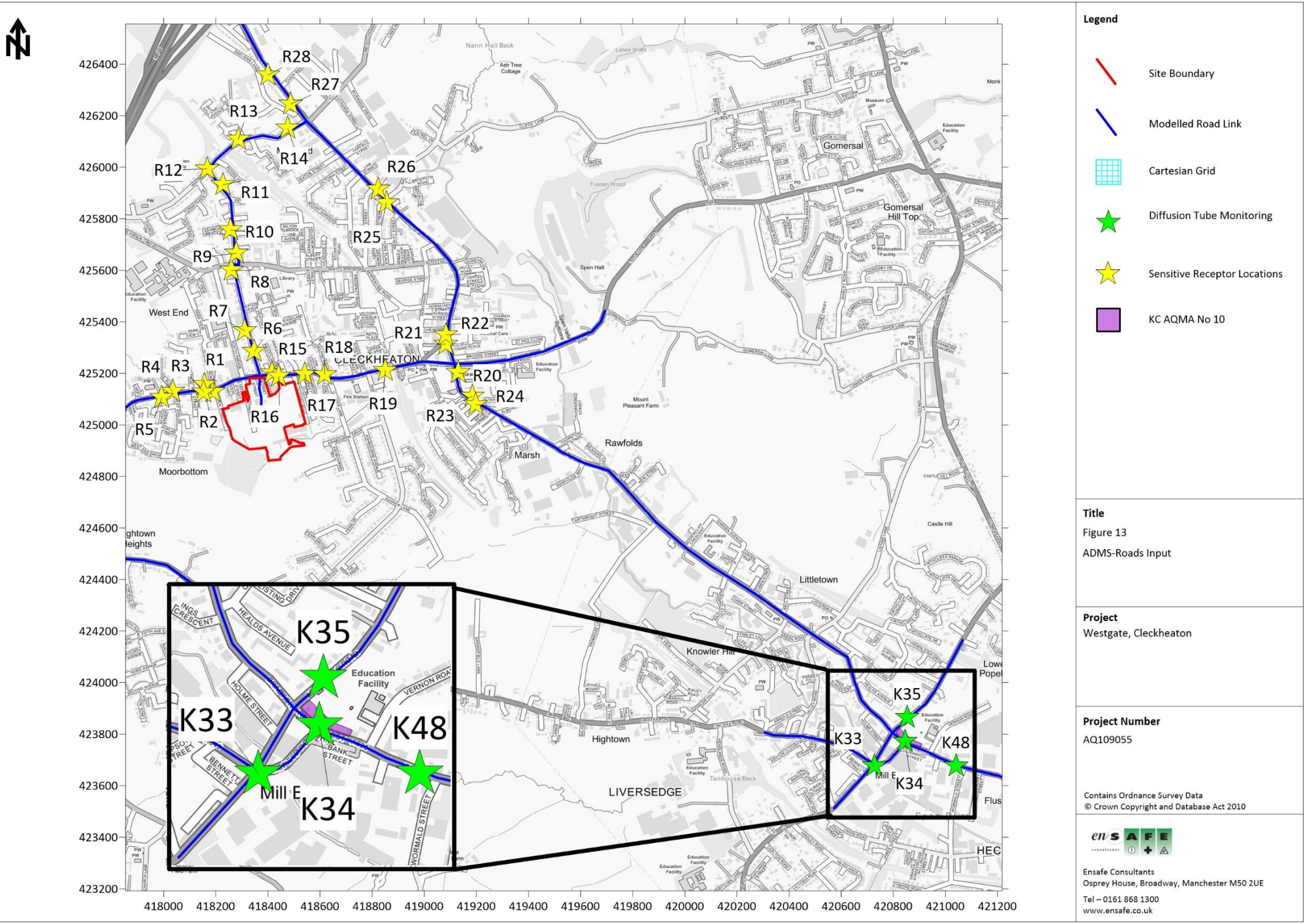
Tel – 0161 868 1300
www.ensafe.co.uk



Legend

- Site Boundary
- Modelled Road Link
- Cartesian Grid
- Diffusion Tube Monitoring
- Sensitive Receptor Locations
- KC AQMA No 10

Title

Figure 13

ADMS-Roads Input

Project

Westgate, Cleckheaton

Project Number

AQ109055

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www.ensafe.co.uk

APPENDIX B – ASSESSMENT INPUTS

ASSESSMENT INPUTS

The Proposed Development has the potential to introduce future site users to poor air quality. Dispersion modelling using ADMS Roads was therefore undertaken to predict NO_2 and PM_{10} concentrations across the site to consider site suitability for the proposed end-use.

The assessment was undertaken in accordance with the guidance contained within the DEFRA document LAQM.TG(16)[2] and the EPUK and IAQM guidance[4].

Dispersion Model

Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 5.0.0.1). 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.

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 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 at approximately NGR: 418180, 424810 and 418600, 425230 at height of 1.5m to represent the proposed ground floor level for the 2026 opening year scenario.

Results were subsequently used to produce contour plots within the Surfer software package. Reference should be made to Figure 7 and 12 within Appendix A for a graphical representation of the verification inputs and operation phase DS extents, respectively.

Traffic Flow Data

Development flow traffic data and associated network distribution was provided by Andrew Mosesley Associates, the appointed Transport Consultants for the scheme, and indicated that a total flow generation of 1,062 AADT is anticipated as a result of the Purposed Development.

Baseline traffic data for the following road links were provided by Andrew Mosesley Associates:

- Westgate
- Westcliffe Road
- Kenmore Road
- Whitechapel Road

Baseline traffic data for the following road links were obtained from the Department for Transport (DfT):

- Moorside
- Parkside
- A638 Bradford Road

- St Peg Lane
- A638 Dewsbury Road
- A62 Leeds Road
- A638 Frost Hill/Flush
- Wakefield Road
- Halifax Road

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 2019. The DfT matrix is referenced in DEFRA guidance LAQM.TG(16)[2] as being a suitable source of data for air quality assessments and is therefore considered to provide a reasonable 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 2019 traffic flow to 2026 which was used to represent the opening 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.

A summary of the traffic data used in the verification scenario is provided in Table B1.

Table B1: 2019 Verification Traffic Data

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L1	Moorside (A643) West of Site	8.7	7,487	2.2	40	DfT
L2	Moorside (A643) Slowdown at Halifax Road (A649)	7.8	7,487	2.2	24	DfT
L3	Westgate (A643) East of Site	7.4	7,487	2.2	40	TC
L4	Westgate (A643) Slowdown at A638 Junction	8.4	7,487	2.2	32	TC
L5	Parkside (A643)	6.7	7,487	2.2	24	TC
L6	Westcliffe Road/Westgate Slow Down	5.5	1,692	1.0	15	TC
L7	Westcliffe Road	5.7	1,692	1.0	32	TC
L8	Westcliffe Road/Whitecliffe Road Slow Down	6.2	1,692	1.0	15	TC
L9	Whitecliffe Road	7.4	1,692	1.0	32	TC
L10	A638 at Junction	8.6	16,577	4.4	24	TC
L11	Halifax Road (East of Moorside)	9.9	10,664	2.2	48	DfT
L12	Halifax Road (West of Moorside)	15.6	10,664	2.2	48	DfT
L13	Bradford Road	8.6	16,577	4.4	24	TC
L14	Bradford Road	7.4	16,577	4.4	40	TC
L15	Bradford Road/Whitechapel Road Junction	14.0	16,577	4.4	15	TC
L16	Bradford Road	9.0	16,577	4.4	40	TC
L17	A638 (South of St Peg Lane)	8.6	13,466	3.3	32	TC
L18	A643 St Peg Lane	9.0	7,478	2.7	32	TC
L19	Whitechapel Road Slow Down	9.0	4,678	1.0	15	TC
L20	Whitechapel Road	8.2	4,678	1.0	32	TC

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L21	Kenmore Road Slow Down	6.1	1,692	1.0	15	TC
L22	Kenmore Road	5.1	1,692	1.0	32	TC
L23	Kenmore Road Slow Down	7.1	1,692	1.0	15	TC
L24	Site Access	5.7	0	0.0	25	TC
L25	A638 South	9.0	13,466	3.3	40	DfT
L26	A638 South	9.4	13,466	3.3	32	DfT
L27	A638/A62 Leeds Road Junction	8.8	13,466	3.3	15	DfT
L28	A62 Leeds Road (north of Bradford Road) Slowdown	9.9	17,558	2.0	15	DfT
L29	A62 North	10.5	17,558	2.0	15	DfT
L30	A62 North	8.0	17,558	2.0	40	DfT
L31	A638 Frost Hill/A62 Leeds Road Slowdown	8.2	15,259	2.7	15	DfT
L32	A638 Frost Hill	9.3	15,259	2.7	15	DfT
L33	A638 Flush	8.3	15,259	2.7	20	DfT
L34	A638 Westgate	8.0	15,259	2.7	32	DfT
L35	A62 Leeds Road (south of Bradford Road) Slowdown	9.0	19,371	2.3	15	DfT
L36	A62 South	8.0	19,371	2.3	25	DfT
L37	A62/A6649 South Slow down	8.0	19,371	2.3	15	DfT
L38	A62 South	8.1	19,371	2.3	40	DfT
L39	Wakefield Road	8.5	7,630	2.7	20	DfT
L40	A629 Slowdown	8.7	10,664	2.2	15	DfT
L41	A649 Halifax Road	7.2	10,664	2.2	40	DfT

*TC – Traffic Consultant

Reference should be made to Figure 6 within Appendix A for a graphical representation of the road link locations used within the verification assessment. The road width, canyon height and mean vehicle speed shown in Table B1 remained the same for the 2026 scenarios.

A summary of the 2026 traffic data is shown in Table B2.

Table B2: 2026 Traffic Data

Road Link		DM Scenario		DS Scenario		Development 24-hr AADT
		24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)	
L1	Moorside (A643) West of Site	8,263	2.2	8,785	2.2	522
L2	Moorside (A643) Slowdown at Halifax Road (A649)	8,263	2.2	8,785	2.2	522
L3	Westgate (A643) East of Site	12,237	2.2	12,777	2.2	541
L4	Westgate (A643) Slowdown at A638 Junction	12,237	2.2	12,777	2.2	541

Road Link		DM Scenario		DS Scenario		Development 24-hr AADT
		24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)	
L5	Parkside (A643)	10,293	2.2	10,579	2.2	286
L6	Westcliffe Road/Westgate Slow Down	1,771	1.0	2,143	1.0	371
L7	Westcliffe Road	1,771	1.0	2,143	1.0	371
L8	Westcliffe Road/Whitecliffe Road Slow Down	1,771	1.0	2,143	1.0	371
L9	Whitecliffe Road	1,771	1.0	2,143	1.0	371
L10	A638 at Junction	17,351	4.4	17,449	4.4	98
L11	Halifax Road (East of Moorside)	11,162	2.2	11,237	2.2	75
L12	Halifax Road (West of Moorside)	11,162	2.2	11,237	2.2	75
L13	Bradford Road	17,351	4.4	17,584	4.4	233
L14	Bradford Road	17,351	4.4	17,584	4.4	233
L15	Bradford Road/Whitechapel Road Junction	17,351	4.4	17,584	4.4	233
L16	Bradford Road	17,351	4.4	17,842	4.4	491
L17	A638 (South of St Peg Lane)	14,095	3.3	14,201	3.3	106
L18	A643 St Peg Lane	7,827	2.7	7,933	2.7	106
L19	Whitechapel Road Slow Down	4,896	1.0	5,204	1.0	308
L20	Whitechapel Road	4,896	1.0	5,204	1.0	308
L21	Kenmore Road Slow Down	1,771	1.0	2,143	1.0	371
L22	Kenmore Road	1,771	1.0	2,143	1.0	371
L23	Kenmore Road Slow Down	1,771	1.0	2,143	1.0	371
L24	Site Access	0	0.0	1,062	1.0	1,062
L25	A638 South	14,095	3.3	14,201	3.3	106
L26	A638 South	14,095	3.3	14,201	3.3	106
L27	A638/A62 Leeds Road Junction	14,095	3.3	14,201	3.3	106
L28	A62 Leeds Road (north of Bradford Road) Slowdown	18,378	2.0	18,378	2.0	-
L29	A62 North	18,378	2.0	18,378	2.0	-
L30	A62 North	18,378	2.0	18,378	2.0	-
L31	A638 Frost Hill/A62 Leeds Road Slowdown	15,972	2.7	15,972	2.7	-
L32	A638 Frost Hill	15,972	2.7	15,972	2.7	-
L33	A638 Flush	15,972	2.7	15,972	2.7	-
L34	A638 Westgate	15,972	2.7	15,972	2.7	-
L35	A62 Leeds Road (south of Bradford Road) Slowdown	20,276	2.3	20,276	2.3	-
L36	A62 South	20,276	2.3	20,276	2.3	-
L37	A62/A6649 South Slow down	20,276	2.3	20,276	2.3	-
L38	A62 South	20,276	2.3	20,276	2.3	-
L39	Wakefield Road	7,986	2.7	7,986	2.7	-

Road Link		DM Scenario		DS Scenario		Development 24-hr AADT
		24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)	
L40	A629 Slowdown	11,162	2.2	11,162	2.2	-
L41	A649 Halifax Road	11,162	2.2	11,162	2.2	-

Reference should be made to Figure 6 within Appendix A for a graphical representation of the road link locations used within the operation phase assessment.

Emission Factors

Emission factors for each link and the 2019 and 2026 scenarios were calculated using the relevant traffic flows and the EfT v10,1 released in August 2020, which incorporates updated COPERT 5.3 vehicle emissions factors for NOx and PM and EURO 6 vehicle fleet sub-categories.

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO_2 concentrations using the NO_x to NO_2 Calculator (v.8.1) provided by DEFRA, which is the method detailed within LAQM.TG(16)[2].

Meteorological Data

Meteorological data used in this assessment was taken from Bingley meteorological station over the period 1st January 2019 to 31st December 2019 (inclusive).

Bingley meteorological station is located at approximate NGR: 408651, 435982 which is approximately 10km north-west of the Proposed Development. Although there is a large distance between the application site and Bingley the use of this data has prior approval from the Environmental Health Department at KC and is therefore considered to provide a reasonable representation of conditions at the development site.

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 A for a wind rose of utilised meteorological data.

Roughness Length

The specific roughness length (z_0) values used to represent conditions during the verification process, DM/DS scenario, as well as conditions at the Bingley meteorological station are summarised in Table B3.

Table B3: Utilised Roughness Lengths

Scenario	Roughness Length (m)	ADMS Description
Verification, DM and DS Scenarios	0.5	Parkland, open suburbia
Bingley Met Station	0.3	Agricultural areas (max)

These values of z_0 are considered appropriate for the morphology of the assessment area.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere within certain urban or rural contexts. The specific length values used to represent conditions during the verification process, DM/DS scenario, as well as conditions at the Bingley are summarised in Table B4

Table B4: Utilised Monin-Obukhov Lengths

Scenario	Monin-Obukhov Length (m)	ADMS Description
Verification, DM and DS Scenarios	30	Mixed urban/industrial
Bingley Met Station	10	Small towns < 50,000

This Monin-Obukhov value is considered appropriate for the morphology of the assessment area.

Background Concentrations

The annual mean NO_2 concentrations detailed in Table 8, was used in the dispersion modelling assessment to represent annual mean pollutant levels at the Proposed Development site and local monitoring sites.

Table B5 displays the specific background concentrations as predicted by DEFRA, utilised to represent the condition at the monitoring locations used within the verification process.

Table B5: Predicted Background Pollutant Concentrations for Diffusion Tubes

Monitoring Location	DEFRA Grid Square	Pollutant	2019 Predicted Background Concentration (µg/m³)
K33,K34, K35	420500, 423500	NO_x	23.92
		NO_2	17.04
K48	421500, 423500	NO_x	24.62
		NO_2	17.42

Table B6 displays the predicted background concentrations by DEFRA used in the operational phase assessment for the sensitive receptor locations.

Table B6: Predicted Background Pollutant Concentrations at Sensitive Receptors

Monitoring Location	DEFRA Grid Square	Pollutant	2019 Predicted Background Concentration (µg/m³)	2026 Predicted Background Concentration (µg/m³)
R5	417500, 425500	NO_x	30.07	20.26
		NO_2	21.04	14.83
		PM_{10}	13.63	12.82
		$PM_{2.5}$	8.98	8.34
R1 to R4, R6 to R12, R15 to R18, R24,R25, P1 to P5	418500, 425500	NO_x	24.64	18.18
		NO_2	17.57	13.39
		PM_{10}	13.22	12.39
		$PM_{2.5}$	9.13	8.50

Monitoring Location	DEFRA Grid Square	Pollutant	2019 Predicted Background Concentration (µg/m³)	2026 Predicted Background Concentration (µg/m³)
R13, R14, R26, R27	418500, 426500	NO_x	32.75	22.46
		NO_2	22.52	16.20
		PM_{10}	14.12	13.29
		$PM_{2.5}$	9.30	8.66
R19 to R23	419500,425500	NO_x	22.39	16.94
		NO_2	16.14	12.56
		PM_{10}	12.45	11.65
		$PM_{2.5}$	8.46	7.86

Similar to emission factors, background concentrations for 2019 and 2026 were utilised in preference to predicted background concentrations for the development opening year (2026). This provided a robust assessment and is likely to overestimate actual pollutant concentrations during the operation of the proposals.

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 2019, using traffic data, meteorological data and monitoring results from this year.

KC undertakes periodic monitoring of NO_2 concentrations at 4 roadside monitoring location within the assessment extents. 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.TG(16)[2]. The monitored annual mean NO_2 concentration and calculated road NO_x concentration are summarised in Table B7.

Table B7: Monitoring Results

Site ID	Monitored Road NO_x Concentration (µg/m³)	Modelled Road NO_x Concentration (µg/m³)	% Difference ((Monitored Modelled)/Monitored)) * 100
K33*	27.58*	26.22*	5%
K34*	32.78*	27.49*	16%
K35	59.15	19.40	67%
K48	37.32	13.36	64%

*K33 and K34 *were not included within the verification process due to suitable correlation with monitored NOx concentration prior to adjustment. This is due to the modelled concentration falling within 25% of modelled concentrations*

According to LAQM.TG(16), no adjustment is necessary where the results of the model all lie within 25% of the monitored concentrations or provide systematic overpredictions (K33). Subsequently, specific monitors have not been included within the calculation of the NO_x adjustment factor. This method ensures that over adjustment is avoided at locations where the initial modelling provides suitable correlation to monitored concentrations.

The monitored and modelled NOx road contribution concentrations were graphed and the equation of the trend line based on the linear progression through zero was calculated, as shown in Graph 1

This indicated that a verification factor of **2.9671** was required to be applied to all NO_x modelling results, showing the model overestimated pollutant concentrations throughout the assessment extents.

Graph 1 is provided below.

Graph 1 - Verification Adjustment Factor

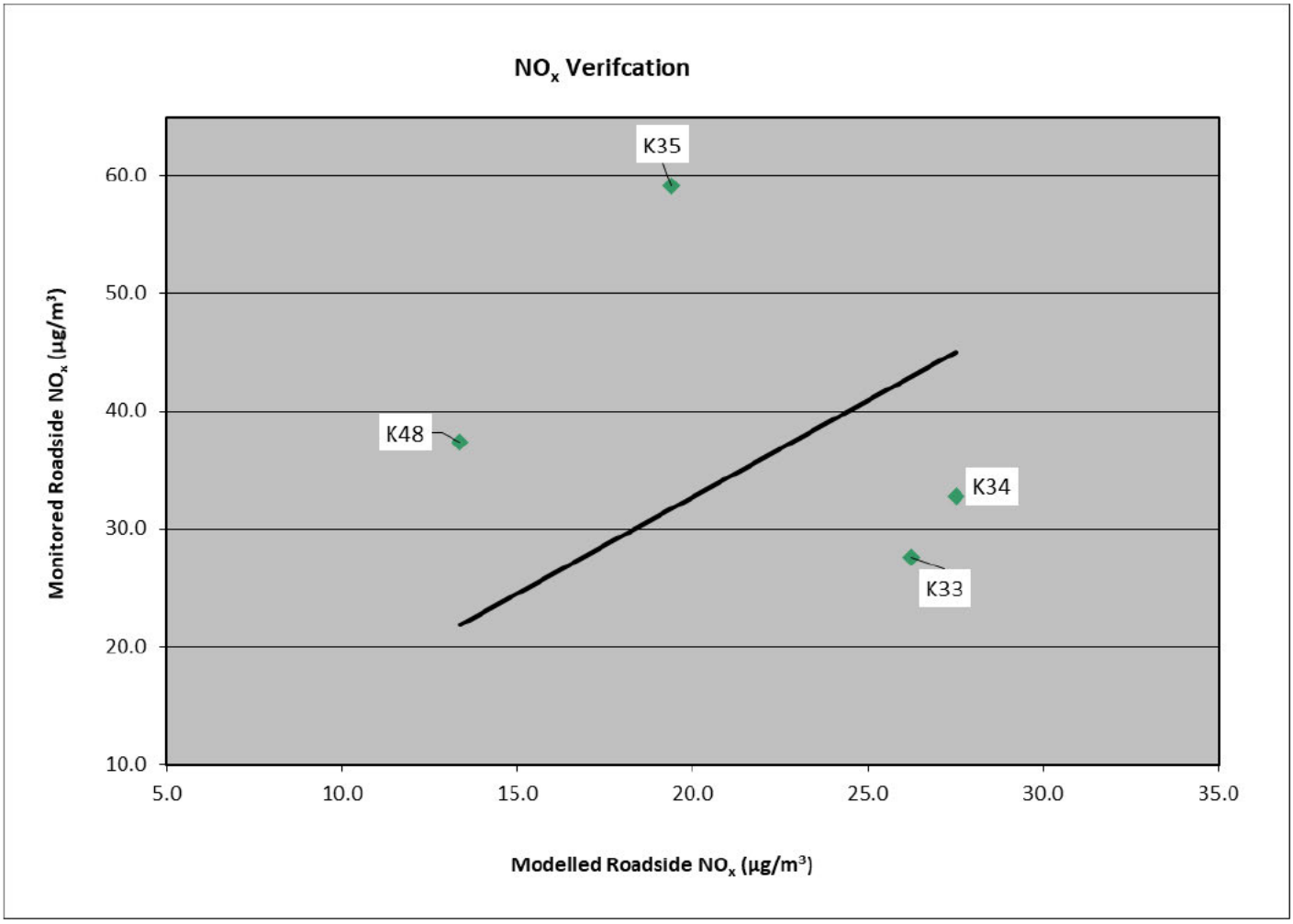


Table B8 presents the monitored annual mean NO_2 concentrations and the adjusted modelled total NO_2 concentration based on the above verification factor. Exceedances of the annual mean NO_2 AQO are highlighted in **bold**.

Table B8: Modelled Concentrations

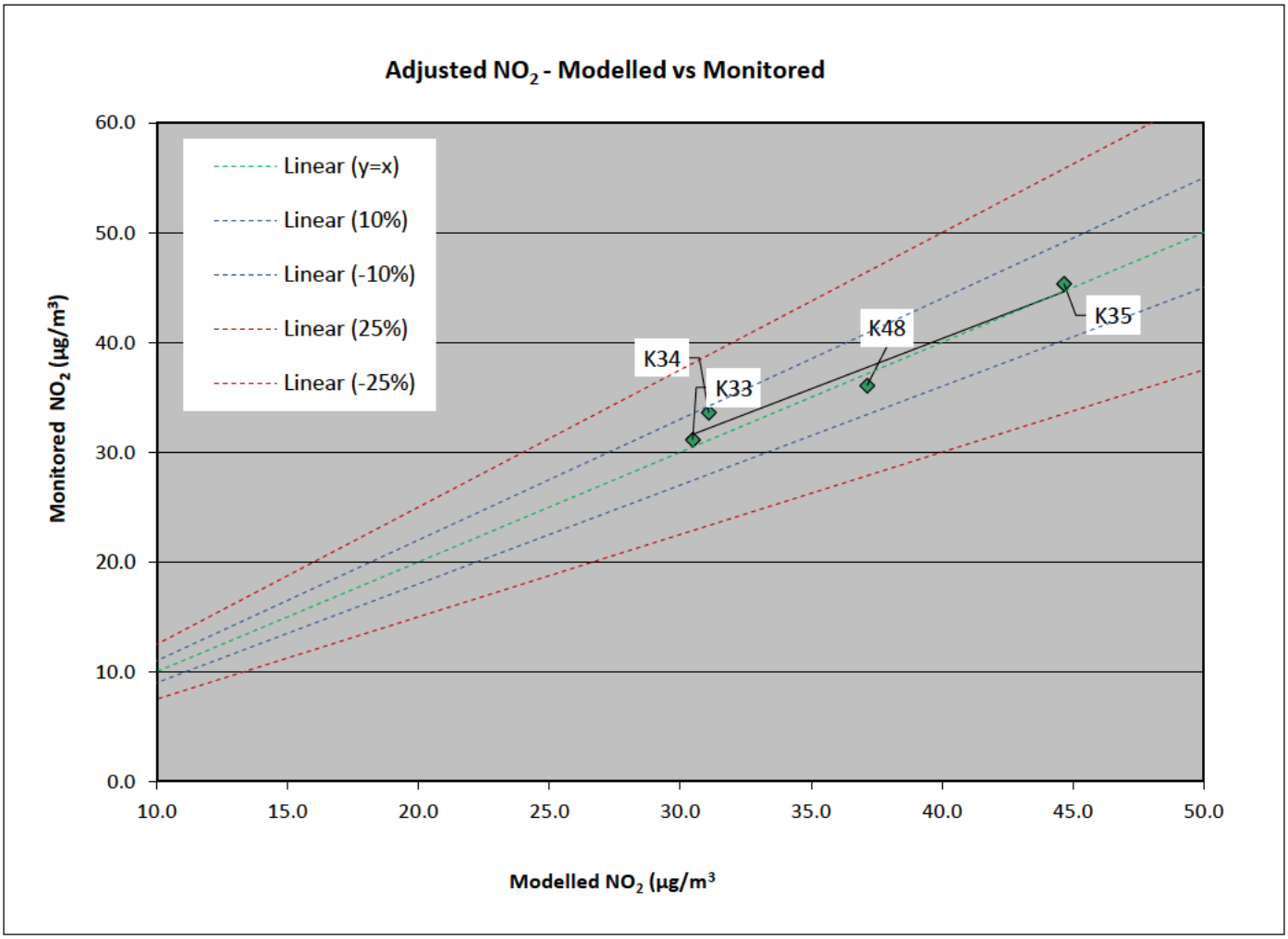
Site ID	Monitored Road NO_2 Concentration (µg/m³)	Adjusted Modelled Road NO_2 Concentration (µg/m³)	% Difference ((Monitored Modelled)/Monitored)) * 100
K33	31.13	30.47*	2%

Site ID	Monitored Road NO_2 Concentration (µg/m³)	Adjusted Modelled Road NO_2 Concentration (µg/m³)	% Difference ((Monitored Modelled)/Monitored)) * 100
K34	33.60	31.09*	7%
K35	45.33	44.66	1%
K48	36.07	37.13	-3%

** Adjustment factor of 1.0 applied*

As demonstrated in Table B8, the percentage difference between modelled and monitored concentrations is deemed acceptable and is less than 10% in all cases. This reduces uncertainties in the model predictions and provide a robust representation of pollutant concentrations in accordance with the guidance suggested in LAQM.TG(16)[2].

A graphical representation of the adjusted NO_2 concentrations is provided within Graph 2.



As PM monitoring is not undertaken within the assessment extents, the NOx adjustment factor of **2.9671** was utilised to adjust model predictions of PM in accordance with the guidance provided within LAQM.TG(16)[2].

APPENDIX C – ASSESSMENT RESULTS

Predicted Concentrations at Sensitive Receptors – 2019 Emission Factors

Nitrogen Dioxide (NO_2)

Annual mean NO_2 concentrations were predicted for 2026 DM and DS scenarios and are summarised in Table C1. Reference should be made to Figure 6 for a graphical representation of these locations.

Table C1: Predicted Annual Mean NO_2 Concentrations

Potential Impact		Predicted Annual Mean NO_2 Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	4 Brick Street	27.00	27.56	0.56
R2	150 Westgate	22.48	22.78	0.30
R3	133 Westgate	27.28	27.86	0.58
R4	28 Moorside Rise	25.52	25.99	0.47
R5	1 School Street	30.76	31.33	0.57
R6	36 Westcliffe Road	22.26	22.98	0.72
R7	37 Westcliffe Road	19.36	19.57	0.21
R8	75 Westcliffe Road	19.55	19.85	0.30
R9	8 Kenmore Road	21.20	21.84	0.64
R10	2 Kenmore Crescent	19.19	19.42	0.23
R11	34 Kenmore Road	20.12	20.52	0.40
R12	182 Whitechapel Road	21.99	22.36	0.37
R13	74 Whitechapel Road	26.80	27.05	0.25
R14	22 Whitechapel Road	29.23	29.55	0.32
R15	104 Westgate	31.88	32.66	0.78
R16	85 Westgate	31.04	31.72	0.68
R17	59 Westgate	32.02	32.64	0.62
R18	6 Peaseland Road	35.05	35.77	0.72
R19	21 Westgate	24.41	24.68	0.27
R20	29 Dewsbury Road	35.92	36.11	0.19
R21	2 Central Parade	30.94	31.09	0.15
R22	7 Cleckheaton	24.63	24.75	0.12
R23	43 Dewsbury Road	33.60	33.74	0.14
R24	10 Dewsbury Road	26.93	27.03	0.10
R25	103 Bradford Road	32.77	32.97	0.20
R26	82 Bradford Road	38.66	38.93	0.27
R27	267 Bradford Road	32.78	33.03	0.25
R28	319 Bradford Road	29.65	29.85	0.20

As indicated in Table C1, annual mean NO_2 concentrations were below the relevant AQO at all receptor locations considered.

Predicted impacts on annual mean NO_2 concentrations are summarised in Table C2.

Table C2: Predicted NO_2 Impacts

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	4 Brick Street	1.40	75% or Less of AQO	Negligible
R2	150 Westgate	0.75	75% or Less of AQO	Negligible
R3	133 Westgate	1.45	75% or Less of AQO	Negligible
R4	28 Moorside Rise	1.18	75% or Less of AQO	Negligible
R5	1 School Street	1.42	76-94% of AQO	Negligible
R6	36 Westcliffe Road	1.80	75% or Less of AQO	Negligible
R7	37 Westcliffe Road	0.53	75% or Less of AQO	Negligible
R8	75 Westcliffe Road	0.75	75% or Less of AQO	Negligible
R9	8 Kenmore Road	1.60	75% or Less of AQO	Negligible
R10	2 Kenmore Crescent	0.58	75% or Less of AQO	Negligible
R11	34 Kenmore Road	1.00	75% or Less of AQO	Negligible
R12	182 Whitechapel Road	0.93	75% or Less of AQO	Negligible
R13	74 Whitechapel Road	0.63	75% or Less of AQO	Negligible
R14	22 Whitechapel Road	0.80	75% or Less of AQO	Negligible
R15	104 Westgate	1.95	76-94% of AQO	*Slight*
R16	85 Westgate	1.70	76-94% of AQO	*Slight*
R17	59 Westgate	1.55	76-94% of AQO	*Slight*
R18	6 Peaseland Road	1.80	76-94% of AQO	*Slight*
R19	21 Westgate	0.67	75% or Less of AQO	Negligible
R20	29 Dewsbury Road	0.47	76-94% of AQO	Negligible
R21	2 Central Parade	0.37	76-94% of AQO	Negligible
R22	7 Cleckheaton	0.30	75% or Less of AQO	Negligible
R23	43 Dewsbury Road	0.35	76-94% of AQO	Negligible
R24	10 Dewsbury Road	0.25	75% or Less of AQO	Negligible
R25	103 Bradford Road	0.50	76-94% of AQO	Negligible
R26	82 Bradford Road	0.68	95-102% of AQO	*Slight*
R27	267 Bradford Road	0.63	76-94% of AQO	Negligible
R28	319 Bradford Road	0.50	75% or Less of AQO	Negligible

As indicated in Table C2 impacts on annual mean NO_2 concentrations as a result of road vehicle exhaust emissions associated with the development were predicted to be were predicted to be **negligible** at 23 human sensitive receptors and **slight** at 5 human receptors considered.

Based on the results, the overall impact significance upon annual mean NO_2 concentrations as a result of the Proposed Development was determined to be of slight adverse.

It is critical to note that the use of 2026 operational traffic data, together with 2019 emission factors is considered to provide a worst-case scenario which significantly overestimates potential impacts. Moreover, this approach does not consider future improvements due to a shift towards a greater production and uptake low emission and electric vehicles. Therefore, further sensitivity analysis is required to provide a more realistic scenario utilising 2026 emission factors.

This must be considered before determining overall significance and further justifications are discussed in Section 5.2.3.

Further detail regarding 2026 sensitivity analysis is provided in Tables C7 to C12 below.

Particulate Matter (PM_{10})

Annual mean PM_{10} concentrations were predicted for 2026 DM and DS scenarios and are summarised Table C3.

Table C3: Predicted Annual Mean PM_{10} Concentrations

Potential Impact		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	4 Brick Street	15.05	15.16	0.11
R2	150 Westgate	14.15	14.21	0.06
R3	133 Westgate	15.11	15.22	0.11
R4	28 Moorside Rise	14.75	14.85	0.10
R5	1 School Street	15.55	15.67	0.12
R6	36 Westcliffe Road	14.06	14.19	0.13
R7	37 Westcliffe Road	13.54	13.58	0.04
R8	75 Westcliffe Road	13.53	13.57	0.04
R9	8 Kenmore Road	13.83	13.94	0.11
R10	2 Kenmore Crescent	13.50	13.55	0.05
R11	34 Kenmore Road	13.66	13.74	0.08
R12	182 Whitechapel Road	13.98	14.04	0.06
R13	74 Whitechapel Road	14.89	14.93	0.04
R14	22 Whitechapel Road	15.17	15.22	0.05
R15	104 Westgate	16.04	16.20	0.16
R16	85 Westgate	15.87	16.01	0.14
R17	59 Westgate	16.08	16.21	0.13
R18	6 Peaseland Road	16.73	16.89	0.16
R19	21 Westgate	14.51	14.57	0.06
R20	29 Dewsbury Road	16.03	16.07	0.04
R21	2 Central Parade	14.83	14.86	0.03
R22	7 Cleckheaton	13.79	13.81	0.02
R23	43 Dewsbury Road	15.62	15.65	0.03
R24	10 Dewsbury Road	14.35	14.37	0.02
R25	103 Bradford Road	16.17	16.21	0.04

Potential Impact		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R26	82 Bradford Road	17.43	17.48	0.05
R27	267 Bradford Road	15.92	15.97	0.05
R28	319 Bradford Road	15.46	15.50	0.04

As indicated in Table AIII.5 annual mean PM_{10} concentrations were below the relevant AQO at all receptor locations considered. Predicted impacts on annual mean PM_{10} concentrations are summarised in Table C4.

Table C4: Predicted PM_{10} Impacts

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	4 Brick Street	0.27	75% or Less of AQO	Negligible
R2	150 Westgate	0.15	75% or Less of AQO	Negligible
R3	133 Westgate	0.28	75% or Less of AQO	Negligible
R4	28 Moorside Rise	0.25	75% or Less of AQO	Negligible
R5	1 School Street	0.30	75% or Less of AQO	Negligible
R6	36 Westcliffe Road	0.32	75% or Less of AQO	Negligible
R7	37 Westcliffe Road	0.10	75% or Less of AQO	Negligible
R8	75 Westcliffe Road	0.10	75% or Less of AQO	Negligible
R9	8 Kenmore Road	0.27	75% or Less of AQO	Negligible
R10	2 Kenmore Crescent	0.13	75% or Less of AQO	Negligible
R11	34 Kenmore Road	0.20	75% or Less of AQO	Negligible
R12	182 Whitechapel Road	0.15	75% or Less of AQO	Negligible
R13	74 Whitechapel Road	0.10	75% or Less of AQO	Negligible
R14	22 Whitechapel Road	0.13	75% or Less of AQO	Negligible
R15	104 Westgate	0.40	75% or Less of AQO	Negligible
R16	85 Westgate	0.35	75% or Less of AQO	Negligible
R17	59 Westgate	0.33	75% or Less of AQO	Negligible
R18	6 Peaseland Road	0.40	75% or Less of AQO	Negligible
R19	21 Westgate	0.15	75% or Less of AQO	Negligible
R20	29 Dewsbury Road	0.10	75% or Less of AQO	Negligible
R21	2 Central Parade	0.07	75% or Less of AQO	Negligible
R22	7 Cleckheaton	0.05	75% or Less of AQO	Negligible
R23	43 Dewsbury Road	0.08	75% or Less of AQO	Negligible
R24	10 Dewsbury Road	0.05	75% or Less of AQO	Negligible
R25	103 Bradford Road	0.10	75% or Less of AQO	Negligible
R26	82 Bradford Road	0.13	75% or Less of AQO	Negligible
R27	267 Bradford Road	0.13	75% or Less of AQO	Negligible

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R28	319 Bradford Road	0.10	75% or Less of AQO	Negligible

As indicated in Table C4 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 of the main report.

Particulate Matter ($PM_{2.5}$)

Annual mean $PM_{2.5}$ concentrations were predicted for 2026 DM and DS scenarios and are summarised Table C5.

Table C5: Predicted Annual Mean $PM_{2.5}$ Concentrations

Potential Impact		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	4 Brick Street	10.19	10.26	0.07
R2	150 Westgate	9.67	9.71	0.04
R3	133 Westgate	10.23	10.30	0.07
R4	28 Moorside Rise	10.02	10.08	0.06
R5	1 School Street	10.09	10.16	0.07
R6	36 Westcliffe Road	9.62	9.70	0.08
R7	37 Westcliffe Road	9.32	9.34	0.02
R8	75 Westcliffe Road	9.31	9.34	0.03
R9	8 Kenmore Road	9.49	9.55	0.06
R10	2 Kenmore Crescent	9.30	9.32	0.02
R11	34 Kenmore Road	9.39	9.43	0.04
R12	182 Whitechapel Road	9.58	9.61	0.03
R13	74 Whitechapel Road	9.76	9.78	0.02
R14	22 Whitechapel Road	9.93	9.96	0.03
R15	104 Westgate	10.77	10.86	0.09
R16	85 Westgate	10.67	10.75	0.08
R17	59 Westgate	10.80	10.87	0.07
R18	6 Peaseland Road	11.17	11.26	0.09
R19	21 Westgate	9.88	9.91	0.03
R20	29 Dewsbury Road	10.57	10.59	0.02
R21	2 Central Parade	9.88	9.89	0.01
R22	7 Cleckheaton	9.26	9.27	0.01
R23	43 Dewsbury Road	10.32	10.34	0.02
R24	10 Dewsbury Road	9.58	9.59	0.01

Potential Impact		Predicted Annual Mean PM_{10} Concentration (µg/m³)		
		DM	DS	Change
R25	103 Bradford Road	10.85	10.87	0.02
R26	82 Bradford Road	11.58	11.61	0.03
R27	267 Bradford Road	10.36	10.39	0.03
R28	319 Bradford Road	10.09	10.11	0.02

As indicated in Table AIII.5 annual mean $PM_{2.5}$ concentrations were below the relevant AQO at all receptor locations considered. Predicted impacts on annual mean $PM_{2.5}$ concentrations are summarised in Table C6.

Table C6: Predicted $PM_{2.5}$ Impacts

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	4 Brick Street	0.28	75% or Less of AQO	Negligible
R2	150 Westgate	0.16	75% or Less of AQO	Negligible
R3	133 Westgate	0.28	75% or Less of AQO	Negligible
R4	28 Moorside Rise	0.24	75% or Less of AQO	Negligible
R5	1 School Street	0.28	75% or Less of AQO	Negligible
R6	36 Westcliffe Road	0.32	75% or Less of AQO	Negligible
R7	37 Westcliffe Road	0.08	75% or Less of AQO	Negligible
R8	75 Westcliffe Road	0.12	75% or Less of AQO	Negligible
R9	8 Kenmore Road	0.24	75% or Less of AQO	Negligible
R10	2 Kenmore Crescent	0.08	75% or Less of AQO	Negligible
R11	34 Kenmore Road	0.16	75% or Less of AQO	Negligible
R12	182 Whitechapel Road	0.12	75% or Less of AQO	Negligible
R13	74 Whitechapel Road	0.08	75% or Less of AQO	Negligible
R14	22 Whitechapel Road	0.12	75% or Less of AQO	Negligible
R15	104 Westgate	0.36	75% or Less of AQO	Negligible
R16	85 Westgate	0.32	75% or Less of AQO	Negligible
R17	59 Westgate	0.28	75% or Less of AQO	Negligible
R18	6 Peaseland Road	0.36	75% or Less of AQO	Negligible
R19	21 Westgate	0.12	75% or Less of AQO	Negligible
R20	29 Dewsbury Road	0.08	75% or Less of AQO	Negligible
R21	2 Central Parade	0.04	75% or Less of AQO	Negligible
R22	7 Cleckheaton	0.04	75% or Less of AQO	Negligible
R23	43 Dewsbury Road	0.08	75% or Less of AQO	Negligible
R24	10 Dewsbury Road	0.04	75% or Less of AQO	Negligible
R25	103 Bradford Road	0.08	75% or Less of AQO	Negligible
R26	82 Bradford Road	0.12	75% or Less of AQO	Negligible

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R27	267 Bradford Road	0.12	75% or Less of AQO	Negligible
R28	319 Bradford Road	0.08	75% or Less of AQO	Negligible

As indicated in Table C6 impacts on annual mean $PM_{2.5}$ 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.

Predicted Concentrations at Sensitive Receptors – 2026 Emission Factors

A more conservative assessment scenario, utilising future year emissions, has been considered given the time period between the 2019 base year and 2026 future year. Reference should be made to Graph 1 in the main body of the report for a graphical representation of the anticipated future year emission factor reductions provided by DEFRA.

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Sensitivity analysis utilising 2026 operational traffic data, together with 2026 emission factors is provided below. This approach assumes an emission drop off in line with DEFRA predictions supported due to the current shift towards a greater production and uptake low emission vehicles and guided locally by the WYLES.

Nitrogen Dioxide (NO_2)

Annual mean NO_2 concentrations were predicted for 2026 DM and DS scenarios and are summarised in Table C7. Reference should be made to Figure 6 for a graphical representation of these locations.

Table C8: Predicted Annual Mean NO_2 Concentrations

Potential Impact		Predicted Annual Mean NO_2 Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	4 Brick Street	18.10	18.39	0.29
R2	150 Westgate	15.81	15.95	0.14
R3	133 Westgate	18.25	18.54	0.29
R4	28 Moorside Rise	17.33	17.57	0.24
R5	1 School Street	19.74	20.03	0.29
R6	36 Westcliffe Road	15.73	16.09	0.36
R7	37 Westcliffe Road	14.27	14.37	0.10
R8	75 Westcliffe Road	14.36	14.51	0.15
R9	8 Kenmore Road	15.20	15.52	0.32
R10	2 Kenmore Crescent	14.19	14.30	0.11
R11	34 Kenmore Road	14.65	14.85	0.20
R12	182 Whitechapel Road	15.60	15.79	0.19
R13	74 Whitechapel Road	18.35	18.47	0.12
R14	22 Whitechapel Road	19.51	19.67	0.16
R15	104 Westgate	20.61	21.01	0.40

Potential Impact		Predicted Annual Mean NO_2 Concentration (µg/m³)		
		DM	DS	Change
R16	85 Westgate	20.19	20.55	0.36
R17	59 Westgate	20.71	21.04	0.33
R18	6 Peaseland Road	22.32	22.70	0.38
R19	21 Westgate	16.81	16.95	0.14
R20	29 Dewsbury Road	22.36	22.46	0.10
R21	2 Central Parade	19.65	19.73	0.08
R22	7 Cleckheaton	16.60	16.66	0.06
R23	43 Dewsbury Road	21.21	21.29	0.08
R24	10 Dewsbury Road	17.74	17.79	0.05
R25	103 Bradford Road	20.70	20.80	0.10
R26	82 Bradford Road	23.84	23.98	0.14
R27	267 Bradford Road	21.11	21.23	0.12
R28	319 Bradford Road	19.59	19.69	0.10

As indicated in Table C7 annual mean NO_2 concentrations were below the relevant AQO at all receptor locations considered. Predicted impacts on annual mean NO_2 concentrations are summarised in Table C2.

Table C9: Predicted NO_2 Impacts

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	4 Brick Street	0.72	75% or Less of AQO	Negligible
R2	150 Westgate	0.35	75% or Less of AQO	Negligible
R3	133 Westgate	0.72	75% or Less of AQO	Negligible
R4	28 Moorside Rise	0.60	75% or Less of AQO	Negligible
R5	1 School Street	0.73	75% or Less of AQO	Negligible
R6	36 Westcliffe Road	0.90	75% or Less of AQO	Negligible
R7	37 Westcliffe Road	0.25	75% or Less of AQO	Negligible
R8	75 Westcliffe Road	0.38	75% or Less of AQO	Negligible
R9	8 Kenmore Road	0.80	75% or Less of AQO	Negligible
R10	2 Kenmore Crescent	0.28	75% or Less of AQO	Negligible
R11	34 Kenmore Road	0.50	75% or Less of AQO	Negligible
R12	182 Whitechapel Road	0.47	75% or Less of AQO	Negligible
R13	74 Whitechapel Road	0.30	75% or Less of AQO	Negligible
R14	22 Whitechapel Road	0.40	75% or Less of AQO	Negligible
R15	104 Westgate	1.00	75% or Less of AQO	Negligible
R16	85 Westgate	0.90	75% or Less of AQO	Negligible
R17	59 Westgate	0.82	75% or Less of AQO	Negligible

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R18	6 Peaseland Road	0.95	75% or Less of AQO	Negligible
R19	21 Westgate	0.35	75% or Less of AQO	Negligible
R20	29 Dewsbury Road	0.25	75% or Less of AQO	Negligible
R21	2 Central Parade	0.20	75% or Less of AQO	Negligible
R22	7 Cleckheaton	0.15	75% or Less of AQO	Negligible
R23	43 Dewsbury Road	0.20	75% or Less of AQO	Negligible
R24	10 Dewsbury Road	0.13	75% or Less of AQO	Negligible
R25	103 Bradford Road	0.25	75% or Less of AQO	Negligible
R26	82 Bradford Road	0.35	75% or Less of AQO	Negligible
R27	267 Bradford Road	0.30	75% or Less of AQO	Negligible
R28	319 Bradford Road	0.25	75% or Less of AQO	Negligible

As indicated in Table C2 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 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 of the main report.

Particulate Matter (PM_{10})

Annual mean PM_{10} concentrations were predicted for 2026 DM and DS scenarios and are summarised Table C3.

Table C10: Predicted Annual Mean PM_{10} Concentrations

Potential Impact		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	4 Brick Street	14.12	14.23	0.11
R2	150 Westgate	13.27	13.32	0.05
R3	133 Westgate	14.18	14.29	0.11
R4	28 Moorside Rise	13.83	13.92	0.09
R5	1 School Street	14.64	14.75	0.11
R6	36 Westcliffe Road	13.18	13.30	0.12
R7	37 Westcliffe Road	12.69	12.72	0.03
R8	75 Westcliffe Road	12.67	12.72	0.05
R9	8 Kenmore Road	12.96	13.06	0.10
R10	2 Kenmore Crescent	12.65	12.69	0.04
R11	34 Kenmore Road	12.80	12.87	0.07
R12	182 Whitechapel Road	13.10	13.16	0.06
R13	74 Whitechapel Road	14.02	14.06	0.04
R14	22 Whitechapel Road	14.26	14.31	0.05

Potential Impact		Predicted Annual Mean PM_{10} Concentration (µg/m³)		
		DM	DS	Change
R15	104 Westgate	15.06	15.21	0.15
R16	85 Westgate	14.91	15.04	0.13
R17	59 Westgate	15.11	15.23	0.12
R18	6 Peaseland Road	15.73	15.88	0.15
R19	21 Westgate	13.62	13.68	0.06
R20	29 Dewsbury Road	15.00	15.04	0.04
R21	2 Central Parade	13.85	13.88	0.03
R22	7 Cleckheaton	12.90	12.92	0.02
R23	43 Dewsbury Road	14.63	14.66	0.03
R24	10 Dewsbury Road	13.41	13.43	0.02
R25	103 Bradford Road	15.13	15.17	0.04
R26	82 Bradford Road	16.38	16.43	0.05
R27	267 Bradford Road	14.96	15.00	0.04
R28	319 Bradford Road	13.29	13.29	0.00

As indicated in Table C9 annual mean PM_{10} concentrations were below the relevant AQO at all receptor locations considered. Predicted impacts on annual mean PM_{10} concentrations are summarised in Table C4.

Table C11: Predicted PM_{10} Impacts

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	4 Brick Street	0.28	75% or Less of AQO	Negligible
R2	150 Westgate	0.13	75% or Less of AQO	Negligible
R3	133 Westgate	0.27	75% or Less of AQO	Negligible
R4	28 Moorside Rise	0.23	75% or Less of AQO	Negligible
R5	1 School Street	0.27	75% or Less of AQO	Negligible
R6	36 Westcliffe Road	0.30	75% or Less of AQO	Negligible
R7	37 Westcliffe Road	0.08	75% or Less of AQO	Negligible
R8	75 Westcliffe Road	0.13	75% or Less of AQO	Negligible
R9	8 Kenmore Road	0.25	75% or Less of AQO	Negligible
R10	2 Kenmore Crescent	0.10	75% or Less of AQO	Negligible
R11	34 Kenmore Road	0.17	75% or Less of AQO	Negligible
R12	182 Whitechapel Road	0.15	75% or Less of AQO	Negligible
R13	74 Whitechapel Road	0.10	75% or Less of AQO	Negligible
R14	22 Whitechapel Road	0.13	75% or Less of AQO	Negligible
R15	104 Westgate	0.38	75% or Less of AQO	Negligible
R16	85 Westgate	0.32	75% or Less of AQO	Negligible

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R17	59 Westgate	0.30	75% or Less of AQO	Negligible
R18	6 Peaseland Road	0.38	75% or Less of AQO	Negligible
R19	21 Westgate	0.15	75% or Less of AQO	Negligible
R20	29 Dewsbury Road	0.10	75% or Less of AQO	Negligible
R21	2 Central Parade	0.08	75% or Less of AQO	Negligible
R22	7 Cleckheaton	0.05	75% or Less of AQO	Negligible
R23	43 Dewsbury Road	0.07	75% or Less of AQO	Negligible
R24	10 Dewsbury Road	0.05	75% or Less of AQO	Negligible
R25	103 Bradford Road	0.10	75% or Less of AQO	Negligible
R26	82 Bradford Road	0.13	75% or Less of AQO	Negligible
R27	267 Bradford Road	0.10	75% or Less of AQO	Negligible
R28	319 Bradford Road	0.00	75% or Less of AQO	Negligible

As indicated in Table C4 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 of the main report.

Particulate Matter ($PM_{2.5}$)

Annual mean $PM_{2.5}$ concentrations were predicted for 2026 DM and DS scenarios and are summarised Table C5.

Table C12: Predicted Annual Mean $PM_{2.5}$ Concentrations

Potential Impact		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	4 Brick Street	9.47	9.53	0.06
R2	150 Westgate	8.99	9.02	0.03
R3	133 Westgate	9.50	9.56	0.06
R4	28 Moorside Rise	9.31	9.36	0.05
R5	1 School Street	9.36	9.42	0.06
R6	36 Westcliffe Road	8.95	9.01	0.06
R7	37 Westcliffe Road	8.67	8.69	0.02
R8	75 Westcliffe Road	8.67	8.69	0.02
R9	8 Kenmore Road	8.83	8.88	0.05
R10	2 Kenmore Crescent	8.65	8.67	0.02
R11	34 Kenmore Road	8.74	8.78	0.04
R12	182 Whitechapel Road	8.91	8.94	0.03
R13	74 Whitechapel Road	9.06	9.08	0.02

Potential Impact		Predicted Annual Mean PM_{10} Concentration (µg/m³)		
		DM	DS	Change
R14	22 Whitechapel Road	9.21	9.23	0.02
R15	104 Westgate	9.99	10.07	0.08
R16	85 Westgate	9.91	9.98	0.07
R17	59 Westgate	10.02	10.09	0.07
R18	6 Peaseland Road	10.36	10.45	0.09
R19	21 Westgate	9.19	9.22	0.03
R20	29 Dewsbury Road	9.73	9.75	0.02
R21	2 Central Parade	9.09	9.10	0.01
R22	7 Cleckheaton	8.56	8.57	0.01
R23	43 Dewsbury Road	9.52	9.53	0.01
R24	10 Dewsbury Road	8.84	8.85	0.01
R25	103 Bradford Road	10.03	10.05	0.02
R26	82 Bradford Road	10.72	10.75	0.03
R27	267 Bradford Road	9.59	9.61	0.02
R28	319 Bradford Road	8.66	8.66	0.00

As indicated in Table AIII.5 annual mean $PM_{2.5}$ concentrations were below the relevant AQO at all receptor locations considered. Predicted impacts on annual mean $PM_{2.5}$ concentrations are summarised in Table C6.

Table C13: Predicted $PM_{2.5}$ Impacts

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	4 Brick Street	0.24	75% or Less of AQO	Negligible
R2	150 Westgate	0.12	75% or Less of AQO	Negligible
R3	133 Westgate	0.24	75% or Less of AQO	Negligible
R4	28 Moorside Rise	0.20	75% or Less of AQO	Negligible
R5	1 School Street	0.24	75% or Less of AQO	Negligible
R6	36 Westcliffe Road	0.24	75% or Less of AQO	Negligible
R7	37 Westcliffe Road	0.08	75% or Less of AQO	Negligible
R8	75 Westcliffe Road	0.08	75% or Less of AQO	Negligible
R9	8 Kenmore Road	0.20	75% or Less of AQO	Negligible
R10	2 Kenmore Crescent	0.08	75% or Less of AQO	Negligible
R11	34 Kenmore Road	0.16	75% or Less of AQO	Negligible
R12	182 Whitechapel Road	0.12	75% or Less of AQO	Negligible
R13	74 Whitechapel Road	0.08	75% or Less of AQO	Negligible
R14	22 Whitechapel Road	0.08	75% or Less of AQO	Negligible
R15	104 Westgate	0.32	75% or Less of AQO	Negligible

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R16	85 Westgate	0.28	75% or Less of AQO	Negligible
R17	59 Westgate	0.28	75% or Less of AQO	Negligible
R18	6 Peaseland Road	0.36	75% or Less of AQO	Negligible
R19	21 Westgate	0.12	75% or Less of AQO	Negligible
R20	29 Dewsbury Road	0.08	75% or Less of AQO	Negligible
R21	2 Central Parade	0.04	75% or Less of AQO	Negligible
R22	7 Cleckheaton	0.04	75% or Less of AQO	Negligible
R23	43 Dewsbury Road	0.04	75% or Less of AQO	Negligible
R24	10 Dewsbury Road	0.04	75% or Less of AQO	Negligible
R25	103 Bradford Road	0.08	75% or Less of AQO	Negligible
R26	82 Bradford Road	0.12	75% or Less of AQO	Negligible
R27	267 Bradford Road	0.08	75% or Less of AQO	Negligible
R28	319 Bradford Road	0.00	75% or Less of AQO	Negligible

As indicated in Table C6 impacts on annual mean $PM_{2.5}$ 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 of the main report.

APPENDIX D – CONSTRUCTION PHASE ASSESSMENT CRITERIA

CONSTRUCTION PHASE METHODOLOGY

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'[3].

Activities are 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.

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.

Step 2

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

- 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 D1.

Table D1: 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

Magnitude	Activity	Criteria
		• Formation of bunds greater than 8m in height • More than 100,000 tonnes of material moved
	Construction	• Total building volume greater than 100,000m³ • 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 20,000m³ to 50,000m³ • Potentially dusty construction material • Demolition activities 10m to 20m above ground level
	Earthworks	• Total site area 2,500m² to 10,000m² • 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 25,000m³ to 100,000m³ • Potentially dusty construction material (e.g. concrete) • On site concrete batching
	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 20,000m³ • 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 2,500m² • 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 25,000m³ • Construction material with low potential for dust release (e.g. metal cladding or timber)
	Trackout	• <10 HDV (3.5t) outward movements in any one day • Surface material with low potential for dust release • Unpaved road length <50m

Step 2B defines the sensitivity of the area around the development site for construction, earthworks and trackout. The factors influencing the sensitivity of the area are shown in Table D2.

Table D2: 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	• Internationally or nationally designated site e.g. Special Area of Conservation

Sensitivity	Examples	
	Human Receptors	**Ecological Receptors**
	• 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	
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 D3.

Table D3: 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
Medium	More than 1	Medium	Low	Low	Low
Low	More than 1	Low	Low	Low	Low

Table D4 outlines the sensitivity of the area to human health impacts.

Table D4: 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/m³	More than 100	High	High	High	Medium	Low
		10 - 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 - 32µg/m³	More than 100	High	High	Medium	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 - 28µg/m³	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/m³	More than 100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
	Less than 24µg/m³	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/m³	More than 10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	28 - 32µg/m³	More than 10	Medium	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	24 - 28µg/m³	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	Less than 24µg/m³	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Low	-	More than 1	Low	Low	Low	Low	Low

Table D5 outlines the sensitivity of the area to ecological impacts.

Table D5: 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 D6 outlines the risk category from demolition activities.

Table D6: Dust Risk Category from Demolition

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Medium
Medium	High	Medium	Low
Low	Medium	Low	Negligible

Table D7 outlines the risk category from earthworks and construction activities.

Table D7: Dust Risk Category from Earthworks and Construction

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table D8 outlines the risk category from trackout.

Table D8: Dust Risk Category from Trackout

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

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.

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'.

APPENDIX E – ASSESSORS CURRICULUM VITAE

JOSHUA DAVIES

Principal Air Quality Consultant

BSc (Hons) AMIEnvSci

KEY EXPERIENCE

Josh is an Environmental Consultant with specialist experience in the air quality sector. HIs key capabilities include:

- Production of Air Quality Assessments to the Department for Environment, Food and Rural Affairs (DEFRA), Environment Agency and Environmental Protection UK (EPUK) methodologies for clients from the residential, retail and commercial sectors.
- Detailed dispersion modelling of road vehicle emissions using ADMS-Roads. Studies have included impact assessment of pollutant concentrations at various floor levels and assessment of suitability of development sites for proposed end-use.
- Assessment of dust impacts from construction sites to the Institute of Air Quality Management (IAQM) methodology.
- Assessment of Odour Impact from commercial and industrial processes in line with Environment Agency (EA) and IAQM methodologies and guidance
- Quantification of Ecological Impacts associated with Nitrogen and Acid Deposition from industrial processes
- Production of air quality mitigation strategies for developments throughout the UK.
- Management of Environmental Permit Applications primarily for the Medium Combustion Plant Directive (MCDP)

SELECT PROJECTS SUMMARY

- Imperial War Museum, Duxford – Air Quality screening assessment associated with dust and odour as a result of proposed restoration activities
- London South Bank University -AQA for redevelopment of the campus, with associated energy centre
- Scunthorpe United Football Stadium - AQA for new sports stadium and commercial and retail park
- Heineken UK, Manchester – Production of various AQAs for the expansion of the Manchester Brewery site.
- Cricklewood Freight Terminal – AQA for an aggregate freight terminal in Brent. Dust and HGV impact assessment and mitigation strategy
- Llay Wrexham – AQ associated with a Short-Term Reserve Operation site in line with the Medium Combustion Plant Directive (MCPD)

ES Chapters

- Great Jackson Street Framework - Production of a number of ES chapters for large-scale mixed use multi storey buildings
- Keele University – Road and Energy Assessment for the proposed re-development of the student campus
- Newton Farm, Perth - EIA for a medium scale residential development in close vicinity to the A9.

Odour Assessments

- Clipsone House Farm – Quantitative odour and ammonia assessment in support of a proposed extension to a large-scale poultry farm.
- Chatteris AD Plant - Quantitative odour modelling and sniff tests to discharge condition on an existing anaerobic digestion plant
- Jennychem, Snodland - Risk Assessment and Best Practice Statement in support of the proposed car repairs facility spray booth

London Borough of Southwark Experience

- Camberwell Road, Southwark - Exposure assessment for a proposed gym within an AQMA, 24 hour and 1 hour mean AQOs assessed.
- Pelier Street- AQA for a residential development located within the Southwark AQMA
- Haddonfield Estate - AQA for a residential development located within the Southwark AQMA
- Lavington Street - AQA for mixed use scheme in AQMA in Southwark, including an AQN assessment.
- Daniels Road - AQA for a residential development within the Southwark AQMA

Educational Developments

- Brinsworth Comprehensive School, Rotherham - Baseline and Construction phase assessment for the proposed extension and new Sports Hall. Site suitability due to the Schools close proximity to the M1 Motorway.
- Ashton House, Waterloo Street, Bolton – Exposure and impact assessment related to a proposed expansion of the existing site located within the Greater Manchester AQMA
- St Marys and Johns CE School, Barnet AQA for the refurbishment of the existing school and the construction of a 3-storey classroom block, within the borough wide Barnet AQMA.
- St Peters Catholic School, Guildford - AQA for the redevelopment of the existing site, and the construction of a two-storey classroom block

Monitoring & Surveying Experience

- Co-ordination and management of NO2 diffusion tube monitoring surveys in accordance with DEFRA guidance.
- Odour Acuity certified, undertaken numerous site sniff tests

QUALIFICATIONS

- Bachelor of Science
- Member of the Institute of Environmental Science (IES)
- Odour Acuity Certified