



BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

## ENVIRONMENT

Avant Homes (England) Ltd and  
Pennine Property Partnership

ST. LUKE'S HOSPITAL, HUDDERSFIELD

### Air Quality Assessment

LDP2217

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## EXECUTIVE SUMMARY

BWB Consulting Ltd was appointed by Avant Homes (England) Ltd and Pennine Property Partnerships to undertake an Air Quality Assessment, for submission with a planning application, for a residential development on the former St. Luke's Hospital, Huddersfield.

The proposed development Site is located within the administrative area of Kirklees Council (KC) and is not situated within an Air Quality Management Area (AQMA).

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

A detailed road traffic emissions assessment was undertaken to predict pollutant concentrations at the proposed development to consider the suitability of the Site for the proposed residential use with regard to air quality. Concentrations of nitrogen dioxide (NO<sub>2</sub>), particulate matter with an aerodynamic diameter of less than 10µm (PM<sub>10</sub>) and particulate matter with an aerodynamic diameter of less than 2.5µm (PM<sub>2.5</sub>) were predicted to be below the relevant air quality objectives.

Road traffic exhaust emissions associated with vehicles travelling to and from the Site during operation also have the potential to impact existing air quality in the surrounding area. Potential operational phase air quality impacts were therefore assessed by predicting air quality conditions at sensitive locations both with and without the development in place. Results were subsequently verified using local monitoring data. The assessment indicated that predicted air quality impacts as a result of traffic generated by the development were considered to be 'not significant' in accordance with IAQM guidance.

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## 1. INTRODUCTION

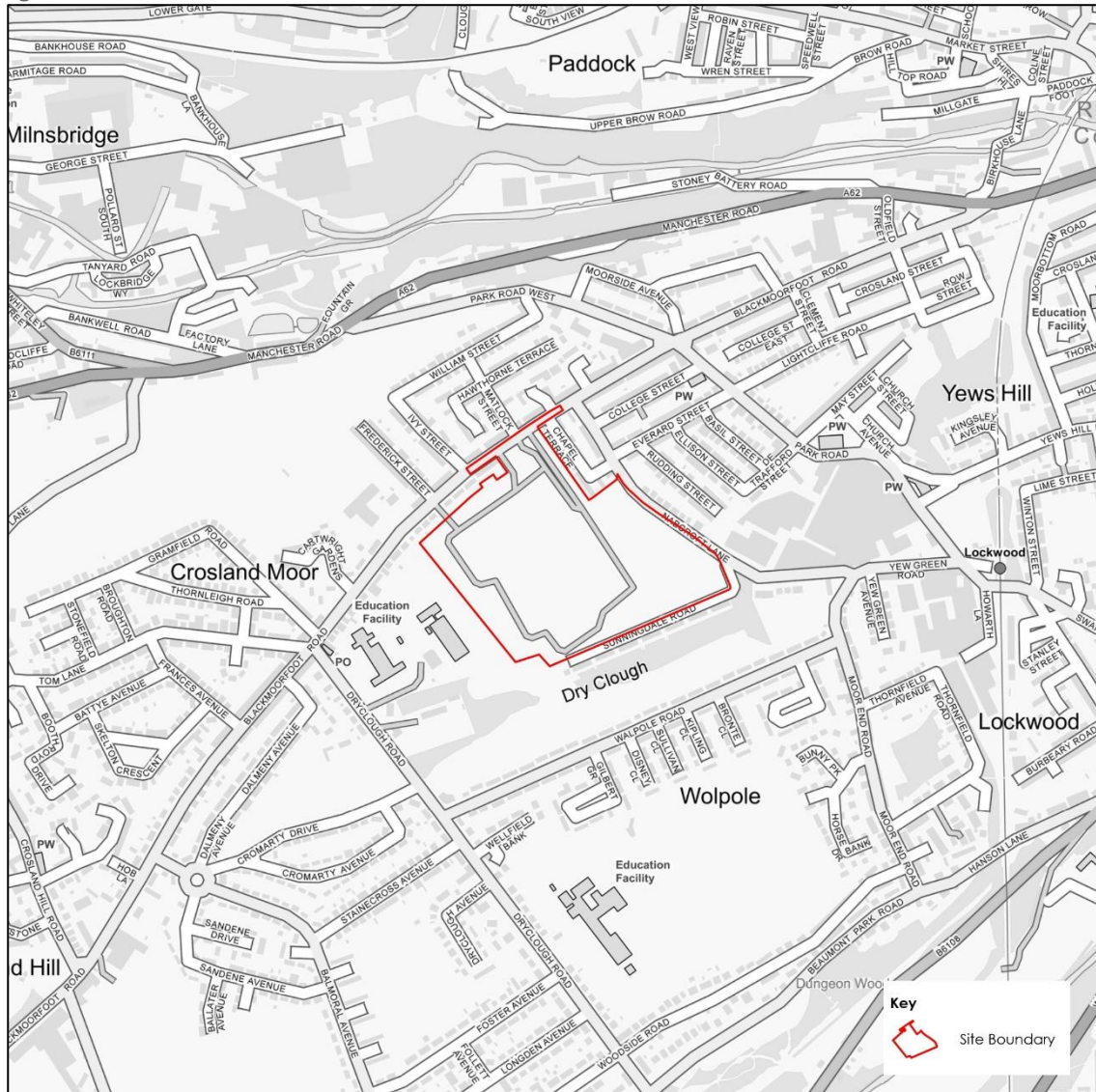
### Appointment & Background

- 1.1 BWB Consulting Ltd was appointed by Avant Homes (England) Ltd and Pennine Property Partnership to undertake an Air Quality Assessment for a residential development on the former St. Luke's Hospital, Huddersfield.
- 1.2 The assessment supports the following applications on the named development:
  1. Reserved Matters Application for the residential development of 200 dwellings in pursuant of application Ref 2016/91337; and
  2. Full application for the residential development of 26 dwellings and onsite open space.
- 1.3 The assessment considers construction phase dust impacts and operational phase road traffic emission impacts. A qualitative construction phase dust assessment was undertaken in accordance with relevant guidance. A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified receptor locations. In addition, pollutant concentrations were predicted at the proposed development Site.
- 1.4 This report is necessarily technical in nature, so to assist the reader, a glossary of air quality terminology can be found in **Appendix A**.

### Site Setting

- 1.5 The proposed development is located on the former St. Luke's Hospital, within the administrative area of KC. The Site is bound by residential dwellings to the north-west, Blackmoorfoot Road to the north, Nabcroft Lane to the east, Sunndingdale Road to the south and playing fields to the west. The Site currently comprises derelict land.
- 1.6 Figure 1.1 details the Site location.

**Figure 1.1: Site Context Plan**



## Proposed Development

- 1.7 The proposed development comprises the erection of a total of 226 residential units on the former St. Luke's Hospital, Huddersfield.
- 1.8 Drawings detailing the proposed development are provided in **Appendix B**.

## 2. LEGISLATION AND PLANNING POLICY

### National Legislation and Planning Policy

#### The UK Air Quality Strategy

- 2.1 European Union (EU) legislation forms the basis of air quality policy and legislation in the UK. The EU 2008 ambient Air Quality Directive<sup>1</sup> sets limits for ambient concentrations of air pollutants including nitrogen dioxide (NO<sub>2</sub>) and particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>). The air quality standards and objectives are prescribed through the Air Quality (England) Regulations 2000<sup>2</sup>, as amended, for the purpose of the Local Air Quality Management Framework.
- 2.2 The UK Government are required under the Environment Act 1995<sup>3</sup> to produce a national Air Quality Strategy (AQS)<sup>4,5</sup>. The AQS was first published in 1997 and was most recently reviewed and updated in 2007. The AQS provides an overview of the Government's ambient air quality policy and sets out the air quality standards and objectives to be achieved and measures to improve air quality.
- 2.3 Part IV of the Environment Act<sup>3</sup> requires local authorities in the UK to review local air quality within their administrative area and, if relevant air quality standards and objectives are likely to be exceeded, designate Air Quality Management Areas (AQMAs). Following the designation of an AQMA, local authorities are required to publish an Air Quality Action Plan (AQAP) detailing measures to be taken to improve local air quality and work towards meeting the relevant air quality standards and objectives.

#### National Planning Policy Framework

- 2.4 The revised National Planning Policy Framework<sup>6</sup> (NPPF) was published in July 2018 and sets out the Government's planning policies for England and how these are expected to be applied.
- 2.5 A core principle relating to air quality effects from development is that planning should "contribute to conserving and enhancing the natural environment and reduce pollution". In achieving this, it states that:

*"The planning system should contribute to and enhance the natural and local environment by:*

*[...]*

*preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability [...]"*.

<sup>1</sup> European Parliament (2008) Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe

<sup>2</sup> HMSO (2000) Statutory Instrument 2000 No. 928, The Air Quality (England) Regulations 2000 (as amended), London: HMSO

<sup>3</sup> HMSO (1995) The Environment Act 1995, London: TSO

<sup>4</sup> Department of the Environment (DoE) (1997) The UK National Air Quality Strategy, London: HMSO

<sup>5</sup> Department of the Environment, Food and Rural Affairs (Defra) (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, London: HMSO

<sup>6</sup> Ministry for Housing, Communities and Local Government (2018) National Planning Policy Framework, HMSO London

2.6 With regard to assessing cumulative effects the NPPF states:

*"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development".*

2.7 The NPPF recognises air quality as part of delivering sustainable development and states that:

*"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*

### Planning Practice Guidance

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

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

*"Whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife).*

*[...]*

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

- *Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry*

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<sup>7</sup> Department for Communities and Local Government (2014) Planning Practice Guidance Air Quality

*park; adds to turnover in a large car park; or result in construction sites that would generate Heavy Goods Vehicle flows over a period of a year or more.*

- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area.*
- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.*
- *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations.*
- *Affect biodiversity. In particular, this is likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site and is not directly connected with or necessary to the management of the site, or does it otherwise affects biodiversity, particularly designated wildlife sites."*

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

### **Local Planning Policy**

- 2.11 The Unitary Development Plan (UDP)<sup>8</sup> sets out KC's policies and proposals for the use and development of land and buildings. The UDP was adopted in March 1999 and a direction issued by the Secretary of State for Communities and Local Government in September 2007 led to a review of the plans, resulting in the removal of a number of policies.

- 2.12 Review of the UDP policies saved beyond September 2007 indicated the following of relevance to this report:

*"Built Environment - BE1*

*All development should be of good quality design such that it contributes to a built environment which:*

*[...]*

*iv. promotes a healthy environment, including space and landscaping about buildings and avoidance of exposure to excessive noise or pollution; [...]"*

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<sup>8</sup> KC (2007) Kirklees UDP, Written Statement - Revised with Effect from 28 September 2007.

- 2.13 KC are currently developing a new Local Plan which will form the new statutory plan for the district and will supersede the UDP. Review of the Strategy & Policies<sup>9</sup> document from the Draft Local Plan indicated the following policies of relevance to this report:

*"Policy PLP 47 - 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 PLP 51 - 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 unacceptably affect or cause a nuisance to the natural and built environment or to people.*

*2. Proposals that have the potential to increase local air pollution either individually or cumulatively must be accompanied by evidence to show that the impact of the development has been assessed in accordance with the relevant guidance. Development which has the potential to cause levels of local air pollution to increase to unsafe levels must incorporate sustainable mitigation measures that reduce this impact to a safe level. If sustainable measures cannot be introduced the development will not be permitted.*

*3. Where the development introduces new receptors into Air Quality Management Areas or Areas of Concern or near other areas of relatively poor air quality, for example near roads or junctions, the development must incorporate sustainable mitigation measures that protect the new receptors from unacceptable levels of air pollution. Where sustainable mitigation measures cannot be introduced which prevent receptors from being exposed to unsafe levels of air pollution, development will not be permitted."*

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

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<sup>9</sup> KC (2016) Strategies and Policies, Draft Local Plan.

### 3. METHODOLOGY

#### Consultation with Kirklees Council

- 3.1 Consultation was undertaken with the Environmental Health department at KC by e-mail, outlining the proposed assessment methodology.
- 3.2 The proposed assessment methodology is detailed below.
- Baseline
    - Baseline air quality conditions in the vicinity of the Site were defined based on recent monitoring results and information from the Department for Environment, Food and Rural Affairs (Defra) Air Quality Resource. Sensitive locations in the vicinity of the Site that could be affected by the proposals also were identified, as well as any relevant planning policies or guidance.
  - Construction Phase Assessment
    - During the construction of the proposed development there is the potential for air quality impacts as a result of fugitive dust emissions from earthworks, construction and trackout activities. These were assessed in accordance with the IAQM guidance 'Assessment of Dust from Demolition and Construction'.
  - Operational Phase Assessment
    - Detailed dispersion modelling using ADMS-Roads was undertaken in order to fully quantify pollutant levels at the Site, identify any potential exposure of future residents to unacceptable concentrations and assess air quality impacts at sensitive locations as a result of traffic generated by the development.
    - The assessment was undertaken using 1-year of meteorological data and the modelled results verified using local monitoring data. Impacts were predicted at sensitive receptor locations.
    - Predicted pollutant concentrations were compared to the relevant Air Quality Objectives, as defined in the UK Air Quality Strategy and associated regulations. The significance of potential impacts was also determined based on the predicted magnitude of change in pollutant concentrations and the criteria provided within the IAQM document 'Land-Use Planning & Development Control: Planning for Air Quality'.
  - Mitigation
    - Mitigation requirements were identified in accordance with the 'West Yorkshire Air Quality and Emissions Technical Planning Guidance'<sup>10</sup> document.
- 3.3 During initial consultation it was indicated that an Odour Assessment was also required in support of the planning application. This was discussed further with Andrew Jameson, Air Quality Officer at KC who indicated that a brief Odour Appraisal of potential odour sources in the vicinity of the Site should be undertaken. As such, a desk top study was included in the assessment in order to identify potential odour sources and identify any requirements for mitigation.

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<sup>10</sup> West Yorkshire Low Emissions Group (2014) Air Quality and Emissions: Technical Planning Guidance.

## Construction Phase Assessment

- 3.4 An assessment of the potential impacts arising from the construction of the proposed development was undertaken in accordance with the IAQM Guidance<sup>11</sup>. The full assessment methodology is not reproduced within this report but a summary of the assessment steps is provided below:
- Step 1 – screen the requirement for a more detailed assessment. No assessment is required if there are no receptors within a certain distance of the works;
  - Step 2 – assess the risk of dust impacts separately for each of the four activities considered (demolition, earthworks, construction and trackout).
    - Step 2A – determine the potential dust emission magnitude for each of the four activities;
    - Step 2B – determine the sensitivity of the area; and
    - Step 2C – determine the risk of dust impacts by combining the findings of steps 2A and 2B.
  - Step 3 – determine the site-specific mitigation for each of the four activities; and
  - Step 4 – examine the residual effects and determine significance.

## Road Traffic Emissions - Air Dispersion Modelling

- 3.5 The air dispersion model ADMS-Roads, version 4.1.1.0, was utilised in the assessment to predict concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> at existing and proposed receptor locations.

### Assessment Scenarios and Traffic Data

- 3.6 The following scenarios were considered in the air dispersion modelling:
- 2017 Verification;
  - Opening Year Do-Minimum (DM) (predicted traffic flows in 2023 should the proposals not proceed); and,
  - Opening year Do-Something (DS) (predicted traffic flows in 2023 should the proposals be completed).
- 3.7 Traffic data was obtained from the BWB Consulting transport team, the Transport Consultants for the project. 24-hour Annual Average Daily Traffic Data (AADT) and Heavy Duty Vehicle (HDV) proportions were provided for the described assessment scenarios for the following roads:
- A62 Castlegate;
  - A62 Queensgate;
  - A62 Manchester Road, East of Blackmoorfoot Road;
  - Blackmoorfoot Road, between Manchester Road and Park Lane;

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<sup>11</sup> Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London.

- A62 Manchester Road, between Park Road West and Blackmoorfoot Road;
- Park Road West;
- Blackmoorfoot Road, between Park Road and Nabcroft Lane;
- Park Road, North;
- A62 Manchester Road, West of Park Road West;
- Blackmoorfoot Road, East of Access;
- Blackmoorfoot Road, West of Access;
- Blackmoorfoot Road, South;
- Park Road, South;
- A616 Lockwood Road;
- A616 Bridge Street; and
- B6108 Meltham Road.

3.8 Traffic data used in the air dispersion modelling are provided in **Table 3.1**.

**Table 3.1: Traffic Data Utilised in the Air Quality Assessment**

| Link | Speed | Total AADT Flow |         |         | HDV% |         |         |
|------|-------|-----------------|---------|---------|------|---------|---------|
|      | kph   | 2017            | 2023 DM | 2023 DS | 2017 | 2023 DM | 2023 DS |
| L1   | 45    | 14,722          | 16,785  | 16,833  | 3.25 | 2.85    | 2.85    |
| L2   | 25    | 14,722          | 16,785  | 16,833  | 3.25 | 2.85    | 2.85    |
| L3   | 25    | 14,722          | 16,785  | 16,833  | 3.25 | 2.85    | 2.85    |
| L4   | 40    | 14,722          | 16,785  | 16,833  | 3.25 | 2.85    | 2.85    |
| L5   | 25    | 14,722          | 16,785  | 16,833  | 3.25 | 2.85    | 2.85    |
| L6   | 45    | 14,722          | 16,785  | 16,833  | 3.25 | 2.85    | 2.85    |
| L7   | 45    | 10,483          | 12,105  | 12,152  | 7.26 | 6.29    | 6.27    |
| L8   | 25    | 10,483          | 12,105  | 12,152  | 7.26 | 6.29    | 6.27    |
| L9   | 45    | 10,483          | 12,105  | 12,152  | 7.26 | 6.29    | 6.27    |
| L10  | 45    | 20,965          | 24,209  | 24,304  | 7.26 | 6.29    | 6.27    |
| L11  | 25    | 11,449          | 12,959  | 12,959  | 4.17 | 3.68    | 3.68    |
| L12  | 40    | 19,081          | 21,599  | 21,884  | 4.17 | 3.68    | 3.64    |
| L13  | 25    | 19,081          | 21,599  | 21,884  | 4.17 | 3.68    | 3.64    |
| L14  | 45    | 19,081          | 21,599  | 21,884  | 4.17 | 3.68    | 3.64    |
| L15  | 30    | 19,081          | 21,599  | 21,599  | 4.17 | 3.68    | 3.68    |
| L16  | 45    | 19,081          | 21,599  | 21,884  | 4.17 | 3.68    | 3.64    |
| L17  | 45    | 10,616          | 12,252  | 12,585  | 6.21 | 5.38    | 5.26    |
| L18  | 25    | 10,616          | 12,252  | 12,585  | 6.21 | 5.38    | 5.26    |

| Link | Speed | Total AADT Flow |         |         | HDV% |         |         |
|------|-------|-----------------|---------|---------|------|---------|---------|
|      | kph   | 2017            | 2023 DM | 2023 DS | 2017 | 2023 DM | 2023 DS |
| L19  | 45    | 10,616          | 12,252  | 12,585  | 6.21 | 5.38    | 5.26    |
| L20  | 30    | 1,472           | 1,679   | 1,726   | 3.25 | 2.85    | 2.85    |
| L21  | 30    | 9,011           | 10,426  | 10,426  | 7.26 | 6.29    | 6.29    |
| L22  | 25    | 13,249          | 15,107  | 15,107  | 3.25 | 2.85    | 2.85    |
| L23  | 30    | 7,632           | 8,640   | 8,925   | 4.17 | 3.68    | 3.68    |
| L24  | 30    | 10,616          | 12,252  | 12,252  | 6.21 | 5.38    | 5.38    |
| L25  | 45    | 22,474          | 25,875  | 26,160  | 6.09 | 5.29    | 5.24    |
| L26  | 25    | 22,474          | 25,875  | 26,160  | 6.09 | 5.29    | 5.24    |
| L27  | 45    | 13,929          | 16,440  | 16,535  | 8.23 | 6.98    | 6.94    |
| L28  | 25    | 13,929          | 16,440  | 16,535  | 8.23 | 6.98    | 6.94    |
| L29  | 25    | 21,232          | 24,504  | 25,170  | 6.21 | 5.38    | 5.26    |
| L30  | 40    | 21,232          | 24,504  | 25,170  | 6.21 | 5.38    | 5.26    |
| L31  | 20    | 21,232          | 24,504  | 25,170  | 6.21 | 5.38    | 5.26    |
| L32  | 20    | 21,232          | 24,504  | 25,170  | 6.21 | 5.38    | 5.26    |
| L33  | 40    | 21,232          | 24,504  | 25,170  | 6.21 | 5.38    | 5.26    |
| L34  | 45    | 8,625           | 10,583  | 10,678  | 5.02 | 4.11    | 4.08    |
| L35  | 45    | 8,625           | 10,583  | 10,678  | 5.02 | 4.11    | 4.08    |
| L36  | 45    | 8,625           | 10,583  | 10,678  | 5.02 | 4.11    | 4.08    |
| L37  | 40    | 10,932          | 13,130  | 13,225  | 5.54 | 4.62    | 4.59    |
| L38  | 35    | 10,755          | 12,935  | 14,076  | 5.73 | 4.77    | 4.44    |
| L39  | 25    | 10,241          | 12,367  | 13,223  | 5.28 | 4.38    | 4.15    |
| L40  | 40    | 10,241          | 12,367  | 13,223  | 5.28 | 4.38    | 4.15    |
| L41  | 25    | 10,241          | 12,367  | 13,223  | 5.28 | 4.38    | 4.15    |
| L42  | 25    | 9,173           | 11,188  | 11,188  | 3.83 | 3.15    | 3.15    |
| L43  | 40    | 8,989           | 10,985  | 11,555  | 3.35 | 2.75    | 2.65    |
| L44  | 25    | 8,989           | 10,985  | 11,555  | 3.35 | 2.75    | 2.65    |
| L45  | 25    | 16,950          | 19,775  | 19,870  | 5.01 | 4.30    | 4.28    |
| L46  | 40    | 16,950          | 19,775  | 19,870  | 5.01 | 4.30    | 4.28    |
| L47  | 45    | 12,307          | 14,648  | 14,648  | 7.39 | 6.22    | 6.22    |
| L48  | 25    | 12,307          | 14,648  | 14,648  | 7.39 | 6.22    | 6.22    |
| L49  | 25    | 20,965          | 24,209  | 24,304  | 7.26 | 6.29    | 6.27    |

| Link | Speed | Total AADT Flow |         |         | HDV% |         |         |
|------|-------|-----------------|---------|---------|------|---------|---------|
|      | kph   | 2017            | 2023 DM | 2023 DS | 2017 | 2023 DM | 2023 DS |
| L50  | 40    | 20,965          | 24,209  | 24,304  | 7.26 | 6.29    | 6.27    |
| L51  | 25    | 20,965          | 24,209  | 24,304  | 7.26 | 6.29    | 6.27    |
| L52  | 25    | 20,965          | 24,209  | 24,304  | 7.26 | 6.29    | 6.27    |
| L53  | 20    | 8,772           | 10,745  | 11,031  | 3.47 | 2.84    | 2.79    |
| L54  | 40    | 8,772           | 10,745  | 11,031  | 3.47 | 2.84    | 2.79    |
| L55  | 25    | 8,772           | 10,745  | 11,031  | 3.47 | 2.84    | 2.79    |
| L56  | 45    | 22,474          | 25,875  | 26,160  | 6.09 | 5.29    | 5.24    |
| L57  | 40    | 11,900          | 14,199  | 16,005  | 5.12 | 4.30    | 3.89    |
| L58  | 40    | 9,173           | 11,188  | 11,188  | 3.83 | 3.15    | 3.15    |

### ADMS-Roads Model Inputs

#### 3.9 The following model inputs were utilised in the assessment

- Emission factors – emission factors were utilised from the Defra Emission Factor Toolkit<sup>12</sup>, version 8.0.1. There is current uncertainty over NO<sub>2</sub> concentrations within the UK, with the implementation of new vehicle emission standards not resulting in the previously expected reduction in roadside levels. Therefore, 2017 emission factors were utilised for all scenarios in preference to the development opening year in order to provide robust model outputs.
- Conversion of oxides of nitrogen – concentrations of NO<sub>x</sub> were predicted using the ADMS-Roads dispersion model. These concentrations were converted to NO<sub>2</sub> using the Defra NO<sub>x</sub> to NO<sub>2</sub> calculator, version 6.1<sup>13</sup>.
- Meteorological data – hourly sequential meteorological data for the base year of assessment (2017) were obtained for the Emley Moor recording station. This is the closest, most representative recording station to the proposed development Site.
- Background pollutant concentrations – background concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> for the study area were obtained from the pollutant concentrations maps<sup>14</sup> provided by Defra as a 1km x 1km grid of the UK. The background levels utilised in the assessment were 23.22µg.m<sup>3</sup> for NO<sub>2</sub>, 13.40µg.m<sup>3</sup> for PM<sub>10</sub> and 8.68 µg.m<sup>3</sup> for PM<sub>2.5</sub>. These were obtained from the grid square containing KC diffusion tube 11 (NGR: 415500, 416500) as they were higher than background concentrations predicted at the development Site, as shown in Table 4.2. This ensured a worst-case assessment.
- Calculation of short term PM<sub>10</sub> concentrations – the following calculation, as detailed in Defra guidance<sup>15</sup>, was utilised to calculate the number of exceedance of the 24-hour mean PM<sub>10</sub> air quality objective:

<sup>12</sup> Defra (2017) Emission Factor Toolkit [https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html]

<sup>13</sup> Defra (2017) NO<sub>x</sub> to NO<sub>2</sub> Calculator [https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc]

<sup>14</sup> Defra (2017) background pollutant concentration maps [https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015]

<sup>15</sup> Defra (2018) Local Air Quality Management Technical Guidance (TG16).

$$\text{Number of 24-Hour Mean Exceedance} = -18.5 + 0.00145 * \text{Annual Mean}^3 + (206 / \text{Annual Mean})$$

### Assessment Criteria

- 3.10 Predicted pollutant concentrations were compared to the relevant air quality objectives. The current relevant air quality standards and objectives are detailed in **Table 3.2**.

**Table 3.2: Air Quality Standards and Objectives (England)**

| Pollutant         | Averaging Period                                                        | Air Quality Objective ( $\mu\text{g.m}^{-3}$ ) | Date to Achieve by |
|-------------------|-------------------------------------------------------------------------|------------------------------------------------|--------------------|
| NO <sub>2</sub>   | Annual Mean                                                             | 40                                             | 31 December 2005   |
|                   | 1-hour mean not to be exceeded more than 18 times per year              | 200                                            | 31 December 2005   |
| PM <sub>10</sub>  | Annual Mean                                                             | 40                                             | 31 December 2004   |
|                   | 24-hour mean not to be exceeded more than 35 times per year             | 50                                             | 31 December 2004   |
| PM <sub>2.5</sub> | Annual mean target (15% cut in annual mean (urban background exposure)) | 25                                             | 2010 - 2020        |

## 4. BASELINE CONDITIONS

### Local Air Quality Management

- 4.1 The development is not located within an AQMA. The closest designated area is situated approximately 1.7km north-east of the proposed Site and covers an area within Huddersfield Ring Road. The AQMA was declared by KC due to exceedances of the annual mean NO<sub>2</sub> air quality objective.

### Local Air Quality Monitoring

- 4.2 KC undertakes monitoring of air quality within its administrative area using a network of automatic monitoring stations and diffusion tube monitoring sites.
- 4.3 Monitoring results for locations most relevant to the development Site are detailed in **Table 4.1** for the most recent five year period available.

**Table 4.1: Air Quality Monitoring Data in the Study Area**

| Site Name | Site Type        | Grid Reference |        | NO <sub>2</sub> Monitored Concentrations (µg.m <sup>-3</sup> ) |       |       |       |       |
|-----------|------------------|----------------|--------|----------------------------------------------------------------|-------|-------|-------|-------|
|           |                  | X              | Y      | 2013                                                           | 2014  | 2015  | 2016  | 2017  |
| 11        | Roadside         | 414389         | 416262 | 41.23                                                          | 41.61 | 42.40 | 37.79 | 36.50 |
| 14        | Urban Background | 413669         | 416463 | 17.95                                                          | 18.62 | 16.34 | 20.96 | 21.13 |
| 49        | Roadside         | 413659         | 416182 | 44.06                                                          | 38.69 | 42.71 | 37.19 | 38.00 |
| 50        | Roadside         | 413414         | 415981 | 42.94                                                          | 43.72 | 45.49 | 42.08 | 39.19 |
| 76        | Roadside         | 413198         | 415957 | -                                                              | -     | -     | -     | 32.25 |
| 77        | Roadside         | 413455         | 416013 | -                                                              | -     | -     | -     | 46.58 |
| 78        | Roadside         | 413464         | 415983 | -                                                              | -     | -     | -     | 24.15 |

### Background Pollutant Concentrations

- 4.4 Background pollutant concentrations were obtained from the latest Defra background concentration maps<sup>14</sup>, which are provided for the UK as a 1km x 1km grid network. The latest maps are based on 2015 monitoring and meteorological data. The background pollutant concentrations at the development Site are detailed in **Table 4.2**.

**Table 4.2: Background Pollutant Concentrations**

| Pollutant        | Grid Square    | 2017 Background Concentration (µg.m <sup>-3</sup> ) | 2023 Background Concentration (µg.m <sup>-3</sup> ) |
|------------------|----------------|-----------------------------------------------------|-----------------------------------------------------|
| NO <sub>2</sub>  | 412500, 415500 | 14.22                                               | 11.18                                               |
| PM <sub>10</sub> | 412500, 415500 | 11.71                                               | 11.34                                               |

| Pollutant         | Grid Square    | 2017 Background Concentration ( $\mu\text{g.m}^{-3}$ ) | 2023 Background Concentration ( $\mu\text{g.m}^{-3}$ ) |
|-------------------|----------------|--------------------------------------------------------|--------------------------------------------------------|
| PM <sub>2.5</sub> | 412500, 415500 | 7.67                                                   | 7.27                                                   |

- 4.5 2016 and 2023 background concentrations are below the relevant annual mean air quality objectives for NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> at the development Site.

### Odour Appraisal

- 4.6 A desk top study was undertaken using aerial photography, digital mapping resources and the Environment Agency website in order to identify potential odour emission sources within the vicinity of the proposed development Site. This did not reveal any locations of concern such as large industrial premises, wastewater treatment works, food manufacturing facilities or agricultural land holdings. Baseline odour levels at the Site are therefore considered suitable for the proposed residential usage.

## 5. CONSTRUCTION PHASE ASSESSMENT

- 5.1 The construction phase of the proposed development will involve a number of activities which have the potential to impact on local air quality. These include emissions of dust generated through excavation, construction, earthworks and trackout activities, exhaust pollutant emissions from construction traffic on the local highways network, and exhaust emissions from non-road mobile machinery (NRMM) within the construction site itself.
- 5.2 The location of sensitive receptors in relation to construction activities will affect the potential for such construction activities to cause dust soiling, nuisance and local air quality impacts. Meteorological conditions and the use of control measures will also contribute to the effects experienced.

### Step 1: Screen the Need for a Detailed Assessment

- 5.3 Step 1 of IAQM Guidance<sup>16</sup> involves a screening assessment to consider whether a more detailed construction phase dust assessment is required.
- 5.4 In accordance with the guidance, a detailed assessment is required if:
- Human receptors are located within 350m of the boundary of the site or 50m of routes used by construction vehicles on the public highways, up to 500m from the site entrances; or
  - Ecological receptors are located within 50m of the boundary of the site or 50m of routes used by construction vehicles on the public highways, up to 500m from the site entrances.
- 5.5 From a review of the Multi Agency Geographic Information for the Countryside (MAGIC)<sup>17</sup> website, no designated ecological sites were identified within the vicinity of the proposed development Site. However, human receptors are located within 350m of the Site boundary, with the closest of these receptors located off Blackmoorfoot Road and Nabcroft Lane. A construction phase assessment was therefore undertaken.

### Step 2: Assess the Risk of Dust Impacts

#### Step 2A: Define the Potential Dust Emission Magnitude

- 5.6 The dust emission magnitudes for the construction activities were defined using the criteria detailed in the IAQM Guidance<sup>18</sup>. These criteria and the dust emission magnitude defined for the proposed development are detailed in **Table 5.1**. No demolition is proposed as part of the development and therefore emissions from demolition activities were not considered as part of the construction phase dust assessment.

<sup>16</sup> Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London.

<sup>17</sup> Defra, Multi Agency Geographic Information for the Countryside (MAGIC) [<http://magic.defra.gov.uk/>]

<sup>18</sup> Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London.

**Table 5.1: Dust Emission Magnitude Criteria and Definition**

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

## Step 2B: Define the Sensitivity of the Area

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

**Table 5.2 Determination of the Sensitivity of the Area**

| Potential Impact | Justification                                                                                                                                                                      | Sensitivity |              |          |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------|----------|
|                  |                                                                                                                                                                                    | Earthworks  | Construction | Trackout |
| Dust Soiling     | There are 10 - 100 highly sensitive receptors within 20m of the proposed development.                                                                                              | High        | High         | High     |
| Human Health     | There are 10 - 100 highly sensitive receptors within 20m of the proposed development.<br>The 2017 background concentration of PM <sub>10</sub> is less than 24µg.m <sup>-3</sup> . | Low         | Low          | Low      |

## Step 2C: Define the Risk of Impacts

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

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

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

| Activity | Step 2A: Dust Emission Magnitude | Step 2B: Sensitivity of the Area | Step 2C: Risk of Dust Impacts |
|----------|----------------------------------|----------------------------------|-------------------------------|
| Trackout | Medium                           | Low                              | Low                           |

### Step 3: Site-Specific Mitigation

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

### Step 4: Determine Significant Effects

- 5.10 In accordance with IAQM Guidance<sup>19</sup>, with the implementation of the mitigation measures detailed in Section 7, the residual impacts from the construction phase are considered to be 'not significant'.

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<sup>19</sup> Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London.

## 6. ROAD TRAFFIC EMISSIONS EXPOSURE ASSESSMENT

### Existing Receptor Locations

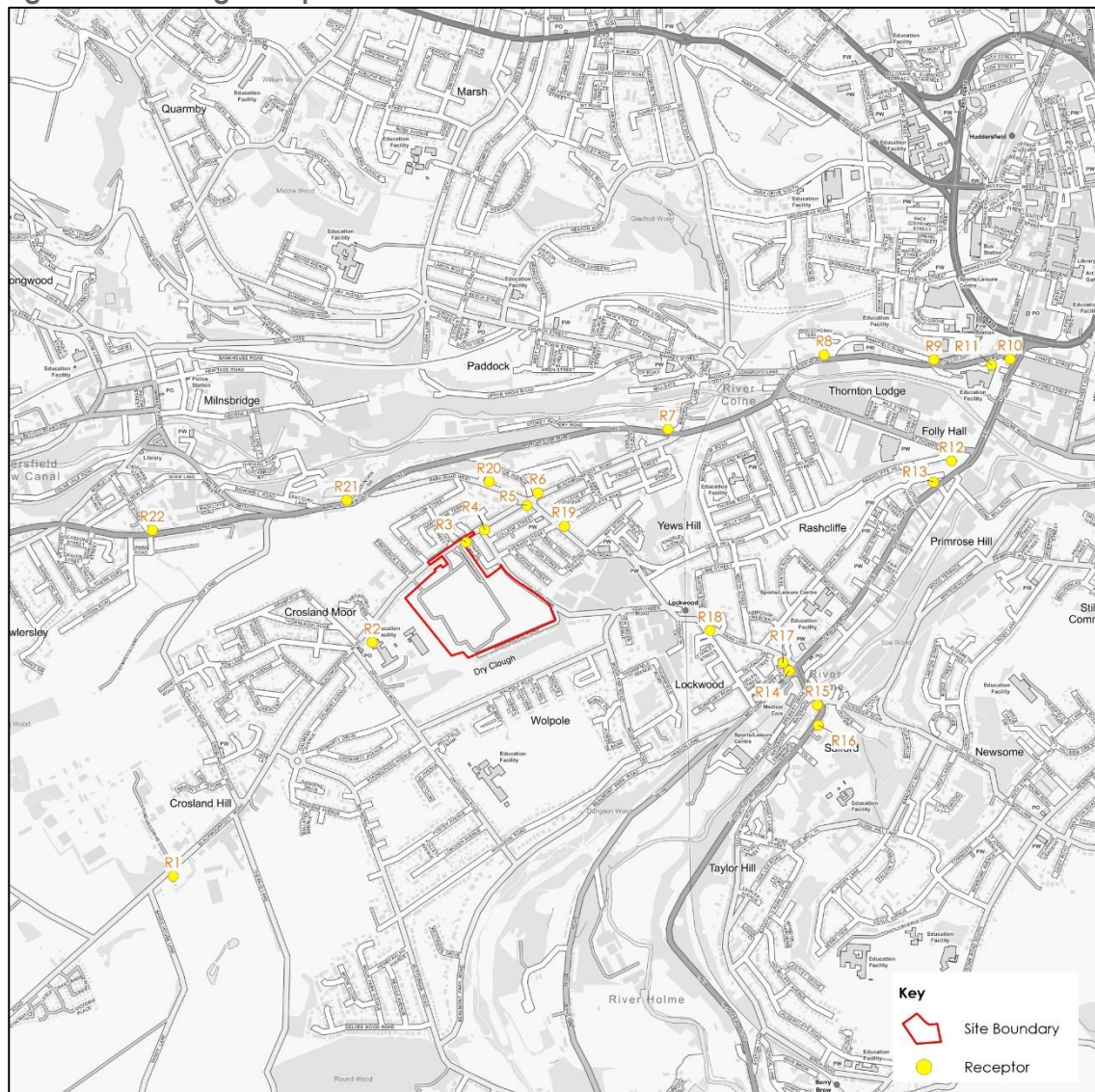
- 6.1 Existing receptor locations were identified within the study area and considered in the operational phase road traffic emissions assessment. Concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> and were predicted at the identified existing receptor locations for the assessment scenarios detailed in paragraph 3.6.
- 6.2 The existing sensitive receptor locations considered in the assessment were chosen based on their relative proximity to road links within the study area. Where possible the closest receptors to those road links were considered, as these receptors are likely to experience the greatest change in pollutant concentrations as a result of the proposed development.
- 6.3 The existing receptor locations are detailed in **Table 6.1** and **Figure 6.1**.

**Table 6.1: Existing Sensitive Receptor Locations**

| Receptor | Grid Reference |          | Modelled Height | Details                                 |
|----------|----------------|----------|-----------------|-----------------------------------------|
|          | X              | Y        | m               |                                         |
| R1       | 411616.4       | 414520.1 | 1.5             | Residential - Blackmoorfoot Road        |
| R2       | 412259.0       | 415274.1 | 1.5             | Education Facility - Blackmoorfoot Road |
| R3       | 412561.4       | 415597.9 | 1.5             | Residential - Blackmoorfoot Road        |
| R4       | 412622.1       | 415637.7 | 1.5             | Residential - Blackmoorfoot Road        |
| R5       | 412758.6       | 415717.1 | 4.5             | Residential - Blackmoorfoot Road        |
| R6       | 412793.9       | 415757.3 | 1.5             | Residential - Blackmoorfoot Road        |
| R7       | 413213.3       | 415961.3 | 1.5             | Residential - Manchester Road           |
| R8       | 413717.7       | 416201.8 | 1.5             | Residential - Manchester Road           |
| R9       | 414071.8       | 416185.6 | 1.5             | Residential - Manchester Road           |
| R10      | 414317.7       | 416187.6 | 4.5             | Residential - Manchester Road           |
| R11      | 414257.6       | 416168.8 | 1.5             | Education Facility - Manchester Road    |
| R12      | 414128.5       | 415859.5 | 1.5             | Residential - Lockwood Road             |
| R13      | 414069.7       | 415792.2 | 1.5             | Residential - Lockwood Road             |
| R14      | 413604.3       | 415182.7 | 4.5             | Residential - Meltham Road              |
| R15      | 413696.0       | 415072.3 | 1.5             | Residential - Woodhead Road             |
| R16      | 413699.2       | 415007.1 | 1.5             | Residential - Woodhead Road             |
| R17      | 413584.6       | 415209.9 | 1.5             | Residential - Swan Lane                 |
| R18      | 413349.5       | 415312.5 | 1.5             | Residential - Swan Lane                 |

| Receptor | Grid Reference |          | Modelled Height | Details                       |
|----------|----------------|----------|-----------------|-------------------------------|
|          | X              | Y        | m               |                               |
| R19      | 412878.7       | 415649.2 | 1.5             | Residential - Park Road       |
| R20      | 412636.4       | 415792.4 | 1.5             | Residential - Park Road West  |
| R21      | 412177.2       | 415733.6 | 1.5             | Residential - Manchester Road |
| R22      | 411549.7       | 415636.7 | 1.5             | Residential - Manchester Road |

**Figure 6.1: Existing Receptor Locations**



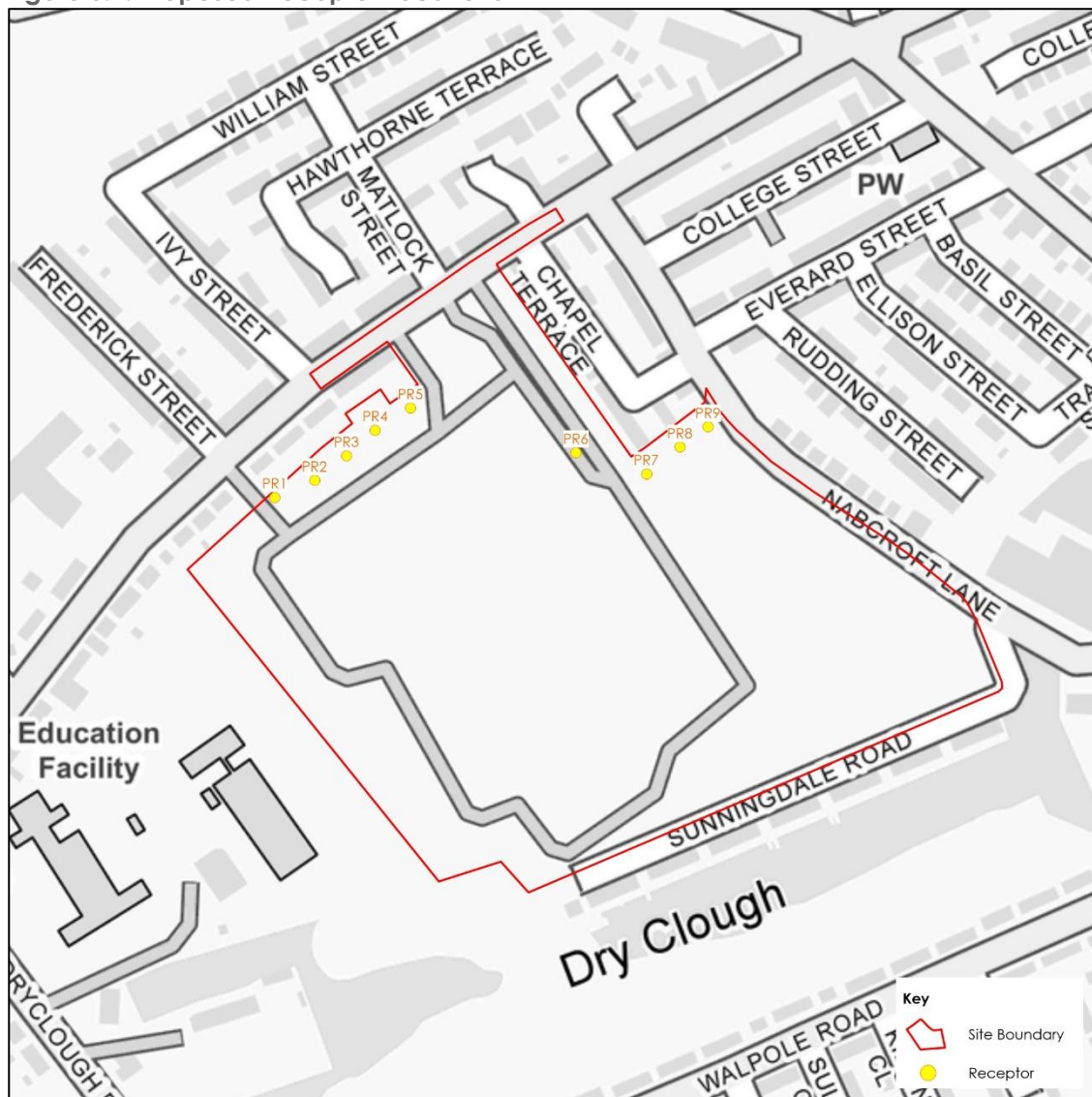
## Proposed Receptor Locations

- 6.4 Pollutant concentrations were predicted at the development Site to consider exposure of future residents of the proposed development to poor air quality. Proposed receptor locations were selected to represent the worst-case exposure locations of future residents i.e. at proposed residential units within the northern most part of the Site, closest to Blackmoorfoot Road. Pollutant concentrations were predicted at the proposed development Site for the Opening year DS scenario at those locations detailed in **Table 6.2** and shown in **Figure 6.2**.

**Table 6.2: Proposed Receptor Locations**

| Proposed Receptor | Grid Reference |          | Modelled Height |
|-------------------|----------------|----------|-----------------|
|                   | X              | Y        | m               |
| PR1               | 412417.7       | 415460.1 | 1.5             |
| PR2               | 412441.3       | 415470.1 | 1.5             |
| PR3               | 412460.3       | 415484.8 | 1.5             |
| PR4               | 412477.4       | 415500.0 | 1.5             |
| PR5               | 412498.3       | 415513.2 | 1.5             |
| PR6               | 412596.8       | 415486.6 | 1.5             |
| PR7               | 412638.7       | 415474.0 | 1.5             |
| PR8               | 412658.7       | 415489.9 | 1.5             |
| PR9               | 412675.4       | 415502.0 | 1.5             |

**Figure 6.2: Proposed Receptor Locations**



## Baseline Assessment

- 6.5 Pollutant concentrations were predicted at the identified existing sensitive receptor locations using the dispersion model ADMS-Roads. Predicted pollutant concentrations for the verification and DM Scenarios are detailed in **Table 6.3**.

**Table 6.3: Predicted Annual Mean Pollutant Concentrations for 2017 and DM Scenario at Existing Receptor Locations**

| Receptor | Verification 2017 ( $\mu\text{g.m}^{-3}$ ) |                  |                   | 2023 DM 'Without Development' ( $\mu\text{g.m}^{-3}$ ) |                  |                   |
|----------|--------------------------------------------|------------------|-------------------|--------------------------------------------------------|------------------|-------------------|
|          | NO <sub>2</sub>                            | PM <sub>10</sub> | PM <sub>2.5</sub> | NO <sub>2</sub>                                        | PM <sub>10</sub> | PM <sub>2.5</sub> |
| R1       | 25.58                                      | 13.80            | 8.91              | 25.99                                                  | 13.87            | 8.95              |
| R2       | 25.23                                      | 13.73            | 8.87              | 25.54                                                  | 13.78            | 8.90              |
| R3       | 28.46                                      | 14.25            | 9.17              | 29.21                                                  | 14.38            | 9.25              |

| Receptor | Verification 2017 ( $\mu\text{g.m}^{-3}$ ) |                  |                   | 2023 DM 'Without Development' ( $\mu\text{g.m}^{-3}$ ) |                  |                   |
|----------|--------------------------------------------|------------------|-------------------|--------------------------------------------------------|------------------|-------------------|
|          | NO <sub>2</sub>                            | PM <sub>10</sub> | PM <sub>2.5</sub> | NO <sub>2</sub>                                        | PM <sub>10</sub> | PM <sub>2.5</sub> |
| R4       | 29.08                                      | 14.32            | 9.22              | 29.92                                                  | 14.47            | 9.31              |
| R5       | 27.98                                      | 14.11            | 9.10              | 28.69                                                  | 14.23            | 9.17              |
| R6       | 29.21                                      | 14.25            | 9.18              | 30.10                                                  | 14.40            | 9.27              |
| R7       | 32.58                                      | 14.66            | 9.43              | 33.62                                                  | 14.84            | 9.54              |
| R8       | 30.34                                      | 14.53            | 9.34              | 31.12                                                  | 14.67            | 9.42              |
| R9       | 31.21                                      | 14.70            | 9.44              | 32.08                                                  | 14.86            | 9.54              |
| R10      | 28.53                                      | 14.25            | 9.17              | 29.10                                                  | 14.35            | 9.24              |
| R11      | 28.06                                      | 14.18            | 9.14              | 28.59                                                  | 14.28            | 9.19              |
| R12      | 25.99                                      | 13.82            | 8.92              | 26.29                                                  | 13.87            | 8.95              |
| R13      | 27.54                                      | 14.07            | 9.07              | 28.01                                                  | 14.16            | 9.12              |
| R14      | 27.15                                      | 13.96            | 9.01              | 27.66                                                  | 14.05            | 9.06              |
| R15      | 28.64                                      | 14.27            | 9.19              | 29.33                                                  | 14.39            | 9.26              |
| R16      | 30.87                                      | 14.65            | 9.41              | 31.82                                                  | 14.83            | 9.51              |
| R17      | 27.39                                      | 14.02            | 9.04              | 28.01                                                  | 14.13            | 9.11              |
| R18      | 26.15                                      | 13.88            | 8.96              | 26.65                                                  | 13.97            | 9.01              |
| R19      | 28.16                                      | 14.19            | 9.14              | 28.97                                                  | 14.34            | 9.23              |
| R20      | 28.20                                      | 14.21            | 9.15              | 29.02                                                  | 14.36            | 9.24              |
| R21      | 31.10                                      | 14.73            | 9.46              | 31.98                                                  | 14.90            | 9.55              |
| R22      | 30.40                                      | 14.60            | 9.38              | 31.19                                                  | 14.76            | 9.47              |

6.6 The baseline assessment for the verification and DM scenarios indicate that pollutant concentrations at identified existing receptor locations are below the respective annual mean air quality objectives at the receptors considered.

6.7 With regard to short term air quality objectives for NO<sub>2</sub> and PM<sub>10</sub>, the predicted annual mean NO<sub>2</sub> concentrations are less than 60 $\mu\text{g.m}^{-3}$  and therefore in accordance with Defra guidance<sup>20</sup>, it may be assumed that exceedance of the 1-hour mean objective are unlikely. The calculation detailed in paragraph 3.9 was used to determine potential exceedance of the 24-hour PM<sub>10</sub> short term objective; no exceedances were predicted.

## Impact Assessment

6.8 Concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> were predicted at identified existing receptor locations for the DS scenario, to consider the impact of development-generated vehicles on local air quality.

<sup>20</sup> Defra (2018) Local Air Quality Management Technical Guidance (TG16).

- 6.9 Predicted pollutant concentrations are detailed in **Tables 6.4, 6.5** and **6.6** for NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> respectively together with the DM scenario concentrations for comparison purposes. The predicted change in pollutant concentrations resulting from development-generated traffic, and the associated impact are also provided.

**Table 6.4: Predicted Annual Mean NO<sub>2</sub> Concentrations and Development Impact at Existing Receptor Locations**

| Receptor | Predicted NO <sub>2</sub> Concentrations (µg.m <sup>-3</sup> ) |                       |        | Impact     |
|----------|----------------------------------------------------------------|-----------------------|--------|------------|
|          | DM 'Without Development'                                       | DS 'With Development' | Change |            |
| R1       | 25.99                                                          | 26.01                 | +0.02  | Negligible |
| R2       | 25.54                                                          | 25.56                 | +0.02  | Negligible |
| R3       | 29.21                                                          | 29.63                 | +0.42  | Negligible |
| R4       | 29.92                                                          | 30.39                 | +0.47  | Negligible |
| R5       | 28.69                                                          | 28.91                 | +0.22  | Negligible |
| R6       | 30.10                                                          | 30.35                 | +0.25  | Negligible |
| R7       | 33.62                                                          | 33.77                 | +0.15  | Negligible |
| R8       | 31.12                                                          | 31.28                 | +0.16  | Negligible |
| R9       | 32.08                                                          | 32.24                 | +0.16  | Negligible |
| R10      | 29.10                                                          | 29.17                 | +0.07  | Negligible |
| R11      | 28.59                                                          | 28.67                 | +0.08  | Negligible |
| R12      | 26.29                                                          | 26.31                 | +0.02  | Negligible |
| R13      | 28.01                                                          | 28.03                 | +0.02  | Negligible |
| R14      | 27.66                                                          | 27.70                 | +0.04  | Negligible |
| R15      | 29.33                                                          | 29.35                 | +0.02  | Negligible |
| R16      | 31.82                                                          | 31.84                 | +0.02  | Negligible |
| R17      | 28.01                                                          | 28.12                 | +0.11  | Negligible |
| R18      | 26.65                                                          | 26.78                 | +0.13  | Negligible |
| R19      | 28.97                                                          | 29.03                 | +0.06  | Negligible |
| R20      | 29.02                                                          | 29.15                 | +0.13  | Negligible |
| R21      | 31.98                                                          | 32.04                 | +0.06  | Negligible |
| R22      | 31.19                                                          | 31.24                 | +0.05  | Negligible |

**Table 6.5: Predicted Annual Mean PM<sub>10</sub> Concentrations and Development Impact at Existing Receptor Locations**

| Receptor | Predicted PM <sub>10</sub> Concentrations (µg.m <sup>-3</sup> ) |                       |        | Impact     |
|----------|-----------------------------------------------------------------|-----------------------|--------|------------|
|          | DM 'Without Development'                                        | DS 'With Development' | Change |            |
| R1       | 13.87                                                           | 13.88                 | +0.00  | Negligible |
| R2       | 13.78                                                           | 13.78                 | +0.00  | Negligible |
| R3       | 14.38                                                           | 14.46                 | +0.08  | Negligible |
| R4       | 14.47                                                           | 14.56                 | +0.09  | Negligible |
| R5       | 14.23                                                           | 14.27                 | +0.04  | Negligible |
| R6       | 14.40                                                           | 14.44                 | +0.04  | Negligible |
| R7       | 14.84                                                           | 14.86                 | +0.02  | Negligible |
| R8       | 14.67                                                           | 14.70                 | +0.03  | Negligible |
| R9       | 14.86                                                           | 14.89                 | +0.03  | Negligible |
| R10      | 14.35                                                           | 14.36                 | +0.01  | Negligible |
| R11      | 14.28                                                           | 14.30                 | +0.01  | Negligible |
| R12      | 13.87                                                           | 13.88                 | +0.00  | Negligible |
| R13      | 14.16                                                           | 14.16                 | +0.00  | Negligible |
| R14      | 14.05                                                           | 14.06                 | +0.01  | Negligible |
| R15      | 14.39                                                           | 14.40                 | +0.00  | Negligible |
| R16      | 14.83                                                           | 14.83                 | 0.01   | Negligible |
| R17      | 14.13                                                           | 14.14                 | +0.02  | Negligible |
| R18      | 13.97                                                           | 13.99                 | +0.02  | Negligible |
| R19      | 14.34                                                           | 14.35                 | +0.01  | Negligible |
| R20      | 14.36                                                           | 14.39                 | +0.02  | Negligible |
| R21      | 14.90                                                           | 14.91                 | +0.01  | Negligible |
| R22      | 14.76                                                           | 14.77                 | +0.01  | Negligible |

**Table 6.6: Predicted Annual Mean PM<sub>2.5</sub> Concentrations and Development Impact at Existing Receptor Locations**

| Receptor | Predicted PM <sub>2.5</sub> Concentrations (µg.m <sup>-3</sup> ) |                       |        | Impact     |
|----------|------------------------------------------------------------------|-----------------------|--------|------------|
|          | DM 'Without Development'                                         | DS 'With Development' | Change |            |
| R1       | 8.95                                                             | 8.95                  | +0.00  | Negligible |
| R2       | 8.90                                                             | 8.90                  | +0.00  | Negligible |
| R3       | 9.25                                                             | 9.30                  | +0.04  | Negligible |

| Receptor | Predicted PM <sub>2.5</sub> Concentrations (µg.m <sup>-3</sup> ) |                       |        | Impact     |
|----------|------------------------------------------------------------------|-----------------------|--------|------------|
|          | DM 'Without Development'                                         | DS 'With Development' | Change |            |
| R4       | 9.31                                                             | 9.36                  | +0.05  | Negligible |
| R5       | 9.17                                                             | 9.19                  | +0.02  | Negligible |
| R6       | 9.27                                                             | 9.30                  | +0.02  | Negligible |
| R7       | 9.54                                                             | 9.55                  | +0.01  | Negligible |
| R8       | 9.42                                                             | 9.44                  | +0.02  | Negligible |
| R9       | 9.54                                                             | 9.55                  | +0.02  | Negligible |
| R10      | 9.24                                                             | 9.24                  | +0.01  | Negligible |
| R11      | 9.19                                                             | 9.20                  | +0.01  | Negligible |
| R12      | 8.95                                                             | 8.96                  | +0.00  | Negligible |
| R13      | 9.12                                                             | 9.12                  | +0.00  | Negligible |
| R14      | 9.06                                                             | 9.07                  | +0.00  | Negligible |
| R15      | 9.26                                                             | 9.26                  | +0.00  | Negligible |
| R16      | 9.51                                                             | 9.52                  | +0.00  | Negligible |
| R17      | 9.11                                                             | 9.12                  | +0.01  | Negligible |
| R18      | 9.01                                                             | 9.02                  | +0.01  | Negligible |
| R19      | 9.23                                                             | 9.23                  | +0.01  | Negligible |
| R20      | 9.24                                                             | 9.26                  | +0.01  | Negligible |
| R21      | 9.55                                                             | 9.56                  | +0.01  | Negligible |
| R22      | 9.47                                                             | 9.48                  | +0.01  | Negligible |

- 6.10 The predicted NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> concentrations for the DM and DS scenarios are below the relevant annual mean air quality objectives for all receptors. Predicted changes in NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> concentrations are considered to be negligible in accordance with IAQM and EPUK Guidance<sup>21</sup>, which is 'not significant'.
- 6.11 With regard to short term air quality objectives for PM<sub>10</sub> at the existing receptor locations, the calculation detailed in paragraph 3.9 was used to determine potential exceedance of the 24-hour PM<sub>10</sub> short term objective; no exceedances were predicted.

<sup>21</sup> Institute of Air Quality Management (2017) Land-Use Planning & Development Control: Planning for Air Quality, Institute of Air Quality Management, London.

## Site Suitability Assessment

### Proposed Receptor Locations

- 6.12 Concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> were predicted at the proposed development Site for the DS scenario. Predicted pollutant concentrations are detailed in **Table 6.7**.

**Table 6.7 Predicted Annual Mean NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> Concentrations at Proposed Receptor Locations**

| Receptor | DS 'With Development' (µg.m <sup>-3</sup> ) |                  |                   |
|----------|---------------------------------------------|------------------|-------------------|
|          | NO <sub>2</sub>                             | PM <sub>10</sub> | PM <sub>2.5</sub> |
| PR1      | 25.84                                       | 13.83            | 8.93              |
| PR2      | 25.51                                       | 13.77            | 8.89              |
| PR3      | 25.49                                       | 13.77            | 8.89              |
| PR4      | 25.53                                       | 13.77            | 8.90              |
| PR5      | 25.48                                       | 13.77            | 8.89              |
| PR6      | 24.46                                       | 13.60            | 8.79              |
| PR7      | 24.31                                       | 13.58            | 8.78              |
| PR8      | 24.35                                       | 13.58            | 8.78              |
| PR9      | 24.37                                       | 13.59            | 8.79              |

- 6.13 The predicted NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> concentrations for the DS scenario indicate that pollutant concentrations at all locations will be below the respective air quality objectives in 2023 with the development in place.
- 6.14 With regard to short term air quality objectives for NO<sub>2</sub> and PM<sub>10</sub> at the residential development, the predicted annual mean NO<sub>2</sub> concentrations are less than 60µg.m<sup>-3</sup> and therefore in accordance with Defra guidance<sup>22</sup> it may be assumed that exceedance of the 1-hour mean NO<sub>2</sub> objective are unlikely. The calculation detailed in paragraph 3.9 was used to determine potential exceedance of the 24-hour PM<sub>10</sub> short term objective; no exceedances were predicted.

<sup>22</sup> Defra (2018) Local Air Quality Management Technical Guidance (TG16).

## 7. MITIGATION

### Construction Phase Assessment

#### Step 3: Site-specific Mitigation

- 7.1 The risk of dust impacts, defined in Step 2C of the assessment, are used to determine the mitigation measures required to minimise the emission of dust during construction phase activities. The IAQM Guidance<sup>23</sup> provides details of highly recommended and desirable mitigation measures which are commensurate with the risk of dust impacts defined in Step 2C for earthworks, construction and trackout activities. Where the mitigation measures are general in nature, the highest risk category was applied in accordance with the IAQM Guidance<sup>24</sup>. The highest risk category identified was 'High Risk'. The identified mitigation measures detailed in **Table 7.1** and **Table 7.2** could be implemented through a Construction Environmental Management Plan (CEMP).

**Table 7.1: Mitigation Measures for a High Risk Site**

| Category        | Mitigation Measures                                                                                                                                                                     |           |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                 | Highly Recommended                                                                                                                                                                      | Desirable |
| Communication   | Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.                                                               | None      |
|                 | Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site manager. |           |
|                 | Display the head or regional office contact information.                                                                                                                                |           |
|                 | Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority.                                             |           |
| Site Management | Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner and record the measures taken.                          | None      |
|                 | Make the complaints log available to the local authority when asked.                                                                                                                    |           |
|                 | Record any exceptional incidents that cause and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.                                |           |
|                 | Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated                                                |           |

<sup>23</sup> Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London.

<sup>24</sup> Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London.

| Category                           | Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                            |           |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                    | Highly Recommended                                                                                                                                                                                                                                                                                                                                                                             | Desirable |
|                                    | 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. | None      |
|                                    | Carry out regular site inspections to monitor compliance with the DMP, record inspections results, and make an inspection log available to the local authority when asked.                                                                                                                                                                                                                     |           |
|                                    | 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.                                                                                                                                                         |           |
|                                    | Agree dust deposition, dust flux, or real-time PM <sub>10</sub> continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during earthworks and construction.                     |           |
| Preparing and maintaining the site | Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.                                                                                                                                                                                                                                                                     | None      |
|                                    | Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.                                                                                                                                                                                                                                                              |           |
|                                    | Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extended period.                                                                                                                                                                                                                                                   |           |
|                                    | 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.                                                                                                                                                                                                                                                                                                                                      |           |

| Category                                                  | Mitigation Measures                                                                                                                                                                                                                                                                                                                                          |           |
|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                           | Highly Recommended                                                                                                                                                                                                                                                                                                                                           | Desirable |
| Operating vehicle/<br>machinery and<br>sustainable travel | Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.                                                                                                                                                                                                                               | None      |
|                                                           | Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced 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) |           |
|                                                           | Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)                                                                                                                                                                                                                                |           |
|                                                           | Ensure all vehicles switch off engines when stationary – no idling vehicles.                                                                                                                                                                                                                                                                                 |           |
|                                                           | Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.                                                                                                                                                                                                                                                             |           |
| Operations                                                | Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.                                                                                                                                                 | None      |
|                                                           | Ensure an adequate water supply on site for effective dust/particulate matter suppression/mitigation, using non-portable water where possible and appropriate.                                                                                                                                                                                               |           |
|                                                           | Use enclose chutes and conveyors and covered skips.                                                                                                                                                                                                                                                                                                          |           |
|                                                           | Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.                                                                                                                                                                                     |           |
|                                                           | Ensure equipment is readily available on site to clean and dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.                                                                                                                                                                               |           |
| Waste Management                                          | Avoid bonfires and burning of waste materials.                                                                                                                                                                                                                                                                                                               | None      |

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

| Category                       | Mitigation Measures                                                                                    |
|--------------------------------|--------------------------------------------------------------------------------------------------------|
| Earthworks<br>(High Risk Site) | Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable. |

| Category                      | Mitigation Measures                                                                                                                                                                                                           |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | 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                                                                                                                                                          |
| Construction (High Risk Site) | Avoid scabbling (roughening of concrete surfaces) if possible                                                                                                                                                                 |
|                               | 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 (Medium Risk Site)   | 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.                                                                                                                                                       |

## Operational Phase Road Traffic Emissions Assessment

### West Yorkshire Technical Planning Guidance

- 7.2 The West Yorkshire Local Authorities have produced air quality technical planning guidance<sup>25</sup> as part of an overarching Low Emissions Strategy to reduce transport emission in the country. It is aimed at helping Local Authorities deliver air quality objective compliance through cost effective service planning brought about by the joint working and relevant Local Plan policies.
- 7.3 The guidance<sup>26</sup> provides a methodology for determining the scale of a development as minor, medium or major and the required air quality mitigation for the relevant banding. Review of the relevant criteria indicated the proposals were classified as major under the following conditions:
- Development provides greater than 50 dwellings;
  - Development generates greater than 100 two-way vehicle movements per day; and
  - Development is anticipated to increase traffic flows on roads greater than 10,000 AADT by 5% or more.
- 7.4 The following mitigation measures were proposed in response to the assessment:
- Provision of Electric Vehicle (EV) charging points throughout the development Site; and
  - Production of a full Travel Plan to encourage the use of non-transport modes and assist with the reduction of development transport related emissions.
- 7.5 In accordance with the requirements of the West Yorkshire guidance<sup>27</sup> an emissions assessment was also undertaken. The results are provided within the following Sections.

### Emissions Assessment

- 7.6 In accordance with the air quality technical planning guidance<sup>28</sup>, a damage cost calculation was undertaken to identify the monetary value of predicted emissions from the proposals. The calculation uses the Emissions Factor Toolkit (EFT) to calculate the amount of transport related pollutant emissions the development is likely to produce. The output is then multiplied by the Interdepartmental Group on Costs and Benefits damage costs for the key pollutants NO<sub>x</sub> and PM<sub>10</sub>, and finally multiplied by five to provide a five-year exposure cost value. This has been summarised in the following equation:
- $$5 \text{ Year Exposure Cost Value} = \text{EFT Output} \times \text{Damage Costs} \times 5$$
- 7.7 The input data values used in the assessment are shown in **Table 7.3**.

<sup>25</sup> West Yorkshire Low Emissions Group (2014) Air Quality and Emissions: Technical Planning Guidance.

<sup>26</sup> West Yorkshire Low Emissions Group (2014) Air Quality and Emissions: Technical Planning Guidance.

<sup>27</sup> West Yorkshire Low Emissions Group (2014) Air Quality and Emissions: Technical Planning Guidance.

<sup>28</sup> West Yorkshire Low Emissions Group (2014) Air Quality and Emissions: Technical Planning Guidance.

**Table 7.3: Emissions Assessment - Inputs**

| Data                                            | Value    |
|-------------------------------------------------|----------|
| Daily vehicle movements produced by development | 1,902    |
| Average Speed (km/h)                            | 50       |
| Average Trip Length (km)                        | 10       |
| NO <sub>x</sub> Output (kg/year)                | 1,542.29 |
| PM <sub>10</sub> Output (kg/year)               | 214.85   |
| NO <sub>x</sub> Output (tonnes/year)            | 1.54     |
| PM <sub>10</sub> Output (tonnes/year)           | 0.21     |
| NO <sub>x</sub> Damage Costs (£/tonne)          | 21,044   |
| PM <sub>10</sub> Damage Costs (£/tonne)         | 58,125   |

7.8 The calculation is shown in **Table 7.4**.

**Table 7.4: Emissions Assessment - Calculation**

| Data                                          | Value   |
|-----------------------------------------------|---------|
| Annual Cost of NO <sub>x</sub> Emissions (£)  | 32,456  |
| Annual Cost of PM <sub>10</sub> Emissions (£) | 12,488  |
| Total Annual Exposure Cost Value (£)          | 44,944  |
| Total Five Year Exposure Cost Value (£)       | 224,722 |

7.9 As shown in **Table 7.4**, the calculation indicated the development is predicted to produce road traffic emissions equal to £224,722 over the 5 year exposure period. As such mitigate should be implemented at the site which will benefit air quality up to this value.

## 8. CONCLUSIONS

- 8.11 An Air Quality Assessment was undertaken for a residential development on the former St. Luke's Hospital, Huddersfield.
- 8.12 A qualitative construction phase assessment was undertaken and measures were recommended for inclusion in a DMP to minimise emissions during construction activities. With the implementation of these mitigation measures the impact of construction phase dust emissions is considered to be 'not significant' in accordance with the IAQM Guidance<sup>29</sup>.
- 8.13 A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified existing receptor locations. Road traffic emissions were modelled using the dispersion model ADMS-Roads and concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> were predicted at identified sensitive receptor locations. The modelling assessment was undertaken in accordance with Defra Local Air Quality Management Technical guidance<sup>30</sup>. Concentrations were predicted to be below the relevant air quality objectives at all receptor locations considered in the assessment and impact of the development on local air quality was predicted to be 'negligible' in accordance with the IAQM and EPUK Guidance<sup>31</sup>.
- 8.14 Pollutant concentrations were also predicted at proposed residential unit locations within the development Site. Concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> were predicted to be below the relevant air quality objectives. The Site was therefore considered to be suitable for the proposed use with regard to air quality.

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<sup>29</sup> Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London.

<sup>30</sup> Defra (2018) Local Air Quality Management Technical Guidance (TG16).

<sup>31</sup> Institute of Air Quality Management (2017) Land-Use Planning & Development Control: Planning for Air Quality, Institute of Air Quality Management, London.

***APPENDICES***

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## **APPENDIX A: Glossary of Terms**

## Air Quality Terminology

| Term                                             | Definition                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Air quality objective                            | Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).                                                                                                                                                   |
| Air quality standard                             | The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).                                                          |
| Annual mean                                      | The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between two years, which is useful for pollutants that have higher concentrations during the winter months. |
| AQAP                                             | Air Quality Action Plan.                                                                                                                                                                                                                                                                                                                                               |
| AQMA                                             | Air Quality Management Area.                                                                                                                                                                                                                                                                                                                                           |
| AQS                                              | Air Quality Strategy.                                                                                                                                                                                                                                                                                                                                                  |
| Defra                                            | Department for Environment, Food and Rural Affairs.                                                                                                                                                                                                                                                                                                                    |
| Exceedance                                       | A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.                                                                                                                                                                                                                                           |
| EV                                               | Electric Vehicle                                                                                                                                                                                                                                                                                                                                                       |
| HDV                                              | Heavy Duty Vehicles, (HGVs + buses)                                                                                                                                                                                                                                                                                                                                    |
| HGV                                              | Heavy Goods Vehicles.                                                                                                                                                                                                                                                                                                                                                  |
| IAQM                                             | Institute of Air Quality Management.                                                                                                                                                                                                                                                                                                                                   |
| LAQM                                             | Local Air Quality Management.                                                                                                                                                                                                                                                                                                                                          |
| LDV                                              | Light Duty Vehicles (motorbikes, cars, vans and small trucks)                                                                                                                                                                                                                                                                                                          |
| NO                                               | Nitrogen monoxide, a.k.a. nitric oxide.                                                                                                                                                                                                                                                                                                                                |
| NO <sub>2</sub>                                  | Nitrogen dioxide.                                                                                                                                                                                                                                                                                                                                                      |
| NO <sub>x</sub>                                  | Nitrogen oxides.                                                                                                                                                                                                                                                                                                                                                       |
| O <sub>3</sub>                                   | Ozone.                                                                                                                                                                                                                                                                                                                                                                 |
| Percentile                                       | The percentage of results below a given value.                                                                                                                                                                                                                                                                                                                         |
| PM <sub>10</sub>                                 | Particulate matter with an aerodynamic diameter of less than 10 micrometres.                                                                                                                                                                                                                                                                                           |
| PM <sub>2.5</sub>                                | Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.                                                                                                                                                                                                                                                                                          |
| micrograms per cubic metre (µg.m <sup>-3</sup> ) | A measure of concentration in terms of mass per unit volume. A concentration of 1 µg.m <sup>-3</sup> means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.                                                                                                                                                                      |
| UK-AIR                                           | UK Air Information Resource – A source of air quality information provided by Defra.                                                                                                                                                                                                                                                                                   |
| UKAQS                                            | United Kingdom Air Quality Strategy.                                                                                                                                                                                                                                                                                                                                   |

**APPENDIX B: Development Proposals**

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**APPENDIX C: Model Verification**

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Whilst ADMS Roads is widely validated for use in this type of assessment, model verification for the area around the Site will not have been included. To determine model performance at a local level, a comparison of modelled results with monitored results in the study area was done in accordance with the methodology provided by DEFRA guidance<sup>32</sup>. This process of verification aims to minimise modelling uncertainty by correcting modelled results by an adjustment factor to give greater confidence to the results.

KC undertook monitoring of NO<sub>2</sub> concentrations at five locations adjacent to roads included within the model during 2017. Results from these monitors were obtained and the model run for the verification year 2017 to predict the 2017 annual mean road contributions of NO<sub>x</sub> at the survey positions. The model NO<sub>x</sub> outputs at these locations were compared to the 2017 monitored concentrations to provide adjustment factors. **Table C1** presents the verification process.

**Table C1: NO<sub>x</sub> Verification Process**

| Model Verification Steps                                                        | 11     | 49     | 50    | 76    | 77    |
|---------------------------------------------------------------------------------|--------|--------|-------|-------|-------|
| 2017 background NO <sub>2</sub> concentration (µg.m <sup>-3</sup> )             | 23.22  |        |       |       |       |
| Monitored road contribution NO <sub>x</sub> (µg.m <sup>-3</sup> )*              | 27.34  | 30.67  | 33.34 | 18.20 | 50.69 |
| Modelled road contribution NO <sub>x</sub> (µg.m <sup>-3</sup> )                | 28.75  | 12.00  | 12.69 | 15.95 | 15.69 |
| Ratio of monitored road NO <sub>x</sub> to modelled road NO <sub>x</sub>        | 0.951  | 2.556  | 2.628 | 1.141 | 3.232 |
| <b>Adjustment factor for modelled road contribution NO<sub>x</sub></b>          | 1.6313 |        |       |       |       |
| Adjusted modelled road contribution NO <sub>x</sub> (µg.m <sup>-3</sup> )       | 46.90  | 19.57  | 20.70 | 26.03 | 25.59 |
| Modelled total NO <sub>2</sub> concentration (µg.m <sup>-3</sup> )              | 45.01  | 32.90  | 33.43 | 35.90 | 35.70 |
| Monitored total NO <sub>2</sub> concentration (µg.m <sup>-3</sup> )             | 36.50  | 38.00  | 39.19 | 32.25 | 46.58 |
| % difference between modelled and monitored total NO <sub>2</sub> concentration | 23.32  | -13.42 | 14.70 | 11.32 | 23.36 |

\* Road-NO<sub>x</sub> component, determined from NO<sub>x</sub> to NO<sub>2</sub> calculator

A road-NO<sub>x</sub> factor of 1.6313 was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero. This factor was then applied to the modelled road-NO<sub>x</sub> concentration at each receptor, before conversion to NO<sub>2</sub> concentrations using the NO<sub>x</sub> to NO<sub>2</sub> calculator provided by Defra and the adjusted NO<sub>2</sub> background concentration.

<sup>32</sup> Defra (2018) Local Air Quality Management Technical Guidance (TG16).



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