14 AIR QUALITY

Introduction

14.1 This chapter of the ES assesses the likely significant effects of the Development on the environment in respect of air quality.

14.2 This chapter has been prepared by Vanguardia (see Appendix 1.2 Statement of Expertise).

14.3 This chapter should be read in conjunction with the following appendices and figures, which have been used to inform the assessment:

Figures:

- Figure 14.1 – Emley Moor Meteorological Site Wind Rose;
- Figure 14.2 – Time Varying Emission Factors;
- Figure 14.3 – Modelled Road Network;
- Figure 14.4 – Sensitive Receptor Locations;
- Figure 14.5 – Local Authority Monitoring;
- Figure 14.6 – Construction Dust Risk Buffers; and
- Figure 14.7 – Trackout Dust Risk Buffers.
- Figure 14.8 – Ecological Transect Locations;

Appendices:

- Appendix 14.1 – Policy and Legislative Context;
- Appendix 14.2 – Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction.
- Appendix 14.3 – Environmental Protection UK (EPUK) & IAQM Planning for Air Quality Guidance.
- Appendix 14.4 – Design Manual for Roads and Bridges (DMRB) LA.105 guidance and Natural England (2018) Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations guidance;
- Appendix 14.5 – Construction Dust Risk Assessment;
- Appendix 14.6 – Traffic Flows;
- Appendix 14.7 – Baseline Air Quality Concentrations;
- Appendix 14.8 – Construction and Operational Traffic Impacts on Sensitive Receptors;
- Appendix 14.9 – Construction and Operational Traffic Impacts (Including Cumulative Development Traffic) on Sensitive Receptors;
- Appendix 14.10 – Model Verification;

- Appendix 14.11 – General Construction Dust Mitigation Measures;
- Appendix 14.12 – Air Quality Damage Calculator;
- Appendix 14.13 – Ecological Impacts; and

  Appendix 14.14 – Vanguardia Air Quality Assessment – Goldthorpe, Barnsley – Impact on Hickleton - VC-00052805-EN-RP-0001

Policy Context

14.4 The following policy and guidance documents have informed the assessment of effects within this Chapter and are detailed further in Appendix 14.1:

- National Planning Policy Framework (NPPF);
- Planning Practice Guidance (PPG);
- Barnsley Metropolitan Borough Council's (BMBC) Local Plan; and
- City of Doncaster Council (CDC) Doncaster Local Plan.

14.5 The following policy legislation has informed the assessment of effects within this Chapter and are detailed further in Appendix 14.1:

- Directive 1999/30/EC
- Directive 2000/69/EC
- Directive 2002/3/EC
- European Union Directive 2008/50/EC
- European Union Directive 2016/2284
- Environment Act 1995;
- Environment Act 2021;
- Environmental Targets (Fine Particulate Matter) (England) Regulations 2023
- Environmental Protection Act 1990;
- Air Quality Standards Regulations 2010, (Amendments 2016);
- UK Air Quality Strategy;
- Environmental Management Plan 2023;
- Reducing Emissions from Road Transport: Road to Zero Strategy (2018); and
- Clean Air Strategy 2019.

Assessment Methodology

Consultation

14.6 The EIA scoping exercise undertaken is summarised in Chapter 2 EIA Methodology of the ES. This chapter has been prepared based on the EIA Scoping Opinion received from BMBC (refer to Appendix 2.2), in accordance with the requirements of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (the 'EIA Regulations')[i].

14.7 Prior to submission of the EIA the following consultation was undertaken with BMBC and with CDC in respect to Air Quality, as set out in Table 14.1.

Table 14.1: Consultation Undertaken

Consultee	Date and Time	Comments	Actions
Barnsley Environmental Protection Officer	22 June 2022 11:33	Scoping email issued	-
Barnsley Environmental Protection Officer	06 July 2022 11:44	Scope agreed	-
Doncaster Environmental Protection Officer	08 November 2022 10:30	Meeting on the impact of traffic through the village of Hickleton	Produced a separate report highlighting the impacts
Barnsley Environmental Protection Officer & Doncaster Environmental Protection Officer	16 June 2023 13:00	Meeting on the impact of traffic through the village of Hickleton	Discussing the separate report highlighting the impacts and recommend mitigation measures. Needed to consider the recently published Vehicle Emission Monitoring Study.
Doncaster Environmental Protection Officer	03 July 2023 16:15	Received comments back after the EHO reviewed the separate report.	Updated the separate report in line with comments received.
Barnsley Environmental Protection Officer & Doncaster Environmental Protection Officer	20 October 2023 12:00	Meeting on the impact of traffic through the village of Hickleton	Continue with producing a separate report highlighting the impacts and recommend mitigation measures.

14.8 A request for a Scoping Opinion was submitted on 10th October 2022, and a response was received on the 25th November 2022, stating the following in regard to air quality:

> *'The scoping report refers to the fact that the site is not within an AQMA or in close proximity to an AQMA, however the LPA is of the opinion that it does need to scoped into the ES as the development will likely generate a significant quantum of additional journeys through Hickleton en route to the A1M. Hickleton is within a designated AQMA where previous survey data has shown concentrations of nitrogen dioxide (NO_2) significantly above the NO_2 standard. Further, Hickleton lies within Doncaster MBC boundary and therefore this constitutes cross boundary effects.'*

14.9 On this basis, in addition to this ES Chapter, a separate assessment is set out in Appendix 14.14 and has been prepared to assess the impacts of the construction and operational phases on the village of Hickleton, as this was a separate air quality impact assessment to the main assessment undertaken in this ES Chapter. This ES Chapter has considered the impact of the Development on the surrounding area within Barnsley, but also cross referenced this separate study, as it does form part of the wider EIA study area.

Scope of Assessment

14.10 During construction activities, temporary impacts may arise from the emission of air pollutants and dust. During both the construction and operational phases, vehicular traffic and emissions from any stationary plant associated with the Development has the potential to lead to changes in the total air quality concentrations at human and ecological receptors.

14.11 The assessment will therefore focus on air pollutants that are likely to arise from the construction and operation of the Development. These pollutants are oxides of nitrogen (NO_x), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), and dust for ecological and human receptors near to the Site. To note, there is also a risk of nitrogen deposition (N) impacts on ecological receptors due to the construction and operation of the Development.

Extent of the Study Area

Construction Dust – Human and Ecological Receptors

14.12 The study area for the construction dust risk assessment includes the following receptors as set out in the IAQM (2023) guidance, which is also summarised in Appendix 14.2:

- Human receptors within 250m of the Site boundary, and/or within 50 m of the routes used by construction vehicles on the local highway network and up to 250m from site entrances; and/or
- Ecological receptors within 50m of the Site boundary, or within 50m of the route(s) used by construction vehicles on the public highway, up to 250m from the Site entrance(s).

Traffic Emissions - Human Receptors

14.13 The study area for both the construction and operational stage assessment includes any roads (provided by the project transport consultants) predicted to experience an increase in traffic trips exceeding the following criteria, as set out in the EPUK & IAQM (2017) guidance (as out in Appendix 14.3):

- A change in flows outside of an Air Quality Management Area (AQMA) of:
  - 500 Annual Average Daily Traffic (AADT) for light duty vehicles; and/or
  - 100 AADT for heavy duty vehicles.
- A change in within or adjacent to an AQMA of:
  - 100 AADT for light duty vehicles; and/or
  - 25 AADT for heavy duty vehicles.

14.14 The study area covered is shown in Figure 14.3.

Traffic Emissions - Ecological Receptors

14.15 In accordance with the IAQM (2020) A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites, DMRB (LA 105: Air Quality) and the Natural England (2018) guidance documents, the study area for ecological impacts during both the construction and operational stage assessment includes any road (provided by the project transport consultants) that is within 200 m of an ecological receptors predicted to experience:

- An increase in 1,000 AADT;
- An increase in 200 HDV AADT for heavy duty vehicles; and/or
- An increase in >1% of critical level/load

Baseline Data Collection

14.16 The existing baseline NO_2, PM_{10} and $PM_{2.5}$ concentrations on, and within the vicinity of the Site (i.e. within the area of Goldthorpe and Hickleton), have been assessed using the following:

- BMBC / CDC air quality review and assessment reports and monitoring data, as set out in their respective Air Quality Annual Status Reports (ASRs);
- The DEFRA background mapping website to provide background NO_x, NO_2, PM_{10} and $PM_{2.5}$ concentrations. The website has mapped background concentrations at a resolution of 1x1km for the whole of the UK; and
- Review of the Doncaster Council Real World Driving Emissions Study.

14.17 To determine the number of ecological receptors that will need assessing, a review of the DEFRA Magic Map website along with a review of the UK Air Pollution Information System, (APIS) website and consultation with the project ecologist has been undertaken.

14.18 To note, during the consultation, specific air quality monitoring related to the Development was not requested, and therefore no specific monitoring has been undertaken.

Assessment Methodology

Construction Phase Assessment Methodology

14.19 To assess the potential effects associated with dust and PM_{10} release during the construction phase of the Development, the Institute of Air Quality Management (IAQM) (2023) Guidance on the Assessment of Dust from Demolition and Construction document has been utilised.

14.20 The main air quality impacts associated with construction activities relate to the potential release of particulate matter of both size fractions (PM_{10} and $PM_{2.5}$). There is also the potential for the evolution of other air quality pollutants (known as secondary pollutants). The sources of potential construction impacts specifically associated with the Development are set out below:

- Potential for generation of airborne dusts from exposure and movement of soils and construction materials;
- Generation of fumes on-site by construction plant and tools throughout the construction phase;
- Increase in vehicle emissions (smoke/fumes) from vehicles (and potentially as a result of slow-moving traffic, should local congestion ensue); and
- Re-suspension of dust as a result of vehicle tyres travelling over dusty surfaces.

14.21 The criteria developed by the IAQM (2023) divides the activities on construction sites into the four main activity types to assess the potential dust effects upon sensitive receptors. These are:

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

14.22 The risk of dust effects (Low, Medium or High) for each of these activities is determined by the scale (magnitude) and nature of the works being undertaken (i.e. how dusty), along with the distance to and sensitivity of the receptor. This is further explained in the full methodology, set out in Appendix 14.2. The full assessment of the Development dust risk assessment in isolation of any ongoing works or committed developments has been undertaken in Appendix 14.5, with no allowance for inherent mitigation set out in the 'Mitigation Measures' section.

Construction and Operational Phase Vehicular Impact Methodology for Human Receptors

14.23 The peak construction and operational phase(s) for the Development is anticipated to be 2025 and 2026 respectively.

14.24 The number of daily vehicular movements associated with the construction phase of the Development will vary on a daily basis, depending upon the construction activity being undertaken at the time. Therefore, reasonable estimates have been provided by the Applicant for the construction phase and a detailed vehicular trip generation exercise has been undertaken by the project transport consultant (Fore Consulting Limited) for the operational phase.

14.25 The traffic predictions, as set out in Appendix 14.6, have been compared to the EPUK & IAQM (2017) criterion thresholds for impacts on human receptors, set out in Appendix 14.3, with the *'Likely Significant Effects'* section setting out the assessment during the construction and operational phase(s).

Construction and Operational Phase Vehicular Impact Methodology for Ecological Receptors

14.26 The traffic predictions provided by Fore Consulting Limited, as set out in Appendix 14.6, have been compared to the DMRB LA 105 (2019) and Natural England (2019) criterion thresholds for impacts on ecological receptors, set out in Appendix 14.4, with the assessment of the Development construction and operational traffic set out in the 'Likely Significant Effects' section.

Air Quality Modelling Parameters

14.27 The air quality modelling conducted for this assessment has calculated the impact of emissions from vehicles generated during the construction and operational phase(s) on the identified sensitive receptors (as detailed in Table 14.2). The impacts have been considered using the EPUK & IAQM (2017) guidance and against the NO_2 annual and 1-hour mean, the PM_{10} annual and 24-hour mean objectives and the annual mean $PM_{2.5}$ concentrations. The modelling parameters are set out below.

Air Quality Model

14.28 Air quality impacts at the worst-case receptor locations (which have been identified later in this section) have been predicted during the construction and operational phase(s) using the industry recognised ADMS-Roads (v5.0.1.3) dispersion model. The model is recognised and validated for this type of assessment. The model uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions of air pollutant concentrations. It can predict long-term and short-term concentrations, including percentile concentrations.

14.29 The model requires the user to provide various input data, to calculate pollution concentrations and deposition over a specific area. The following input data has been used in the model:

- Source parameters: e.g. highway width, average speed of vehicles, the number of vehicles per hour (or user defined emission rates in respect to the Hickleton assessment) and the diurnal traffic profile;
- Meteorological parameters: e.g. wind speed, direction, precipitation, temperature and atmospheric stability; and
- Topographical factors: e.g. ground levels, gradients, buildings and surface roughness.

Meteorological Site

14.30 The meteorological data used within the model will be taken from Doncaster Sheffield Meteorological Site for 2022, which was agreed during the consultation with BMBC. The windrose is illustrated in Figure 14.1.

Diurnal Profile

14.31 A standard diurnal profile from the Department for Transport (DfT) website has be utilised as part of the modelling process for an average 7-day week. The diurnal profile is 2022, in line with the year used for the verification scenario. This 2022 diurnal profile has then been used for all other scenarios. The 2022 diurnal profile is illustrated in Figure 14.2.

Modelling Scenarios

14.32 The following scenarios have been modelled / assessed:

- Scenario 1 – 2022 Verification;
- Scenario 2 – 2022 Baseline;
- Scenario 3 – 2025 Construction Year;
- Scenario 4 – 2025 Construction Year + Development Construction Traffic;
- Scenario 5 – 2025 Construction Year + Development Construction Traffic + Cumulative Traffic;
- Scenario 6 – 2026 Future Development Year;
- Scenario 7 – 2026 Future Development Year + Development Traffic; and
- Scenario 8 – 2026 Future Development Year + Development Traffic + Cumulative Traffic.

14.33 The committed developments included within scenario 5 and 8 are set out in Chapter 13 of this EIA.

Emission Factors

14.34 The most recently available emission factor tool kit (EFT) (Version 11.0), released by DEFRA in November 2021, has been used to predict the traffic related emissions in 2022, 2025, and 2026.

14.35 The model will be utilised to predict concentrations of NO_x, PM_{10} and $PM_{2.5}$, based upon vehicle flow, composition and speed data. Vehicles emit NO_x with different proportions of NO_2. Following release into the atmosphere, chemical reactions take place between nitric oxide (NO), NO_2 and Ozone (O_3). In this assessment, the screening of NO_x emissions has taken place and the resulting NO_2 concentration has been calculated using the DEFRA NO_x to NO_2 Calculator (v8.1), which derives NO_2 from the modelled NO_x concentrations.

Modelled Road Network

14.36 The modelled road network is consistent with the traffic data provided by the Applicant's transport consultant, as set out in Chapter 13 of this EIA. The traffic flows used within the assessment are set out in Appendix 14.6. Road junctions have been modelled in line with the LAQM Technical Guidance (TG(22)), which states:

> *'For junctions, common sense, driving experience and local knowledge are helpful to estimate speeds. For example, for a section of road leading up to traffic lights, the aim should be to estimate average speeds over a 50 m section of road:*
>
> - *Traffic pulling away from the lights, e.g. 40-50 kph;*
> - *Traffic approaching the lights when green, e.g. 20-50 kph; and*
> - *Traffic on the carriageway approaching the lights when red, e.g. 5-20 kph, depending on the time of day and how congested the junction is.*
>
> *It is considered that the combined effect of these three conditions is likely in most instances to be a two-way average speed for all vehicles of 20 to 40 kph. Speeds in similar ranges would also apply at roundabouts, although on sections of large roundabouts, speeds may well average between 40-50 kph.'*

14.37 The modelled road network for the 2022, 2025 and 2026 assessment year scenarios, including the modelled speeds, are illustrated in Figure 14.3.

Sensitive Human Receptors

14.38 The concentrations of NO_2, PM_{10}, and $PM_{2.5}$ have been considered at sensitive human receptors. Sensitive human receptors have been identified at locations representative of worst-case public exposure alongside impacted highways in the vicinity of the Site and extensively across the village of Hickleton.

14.39 While selecting the human receptor locations, careful consideration was made to human receptors located near key road junctions, where congestion may occur, or where a number of highway links merge, these are considered the 'worst case human receptors.'

14.40 The TG(22) guidance states:

> *'locations representative of human (or ecological) exposure to a pollutant, over a time relevant to the objective that is being assessed against, where the Air Quality Strategy objectives are considered to be apply.'*

14.41 The sensitive locations at which the standards apply are places where the population is expected to be exposed to the various pollutants over the particular averaging period. Thus, for those standards to which an annual mean standard applies, the most common sensitive receptor locations used to measure concentrations against the set standards are areas of residential housing, since it is reasonable to expect that people living in their homes could be exposed to pollutants over such a period of time.

14.42 The existing sensitive receptor locations are split between 'residential' receptors, which represent the façades of residential properties, and 'commercial' sensitive receptors which represent the façades of commercial properties. The proposed sensitive receptors have been selected based on the exceedances of the Stage 2 criteria within the EPUK & IAQM (2017) guidance, as set out in Appendix 14.3.

14.43 As a number of sensitive human receptors are more representative of short-term exposure, the model needs to predict short-term concentrations. However, TG(22) document states:

> *'Dispersion models cannot predict short-term concentrations as reliably as annual mean concentrations.*
>
> *[…]*
>
> *Previous research carried out on behalf of Defra and the Devolved Administrations identified that exceedances of the NO_2 1-hour mean are unlikely to occur where the annual mean is below 60 µg/m³ This assumption is still considered valid; therefore local authorities should refer to it.'*

14.44 On this basis, the relevant human receptors have been compared to the NO_2 short-term average objectives by using the annual mean concentrations.

14.45 All identified receptors are considered to be representative of the PM_{10} 24-hour mean objective, and therefore the following, taken from the TG(22) document, has been used to calculate the PM_{10} 24-hour mean objective at each receptor:

> *'As for NO_2, using a dispersion model to predict exceedances of the PM_{10} short term (24-hour mean) objective may be challenging. Therefore, to estimate potential exceedances of the PM_{10} 24-hour mean objective, local authorities should use the following relationship, provided in previous Technical Guidance, but still considered adequate:*
>
> $$\text{Num. 24-hour exceedances} = -18.5 + 0.00145 \times \text{annual mean}^3 + \left(\frac{206}{\text{annual mean}}\right)$$
>
> *The relationship does have limitations in so far that it should not be applied when the annual mean PM_{10} concentration is lower than 14.8µg/m³'*

14.46 The modelled human receptor locations are set out in Table 14.2 and illustrated in Figure 14.4.

Table 14.2: Modelled Human Receptor Locations

Receptor	Location	Coordinates (m)		
		X	Y	Z
Residential Receptors				
R.01	19, Kathleen Grove, Goldthorpe, S63 9JF	446782	404730	1.5
R.02	33, Lockwood Road, Goldthorpe, S63 9JY	446315	404729	1.5
R.03	30, Cherry Grove, Goldthorpe, S63 9LB	445305	404456	1.5
R.04	25, Mulberry Close, Goldthorpe, S63 9LB	445095	404380	1.5
R.05	2, Hollygrove, Goldthorpe, S63 9LA	445139	404215	1.5
R.06	243, Barnsley Road, Goldthorpe, S63 9AU	445194	404193	1.5
R.07	152, Barnsley Road, Goldthorpe, S63 9AP	445366	404224	1.5
R.08	181, Barnsley Road, Goldthorpe, S63 9AU	445364	404191	1.5
R.09	Woodbine Cottage, Doncaster Road, Billingley, S72 0JE	444045	404085	1.5
R.10	Rose Valley, Doncaster Road, Billingley, S72 0JE	443963	404114	1.5
R.11	174, Doncaster Road, Darfield, S73 9JF	442618	404361	1.5
R.12	23, Doncaster Road, Darfield, S73 9JB	442475	404409	1.5
R.13	11, Doncaster Road, Darfield, S73 9JB	442437	404441	1.5
R.14	124, Doncaster Road, Darfield, S73 9JA	442425	404437	1.5

Receptor	Location	Coordinates (m)		
		X	Y	Z
R.15	88, Doncaster Road, Darfield, S73 9JA	442369	404517	1.5
R.16	72, Doncaster Road, Darfield, S73 9HX	442244	404539	1.5
R.17	62, Doncaster Road, Darfield, S73 9HX	442211	404532	1.5
R.18	5, Norville Crescent, Darfield, S73 9HG	441839	404748	1.5
R.19	7, Highview Close, Darfield, S73 9AR.	441531	404886	1.5
R.20	26, Saltersbrook Road, Darfield, S73 9AP	441517	404860	1.5
R.21	1, Quern Way, Darfield, S73 9DR	441211	405012	1.5
R.22	29, Kingfisher Drive, Wombwell, S73 0UX	441499	402274	1.5
R.23	8 Warwick Mews, Wath-Upon-Dearne, Rotherham, S63 7FZ	442772	401640	1.5
R.24	8 Oxford Mews, Wath-Upon-Dearne, Rotherham, S63 7GA	442860	401597	1.5
R.25	23 Stonechat Mead, Wath-upon-Dearne, Rotherham, S63 7GR	443218	401510	1.5
R.26	70 Red Kite Avenue, Wath-Upon-Dearne, Rotherham, S63 7GP	443656	401447	1.5
R.27	20 Marvell Way, Wath-Upon-Dearne, Rotherham, S63 7FL	443557	401407	1.5
R.28	11 Utley Croft, Wath-Upon-Dearne, Rotherham, s63 6FT	442725	401585	1.5
R.29	52 Hemingfield Road, Hemingfield, Barnsley, S73 0QA	439084	401977	1.5
Commercial Receptors				
C.01	Portwest Clothing Ltd, Fields End Business Park, Thurnscoe, S63 0JF	445968	404739	1.5
C.02	Solarframe Ltd, 3, Fields End Business Park, Thurnscoe, S63 0JF	445901	404700	1.5
C.03	Portwest, Goldthorpe, S63 9EU	445916	404643	1.5
C.04	Aldi Food Stores Limited, Barnsley Road, Goldthorpe, S63 9PJ	444955	404295	1.5
C.05	Cathill Services, Doncaster Road, Darfield, S73 9JG	442852	404306	1.5
C.06	Cranswick Convenience Foods, Wombwell, S73 0UN	441606	402333	1.5

Sensitive Ecological Receptors

14.47 The air quality impacts associated with the Development have the potential to impact sensitive ecological receptors. The IAQM (2020) guidance sets out the type of ecological sites which may require an air quality impact assessment. These are:

- Sites of Special Scientific Interest (SSSIs);
- Special Areas of Conservation (SACs);
- Special Protection Areas (SPAs);
- Ramsar Sites;
- Areas of Special Scientific Interest (ASSIs);
- National Nature Reserves (NNRs);

- Local Nature Reserves (LNRs);
- Local Wildlife Sites (LWSs); and
- Areas of Ancient Woodland (AW).

14.48 A review of the Defra Magic Map website, and consultation with the project ecologist, indicates that the following ecological site is of interest in the study area:

Dearne Valley Park SSSI – Gypsy Marsh.

14.49 As the SSSI designation for the above site is new, the project ecologist visited the site to assess the sensitivity to changes in pollution, specifically nitrogen deposition. The ecologist concluded that the fen habitat, which was located north of the A6195 west of the Broomhill Roundabout, is sensitive to nutrient inputs and acid deposition (ammonia, nitrogen, and acidification). Therefore, a detailed assessment is required on the impacts on this ecological receptor.

14.50 A screening assessment has been carried out on the Deane Valley Park SSSI – Gypsy Marsh ecological receptor in the *'Likely Significant Effects'* section of this chapter, in line with the DMRB (2019) and Natural England (2018) document.

14.51 Discrete indicative transect points have been modelled for the Deane Valley Park SSSI – Gypsy Marsh ecological receptor. The location of modelled transect points are set out in Appendix 14.13 and illustrated in Figure 14.5.

Assessment of Significance

Construction Dust Impacts – Assessment of Significance

14.52 The IAQM (2023) guidance does not provide a method for assessing the significance of effects before mitigation and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM (2023) guidance is clear that the residual effect will normally be expected to be 'Not Significant.'

Traffic Emissions – Impact Descriptors and Assessment of Significance

14.53 The assessment of likely significant environmental effects as a result of the Development has taken into account the construction and operational stage(s).

14.54 Currently there is no official guidance in the UK on how to describe the nature of air quality effects, nor how to assess their significance. Therefore, the approach developed by EPUK & IAQM (2017) has been used. This approach involves a two-stage process:

- A quantitative description of the impacts on local air quality arising from a proposed development; and
- A judgement on the overall significance of the effects.

Determining Sensitivity

14.55 The receptors identified have little ability to absorb change without fundamentally altering their present character, therefore, they are classified as 'high' sensitivity.

Determining Magnitude of Impact (Magnitude of Change)

14.56 The guidance recommends that the percentage of change in concentration relative to the air quality assessment level (AQAL) is combined with the total long-term average concentration with the Development in place to give an 'impact descriptor' (substantial, moderate, slight or negligible) at a

specific receptor, as set out in Table 14.4. To note, the current legislated annual mean (or limit for PM2.5) AQALs have been used for NO2 (40 µg/m3), PM10 (40 µg/m3) and PM2.5 (20 µg/m3).

Table 14.4: Operational Impact Descriptors for Individual Existing Receptors

Long Term Average Concentration at Receptor in Assessment Year	% Change in concentration relative to Air Quality Action Level (AQAL)				
	<0.5	1	2 – 5	6 – 10	>10
75% or less of AQAL	Negligible	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Negligible	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

Notes:

Values are rounded to the nearest whole number.

When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme;' concentration for an increase.

AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL).'

14.57 The EIA magnitudes of change (major, moderate, minor or negligible) have also been used in addition to the EPUK & IAQM (2017) descriptors to describe the air quality impact at all sensitive human receptors. The EPUK & IAQM (2017) impact descriptor of 'substantial' corresponds to a major magnitude of impact, a 'moderate' impact corresponds to moderate magnitude of impact, a 'slight' impact corresponds to a minor magnitude of impact and a 'negligible' impact corresponds to a negligible magnitude of impact. The definition of each magnitude of impact is defined in Table 14.5 below, and can be 'beneficial' or 'adverse':

Table 14.5: Magnitude of Impact Definitions

Magnitude of Impact	Definition
Major	Total loss or major/substantial alteration to key elements/features of the baseline (pre-Development) conditions such that the post Development character/composition/attributes will be fundamentally changed.
Moderate	Loss or alteration to one or more key elements/features of the baseline conditions such that post Development character/composition/attributes of the baseline will be materially changed.
Minor	A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible/detectable but not material. The underlying character/composition/attributes of the baseline condition will be similar to the pre-Development circumstances/situation.
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.

Determining the Level of Effect

14.58 The level of effect attributed to each sensitive receptor has been assessed based on the sensitivity of the modelled receptor and magnitude of impact (EIA Magnitudes) due to the Development. This then determines the significance of an environmental effect at each modelled receptor. The Effect Significance Matrix is set out in Table 14.6.

Table 14.6: Effect Significance Matrix

Magnitude	Sensitivity		
	High	Moderate	Low
Major	Major Adverse/Beneficial	Major – Moderate Adverse/Beneficial	Moderate – Minor Adverse/Beneficial
Moderate	Major – Moderate Adverse/Beneficial	Moderate – Minor Adverse/Beneficial	Minor Adverse/Beneficial
Minor	Moderate – Minor Adverse/Beneficial	Minor Adverse/Beneficial	Minor Adverse/Beneficial - Negligible
Negligible	Negligible	Negligible	Negligible

Determining Significance

14.59 The assessment has also determined whether the level of effect for the residual effect is either 'significant' or 'not significant'.

14.60 The EPUK & IAQM (2017) advise that the existing sensitive receptors with air quality impacts described as 'moderate' or 'substantial' will generally give rise to a significant effect, and impacts described as 'negligible' or 'slight' will generally not have a significant effect. However, although the impacts might be considered 'slight,' 'moderate' or 'substantial' at one or more receptor location, the overall effects of a Development may not always be judged as being 'significant.'

14.61 The guidance believes that the assessment of significance should be based on professional judgement, with the overall air quality impact of a development described as either 'significant' or 'not significant'. In drawing this conclusion, the following factors should be taken into account:

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

14.62 The judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix 1.2.

Limitations and Assumptions

14.63 There are many uncertainties when considering both measured and predicted pollution concentrations. For transparency, these have been detailed below:

- The predicted air quality is dependent on traffic data. It has been assumed that the estimates of traffic on local roads for the baseline and future year scenarios, provided by Fore Consulting Limited, are accurate. Should these flows be subject to change, so may the resulting pollution concentrations.

- The background air quality concentrations have been taken from the DEFRA background mapping. The DEFRA website includes estimated background air pollution data for NO_x, NO_2, PM_{10} and $PM_{2.5}$ for each 1km by 1km OS grid square. Background pollutant concentrations are modelled from the base year of 2018 and based on ambient monitoring and meteorological data from 2018. Therefore, future year scenarios are based on projections, up to 2030. Furthermore, the concentrations are modelled at a standard 'living height,' which has been averaged across the grid square.

- There is discrepancy between the concentrations mapped by DEFRA and those recorded at local background sites. Therefore, background monitoring collected by BMBC and CDC has been compared to the DEFRA background mapping concentrations, with the mapping concentrations then calibrated against the ratio of this comparison. NO_2 concentrations have been calibrated using the local monitoring data. In the absence of background monitoring data for PM_{10} and $PM_{2.5}$, the NO_2 calibration factor has been used to calibrate these background concentrations.

- It has been assumed that DEFRA's NO_x to NO_2 calculator (v8.1) accurately predicted NO_2 concentrations;

- It has been assumed that weather conditions at the Doncaster Sheffield meteorological station are similar to those in Goldthorpe and Hickleton, and that meteorological data for 2022 is representative of the conditions in 2025 and 2026;

- It has been widely known for some time that NO_x/NO_2 levels are not reducing as quickly as anticipated and this was identified by DEFRA in 2011. This was reiterated in an IAQM Interim Position Statement (v1.1) released in July 2018 recognising that emissions from diesel vehicles have not declined as expected by DEFRA. This document has since been formally withdrawn, stating:

  > *'There is a growing body of evidence to suggest that the latest COPERT vehicle emission factors, which feed into the EFT (v9 and onwards), reflect the real-world NO_x emissions more accurately.*
  >
  > *It is judged that an exclusively vehicle emissions-based sensitivity test is no longer necessary.*
  >
  > *On this basis, the EFT may be used for future year modelling with greater confidence when considering the per vehicle emission, provided that the assessment is verified against measurements made in the year 2016 or later.'*

  On this basis it is anticipated the most up to date (EFT) v11.0 can be relied upon to provide a good representation of the air quality concentrations and impacts, and no sensitivity test has therefore been undertaken.

- Due to the ongoing uncertainty regarding 2020 and 2021 air quality monitoring data as a result of the COVID-19 global pandemic, and to ensure a conservative assessment of future exposure and impacts is made, the verification process has used 2022 monitoring data, which is considered to be the most recent representative year post COVID-19 pandemic.

- The emissions factors within the latest DEFRA Emission Factor Toolkit (EFT) are based on assumptions which were current before the occurrence of the COVID-19 pandemic. As such, this data will not reflect any changes that have occurred or may occur in the future as a result of behavioural change caused by the pandemic and / or as a result of measures implemented by governing authorities (e.g. lockdowns, travel restrictions, etc.). This is highlighted by a recent statement published by DEFRA, which states:

  'Users of the updated LAQM tools should be aware that the projections in the 2018 reference year background maps and associated tools are based on assumptions which were current before the Covid-19 outbreak in the UK. In consequence these tools do not reflect short or longer term impacts on emissions in 2020 and beyond resulting from behavioural change during the national or local lockdowns.'

- In order to reduce the uncertainty associated with predicted concentrations, model verification has been carried out against monitored air pollution data published by BMBC and CDC, following guidance set out in TG(22) and is set out in Appendix 14.10. To note, a separate verification process has been undertaken for the specific impact assessment in Hickleton (as set out in Appendix 14.14).

14.64 However, despite these uncertainties, this assessment is robust and provides the Local Authority with the necessary information on likely environmental effects needed to determine the planning application.

Baseline Conditions

Local Air Quality Management

14.65 Under the Air Quality Strategy there is a duty on all Local Authorities to consider the air quality within their boundaries and to report annually to DEFRA. Local Air Quality Management in the Goldthorpe area has been assessed by BMBC, through the national Review and Assessment process and, in fulfilment of Part IV of the Environment Act 1995.

14.66 Although BMBC have declared AQMA's, covering some of the major routes in the council's area, the nearest AQMA is approximately 3.3 km east of the Site, in the village of Hickleton (within CDC), and has been declared by CDC for exceedances of the NO_2 annual mean and 1-hour mean objectives.

14.67 The latest annual air quality results were published by BMBC in 2023 (setting out the monitored data up to 2022). BMBC undertook automatic monitoring at three sites in 2022, with one measuring concentrations of NO_2, one measuring PM_{10} and one measuring NO_2, sulphur dioxide (SO_2) and ozone (O_3). NO_2 diffusion tube monitoring was also carried out at various strategic locations across the jurisdiction in 2022.

14.68 Table 14.7 sets out the location of the air pollution monitoring conducted by BMBC within 3 km of the Site, with the locations illustrated in Figure 14.6. To note, diffusion tube 45 appears to have been moved on the ASR, and therefore the 2021 and 2022 results have not been reported in the below table due to uncertainty.

Table 14.7: Monitoring Annual Mean NO_2 Concentrations

ID	Type	Annual Mean (µg/m^3)					
		2017	2018	2019	2020	2021	2022
Diffusion Tube							
45	Roadside	24.8	21.7	22.6	24.8	-	-

14.69 The air quality monitoring carried out closest to the Development shows compliance of the NO_2 annual mean objective for the past 4 years of available data.

14.70 To note, due to the impact of the COVID-19 pandemic on traffic, 2020 concentrations are not considered to be representative of 'typical' air quality concentrations. Whilst it is expected that, as a result of the COVID-19 pandemic, behaviours will change in the future, the impact of this on air quality long-term is currently unknown.

14.71 Further details on the baseline conditions in Hickleton are set out in Section 4 of Appendix 14.14.)

DEFRA Background Concentrations

14.72 As set out in the '*Assumptions/Limitations*' section, the DEFRA background concentrations have been calibrated against local background monitoring data.

14.73 The background calibration factor for NO_2 for the Goldthorpe study area, is set out in Table 14.8. The adjusted projected pollutant concentrations for the assessment years are set out in Table 14.9. The Hickleton background calibration factor process is set out in Appendix 14.4.

Table 14.8: NO_2 Background Calibration Factor

NO_2	Monitoring Sites	
	BAR3	29
Measured Concentration ($\mu g/m^3$)	13	20.3
Mapped Concentration ($\mu g/m^3$)	10.5	14.7
Calibration Factor	1.2	1.4
Average Calibration Factor	1.3	

Table 14.9: Estimated Annual Mean Background Pollutant Concentrations ($\mu g/m^3$)

Pollutant	2022	2025	2026
NO_2	11.2 – 15.5	10.1 – 14.0	9.9 – 13.7
PM_{10}	13.9 – 17.7	13.5 – 17.3	13.5 – 17.3
$PM_{2.5}$	8.9 – 9.8	8.5 – 9.5	8.5 – 9.5

Notes: Data presented are derived from the ordnance survey grid reference at the modelled receptor locations , as set out in Table 14.2.

Future Baseline

14.74 From an air quality perspective, the change in the baseline in the absence of the Development is largely down to human interventions rather than natural changes, such as improving emission and future Developments being completed. Therefore, some judgement has been applied to discuss a likely evaluation on the future baseline based on current information.

14.75 The future baseline will be impacted by those committed developments coming forward, which will increase the concentrations at receptor locations on impacted highways. It is, however, noted that air quality is generally expected to improve with time with the increased uptake of cleaner vehicles, such as electric vehicles, newer vehicles having more stringent emission standards, and the continuation of hybrid home working patterns post the COVID-19 pandemic. The exception is ammonia emissions from vehicles, which have been identified to increase between 15 – 23% from 2017 to 2030, with the increase most rapid in fleets with fewer HDV's. This is based on National Atmospheric Emission Inventory (NAEI)/ EFT rural fleet projection assumptions.

14.76 In order to give an indication of potential future baseline concentrations, the predicted background concentrations for NO_2, PM_{10} and $PM_{2.5}$ for the grid squares covering the modelled receptor locations provided in Table 14.8 shows a general decrease from 2022 to 2025 and 2026. This is also highlighted by the modelled baseline concentrations of NO_2, PM_{10} and $PM_{2.5}$ at each of the previously identified human receptor locations. The results, which cover the baseline years of 2022, 2025 and 2026, are set out in Tables 14.7.1, 14.7.2 and 14.7.3 in Appendix 14.7, and it can be seen that the concentrations are reducing over time.

14.77 The predicted annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ are all below their respective annual mean objectives / Limits in 2022, 2025 and 2026 at all modelled receptor locations.

14.78 The annual mean NO_2 concentrations are all below 60 µg/m^3, which is regarded to be an indicator that the hourly mean objective will also not be breached.

14.79 The annual mean PM_{10} concentrations are below 32 µg/m^3, which is an indication of potential exceedances of the 24-hour mean PM_{10} objective and it is, therefore, unlikely that the 24-hour mean PM_{10} objective will be exceeded.

14.80 As highlighted in the separate report (Appendix 14.4), the existing baseline in Hickleton continues to demonstrate exceedances of the NO_2 annual mean and, in one location, potentially exceeding the hourly mean objective (as the 60 µg/m^3 annual mean is exceeded). Without suitable measures in place, the future baseline is likely to have exceedances of the NO_2 air quality standards.

Likely Significant Effects

Construction Phase – Dust Risk Assessment

14.81 A construction dust assessment has been undertaken in line with the IAQM (2023) guidance methodology as set out in Appendix 14.2, with the assessment provided in Appendix 14.5.

14.82 The IAQM (2023) guidance does not provide a method for assessing the significance of effects before mitigation and advises that pre-mitigation significance should not be determined. Mitigation measures for dust impacts during the construction phase are set out in the 'Mitigation Measures' section.

Construction Phase – Construction Traffic

14.83 A review of the construction traffic data provided by the project transport consultants indicates that the EPUK & IAQM (2017) criteria for both LDV's and HDV's will be exceeded on a number of roads, and therefore a detailed impact assessment has been undertaken, which is set out below. The significance is then set out in paragraph 14.102.

NO_2

14.84 The predicted annual mean NO_2 concentrations are set out in Table 14.8.1 in Appendix 14.8 for the 2025 Baseline and 2025 Baseline + Development Construction Traffic scenarios. The results of the assessment are outlined in more detail below.

14.85 The predicted annual mean NO_2 concentrations at all of the modelled sensitive human receptor locations are not predicted to exceed the AQAL of 40 µg/m^3, where the annual mean objective applies, in either assessment scenario.

14.86 Furthermore, the annual mean NO_2 concentrations predicted at all sensitive human receptors are below 60 µg/m^3 for both scenarios; if concentrations are above this, TG(22) regards this as an indicator that the NO_2 1-hour mean objective could be breached. Therefore, it is considered unlikely that the 1-hour objective will be exceeded at any of the human sensitive receptors considered in this assessment.

14.87 The highest NO_2 concentration is predicted at R.13, representative of a residential dwelling located along the A635 Doncaster Road, west of the Cathill roundabout. The annual mean concentration predicted at this human receptor, in the 2025 Baseline + Development Construction Traffic scenario, is 31.1 µg/m^3, which is 78% of the AQAL. The predicted increase in the NO_2 annual mean concentration at this receptor is 0.2 µg/m^3 or 0% of the AQAL. Subsequently, the impact predicted at this human receptor is described as negligible, in accordance with both the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.88 The largest predicted increase in NO_2 concentration from the 2025 Baseline scenario to the 2025 Baseline + Development Construction Traffic scenario is at R10, located at Rose Valley Cottage, along the Doncaster Road in Billingley. This human receptor is predicted to experience a 0.4 µg/m^3 increase, or a 1% increase compared against the AQAL. The concentration at this human receptor, as a result of the construction traffic is predicted to be 25.7 µg/m^3, which is 64% of the AQAL. The impact predicted is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.89 Overall, the magnitude of impact on annual mean NO_2 concentrations is described as negligible at all modelled human sensitive receptors.

PM_{10}

14.90 The predicted annual mean PM_{10} concentrations are set out in Table 14.8.2 in Appendix 14.8 for the 2025 Baseline and 2025 Baseline + Development Construction Traffic scenarios. The results of the assessment are outlined in more detail below.

14.91 The predicted annual mean PM_{10} concentrations at all of the modelled sensitive human receptor locations are not predicted to exceed the AQAL of 40 µg/m^3, where the annual mean objective applies, in either assessment scenario.

14.92 The highest PM_{10} concentration is predicted at R.13, representative of a residential dwelling located along the A635 Doncaster Road, west of the Cathill roundabout. The annual mean concentration predicted at this human receptor, in the 2025 Baseline + Development Construction Traffic scenario, is 27.9 µg/m^3, which is 70% of the AQAL. The predicted increase in the PM_{10} annual mean concentration at this human receptor is predicted to experience a concentration increase of 0.2 µg/m^3 or 0% increase compared against the AQAL. Subsequently, the impact predicted at this human receptor is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.93 The predicted number of PM_{10} 24 hour mean exceedances is calculated by using the following equation:

$$\text{Num. 24-hour exceedances} = -18.5 + 0.00145 \times \text{annual mean}^3 + \left(\frac{206}{\text{annual mean}}\right)$$

14.94 It should be noted that the number of exceedances can only be calculated if the modelled annual mean concentration at the receptors is above 14.8 µg/m^3, which is the case for this assessment. The highest PM_{10} concentration is predicted at R.13 (as set out above), which therefore predicts 21.0 exceedances, under the 35 permitted annually. On this basis, it is also reasonable to assume that the PM_{10} 24-hour concentration will not be exceeded at any of the modelled receptor concentrations.

14.95 The largest predicted increase in PM_{10} concentration from the 2025 Baseline scenario to the '2025 Baseline + Development Construction Traffic' scenario is at R10, located at Rose Valley Cottage, along the Doncaster Road in Billingley. This human receptor is predicted to experience a 0.3 µg/m^3 increase, or a 1% increase compared against the AQAL. The concentration at this human receptor, as a result of the construction traffic is predicted to be 25.7 µg/m^3, which is 64% of the AQAL. Subsequently, the impact predicted at this human receptor is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.96 Overall, the magnitude of impact on annual mean PM_{10} concentrations is described as negligible adverse at all modelled sensitive human receptors.

$PM_{2.5}$

14.97 The predicted annual mean $PM_{2.5}$ concentrations are set out in Table 14.8.3 in Appendix 14.8 for the '2025 Baseline' and '2025 Baseline + Development Construction Traffic' scenarios. The results of the assessment are outlined in more detail below.

14.98 The predicted annual mean $PM_{2.5}$ concentrations at all of the modelled sensitive human receptor locations are not predicted to exceed the AQAL of 20 µg/m^3, where the annual mean limit applies, in either assessment scenario.

14.99 The highest $PM_{2.5}$ concentration is predicted at R.13, representative of a residential dwelling located along the A635 Doncaster Road, west of the Cathill roundabout. The annual mean concentration predicted at this human receptor, in the '2025 Baseline + Development Construction Traffic' scenarios, is 15.8 µg/m^3, which is 80% of the AQAL. The predicted increase in the $PM_{2.5}$ annual mean concentration at this receptor is 0.08 µg/m^3 or 0% of the AQAL. Subsequently, the impact predicted at this human receptor is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.100 The largest predicted increase in $PM_{2.5}$ concentration from the '2025 Baseline' scenario to the '2025 Baseline + Development Construction Traffic' scenario is at R10, located at Rose Valley Cottage, along the Doncaster Road in Billingley. This human receptor is predicted to experience a 0.17 µg/m^3 increase, or a 1% increase compared against the AQAL. The concentration at this human receptor as a result of the construction traffic is predicted to be 14.3 µg/m^3, which is 71% of the AQAL. The impact predicted is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.101 Overall, the magnitude of impact on annual mean $PM_{2.5}$ concentrations is described as negligible at all modelled sensitive human receptors.

Summary and Significance of Effects

14.102 The magnitude of impact at the high sensitivity human receptors is considered to be negligible for NO_2, PM_{10} and $PM_{2.5}$, with concentrations remaining within their respective AQALs. Therefore, it is predicted that there will be a temporary, adverse effect on NO_2, PM_{10} and $PM_{2.5}$ concentrations, which is considered to be 'Negligible adverse'(i.e 'Not Significant' in line with the EPUK & IAQM (2017) guidance) in line with Table 14.5.

Ecological Impacts

14.103 A review of the construction traffic data provided by the project transport consultants in isolation will not trigger the DMRB screening criteria for a requirement of an impact assessment at the identified ecological receptor, Deane Valley Park SSSI – Gypsy Marsh. However, an assessment has been carried out to determine whether the 1% threshold will be exceeded. Should a process contribution of 1% or more of the critical level / load be predicted, it does not necessarily follow that there will be a consequent significant ecological effect; rather, it indicates the potential for such an effect to occur.

14.104 The process contribution to annual mean NO_x and NH_3 concentrations have been assessed as a percentage of the critical level. The modelled NO_x concentrations at the identified transect points are set out in Appendix 14.13 and illustrated in Figure 14.8. No background 24-hour mean nitrogen oxides concentrations are available, therefore baseline 24-hour mean concentrations have not been calculated. Notwithstanding this, the maximum changes in predicted concentrations of the 24-hour NO_X in 2025, as a result of the construction traffic (Process Contributions (PC)) has also been set out.

14.105 The greatest difference in annual mean concentrations between the '2025 Baseline' and '2025 Baseline + Development Construction Traffic' scenarios is an increase of 1.0 µg/m^3 at Transect E1_0 (0m from edge of the Deane Valley Park SSSI – Gypsy Marsh). This is greater than 1% of the critical level, indicating the potential for harm to habitats and species, therefore requiring further assessment by a qualified ecologist. The 1% criteria is exceeded up to 40 m on transect E1 and up to 30 m on transect E2.

14.106 The highest 24-hour mean process contribution is seen at Transect E1 at 0m from edge of the SSSI, which is less than 10% of the short-term critical level, therefore a further detailed assessment on the NO_x 24-hour impacts at Deane Valley Park SSSI – Gypsy Marsh is not required.

14.107 Specific details of the SSSI are not listed on the APIS website, therefore, the more conservative critical level of 1 µg/m^3 (as opposed to 3 µg/m^3 at the higher end of the range) has been used to assess NH_3. The greatest increase in annual mean NH_3 concentrations is 0.01 µg/m^3 at Transect E1.0 and E2_0 (0m from edge of the Deane Valley Park SSSI – Gypsy Marsh). This is not greater than 1 % of the critical level and therefore does not require a further assessment by a qualified ecologist.

14.108 Due to exceedances of the screening criteria for annual mean NO_x concentrations, and the project ecologist reviewing the site and highlighting that the Fen habitat and the Acid Grassland habitat at the Deane Valley Park SSSI – Gypsy Marsh is sensitive to nitrogen and acid deposition, the nitrogen and acid deposition has been calculated. Appendix 14.13 sets out the predicted annual nutrient nitrogen deposition for the transects.

14.109 The minimum critical load of 5 kg N/ha/yr, as available from the APIS resource and based on the grid square of the SSSI, has been used for comparison to the predicted nitrogen deposition rates. As stated previously, this is not specific to the SSSI, as the APIS website did not have site specific loads or concentrations for the Deane Valley Park SSSI – Gypsy Marsh.

14.110 The change in nitrogen deposition (including nitrogen derived ammonia) against the minimum critical load for N as a result of the '2025 Baseline' and '2025 Baseline + Development Construction Traffic' scenario is above the 1% threshold at Transects E1 (up to 20 m from edge of SSSI)and Transects E2 (up to 20 m from edge of SSSI). This indicates these areas require evaluation by a qualified ecologist. This is assessed in Chapter 9 (Biodiversity) of this ES.

14.111 There is no critical load for acid deposition for the Fen habitat, therefore the acid deposition for the Acid Grassland has been calculated. The critical load for acid deposition from nitrogen is between 0.438 and 2.088 keq N/ha/yr with reference to APIS. For the purposes of this assessment, the most conservative critical load for acid deposition has been used.

14.112 The change in acid deposition (against the minimum critical load for nitrogen derived acid) as a result of the '2025 Baseline + Development Construction Traffic' scenario is above the 1% threshold at Transects E1 (up to 0 m from edge of SSSI and 2 m from the edge of the closest road) and does not exceed at any transect point for Transects E2. This indicates these areas require evaluation by a qualified ecologist. This is assessed in Chapter 9 (Biodiversity) of this ES.

Impacts at Hickleton

14.113 The magnitude of impact is considered to be negligible for NO_2, PM_{10} and $PM_{2.5}$ at the majority of the modelled receptors, with concentrations remaining within their respective AQALs. The exception is the John O Gaunts property in Hickleton, which will experience a Major impact for NO_2, in line with the EPUK & IAQM (2017) guidance and EIA magnitudes. The AQAL for NO_2 is exceeded at this receptor, for the annual mean objective.

14.114 Therefore, it is predicted that there will be a temporary, adverse effect on NO_2, PM_{10} and $PM_{2.5}$ concentrations at the John O Gaunts receptor, which is considered to be 'Major adverse' for NO_2. The effect at this receptor, before mitigation, is therefore considered to be 'Major adverse' (i.e 'Significant' in line with the EPUK & IAQM (2017) guidance) for NO_2, in line with Table 14.5.

Operational Phase - Development Operational Traffic

14.115 A review of the operational traffic data provided by the project transport consultant indicates that the EPUK & IAQM (2017) criteria for both LDV's and HDV's will be exceeded on a number of roads, and therefore a detailed impact assessment has been undertaken, which is set out below. The significance is then set out in paragraph 14.134.

NO_2

14.116 The predicted annual mean NO_2 concentrations are set out in Table 14.8.4 in Appendix 14.8 for the '2026 Future Development Year' and '2026 Future Development Year + Development Traffic' scenarios. The results of the assessment are outlined in more detail below.

14.117 The predicted annual mean NO_2 concentrations at all of the modelled sensitive human receptor locations are not predicted to exceed the AQAL of 40 µg/m^3, where the annual mean objective applies, in either assessment scenario.

14.118 Furthermore, the annual mean NO_2 concentrations predicted at all sensitive human receptors are below 60 µg/m^3 for both scenarios; if concentrations are above this, TG(22) regards this as an indicator that the NO_2 1-hour mean objective could be breached. Therefore, it is considered unlikely that the 1-hour objective will be exceeded at any of the human sensitive receptors considered in this assessment.

14.119 The highest NO_2 concentration is predicted at R.13, representative of a residential dwelling located along the A635 Doncaster Road, west of the Cathill roundabout. The annual mean concentration predicted at this human receptor, in the '2026 Future Development Year + Development Traffic scenario, is 30.7 µg/m^3, which is 77% of the AQAL. The predicted increase in the NO_2 annual mean concentration at this receptor is 1.7 µg/m^3 or 2-5% of the AQAL. Subsequently, the magnitude of impact at this human receptor is described as slight/minor, in accordance with both the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.120 The largest predicted increase in NO_2 concentration from the 2026 Future Development Year' to the '2026 Future Development Year + Development Traffic' scenario is at R10, located at Rose Valley, along the Doncaster Road in Billingley. This human receptor is predicted to experience a 2.0 µg/m^3 increase, or a 2-5% increase compared against the AQAL. The concentration at this human receptor, as a result of the operational traffic is predicted to be 25.7 µg/m^3, which is 64% of the AQAL. The magnitude of impact at this human receptor is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.121 Overall, the magnitude of impact on annual mean NO_2 concentrations is described as slight/minor to negligible at all modelled human sensitive receptors.

PM_{10}

14.122 The predicted annual mean PM_{10} concentrations are set out in Table 14.8.5 in Appendix 14.8 for the '2026 Future Development Year' and '2026 Future Development Year + Development Traffic' scenarios. The results of the assessment are outlined in more detail below.

14.123 The predicted annual mean PM_{10} concentrations at all of the modelled sensitive human receptor locations are not predicted to exceed the AQAL of 40 µg/m^3, where the annual mean objective applies, in either assessment scenario.

14.124 The highest PM_{10} concentration is predicted at R.13, representative of a residential dwelling located along the A635 Doncaster Road, west of the Cathill roundabout. The annual mean concentration predicted at this human receptor, in the '2026 Future Development Year + Development Traffic', is 29.2 µg/m^3, which is 73% of the AQAL. The predicted increase in the PM_{10} annual mean concentration at this human receptor is predicted to experience a concentration increase of 1.3 µg/m^3 or 2-5 % increase compared against the AQAL. Subsequently, the impact predicted at this human receptor is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.125 The predicted number of PM_{10} 24 hour mean exceedances is calculated by using the following equation:

$$\text{Num. 24-hour exceedances} = -18.5 + 0.00145 \times \text{annual mean}^3 + \left(\frac{206}{\text{annual mean}}\right)$$

14.126 It should be noted that the number of exceedances can only be calculated if the modelled annual mean concentration at the receptors is above 14.8 µg/m^3, which is the case for this assessment. The highest PM_{10} concentration is predicted at R.13 (as set out above), which therefore predicts 24.6 exceedances, under the 35 permitted annually. On this basis, it is also reasonable to assume that the PM_{10} 24-hour concentration will not be exceeded at any of the modelled human receptor concentrations.

14.127 The largest predicted increase in PM_{10} concentration from the 2026 Future Development Year Baseline scenario to the '2026 Future Development Year + Development Traffic' is at R10, located at Rose Valley Cottage, along the Doncaster Road in Billingley. This human receptor is predicted to experience a 1.3 µg/m^3 increase, or a 2-5 % increase compared against the AQAL. The concentration at this human receptor, as a result of the operational traffic is predicted to be 26.7 µg/m^3, which is 67% of the AQAL. Subsequently, the impact predicted at this human receptor is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.128 Overall, the magnitude of impact on annual mean PM_{10} concentrations is described as negligible at all modelled sensitive human receptors.

$PM_{2.5}$

14.129 The predicted annual mean $PM_{2.5}$ concentrations are set out in Table 14.8.6 in Appendix 14.8 for the '2026 Future Development Year' and '2026 Future Development Year + Development Traffic' scenarios. The results of the assessment are outlined in more detail below.

14.130 The predicted annual mean $PM_{2.5}$ concentrations at all of the modelled sensitive human receptor locations are not predicted to exceed the AQAL of 20 µg/m^3, where the annual mean limit applies, in either assessment scenario.

14.131 The highest $PM_{2.5}$ concentration is predicted at R.13, representative of a residential dwelling located along the A635 Doncaster Road, west of the Cathill roundabout. The annual mean concentration predicted at this human receptor, in the '2026 Future Development Year + Development Traffic' scenarios, is 16.5 µg/m^3, which is 82% of the AQAL. The predicted increase in the $PM_{2.5}$ annual mean concentration at this receptor is 0.7 µg/m^3 or 2-5 % of the AQAL. Subsequently, the magnitude of impact at this human receptor is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.132 The largest predicted increase in $PM_{2.5}$ concentration from the '2026 Future Development Year' to the '2026 Future Development Year + Development Traffic' scenario is at R10, located at Rose Valley, along the Doncaster Road in Billingley. This human receptor is predicted to experience a 0.8 µg/m^3 increase, or a 2-5 % increase compared against the AQAL. The concentration at this human receptor as a result of the operational traffic is predicted to be 14.9 µg/m^3, which is 75% of the AQAL. The magnitude of impact is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.133 Overall, the magnitude of impact on annual mean $PM_{2.5}$ concentrations is described as negligible adverse at all modelled sensitive human receptors.

Summary and Significance of Effects

14.134 The magnitude of impact is considered to be slight/minor negligible for NO_2 and $PM_{2.5}$, with negligible adverse changes for PM_{10}, with concentrations for all pollutants remaining within their respective AQALs. Therefore, it is predicted that there will be a permanent, adverse effect on NO_2, PM_{10} and $PM_{2.5}$ concentrations, which is considered to be 'Negligible adverse', in line with Table 14.5, with the exception of R.13 for NO_2 and R12 and R13 for $PM_{2.5}$, which is predicted to be a 'Moderate-Minor adverse' effect(i.e 'Not Significant' in line with the EPUK & IAQM (2017) guidance) for NO_2, in line with Table 14.5.

Ecological Impacts

14.135 A review of the operational traffic data provided by the project transport consultants in isolation will trigger the DMRB screening criteria for a requirement of an impact assessment at the identified ecological receptor, Deane Valley Park SSSI – Gypsy Marsh. Therefore, an assessment has been carried out to determine whether the 1% threshold will be exceeded. Should a process contribution of 1% or more of the critical level / load be predicted, it does not necessarily follow that there will be a consequent significant ecological effect; rather, it indicates the potential for such an effect to occur.

14.136 The process contribution to annual mean NO_x and NH_3 concentrations have been assessed as a percentage of the critical level. The modelled NO_x concentrations at the identified transect points are set out in Appendix 14.13 and illustrated in Figure 14.8. No background 24-hour mean nitrogen oxides concentrations are available, therefore baseline 24-hour mean concentrations have not been calculated. Notwithstanding this, the maximum changes in predicted concentrations of the 24-hour NO_X in 2026, as a result of the operational traffic PC has also been set out.

14.137 The greatest difference in annual mean concentrations between the '2026 Future Development Year' to the '2026 Future Development Year + Development Traffic' scenarios is an increase of 7.0 µg/m^3 at Transect E1_0 (0m from edge of the Deane Valley Park SSSI – Gypsy Marsh). This is greater than 1% of the critical level, indicating the potential for harm to habitats and species, therefore requiring further assessment by a qualified ecologist. The 1% criteria is exceeded up to 200 m on both Transect E1 and E2.

14.138 The highest 24-hour mean process contribution is seen at Transect E1_0 at 0m from edge of the SSSI, which is less than 10% of the short-term critical level, therefore a further detailed assessment on the NO_x 24-hour impacts at Deane Valley Park SSSI – Gypsy Marsh is not required.

14.139 Specific details of the SSSI are not listed on the APIS website, therefore, the more conservative critical level of 1 µg/m^3 (as opposed to 3 µg/m^3 at the higher end of the range) has been used to assess NH_3. The greatest increase in annual mean NH_3 concentrations is 0.06 µg/m^3 at Transect E2_0 (0m from edge of the Deane Valley Park SSSI – Gypsy Marsh). This is greater than 1 % of the critical level and therefore does not require a further assessment by a qualified ecologist. The 1% screening of the critical level is exceeded up to 200 m at Transect E1 and up to 120 m at Transect E2.

14.140 Due to exceedances of the screening criteria for annual mean NO_x and NH_3 concentrations, and the project ecologist reviewing the site and highlighting that the Fen habitat and the Acid Grassland habitat at the Deane Valley Park SSSI – Gypsy Marsh is sensitive to nitrogen and acid deposition, the nitrogen and acid deposition has been calculated. Appendix 14.13 sets out the predicted annual nutrient nitrogen deposition for the transects.

14.141 The minimum critical load of 5 kg N/ha/yr, as available from the APIS resource and based on the grid square of the SSSI, has been used for comparison to the predicted nitrogen deposition rates. As stated previously, this is not specific to the SSSI, as the APIS website did not have site specific loads or concentrations for the Deane Valley Park SSSI – Gypsy Marsh.

14.142 The change in nitrogen deposition (including nitrogen derived ammonia) against the minimum critical load for N as a result of '2026 Future Development Year + Development Traffic' scenario is above the 1% threshold at Transects E1 and E2 (up to 200 m from edge of SSSI). This indicates these areas require evaluation by a qualified ecologist. This is assessed in Chapter 9 of this ES.

14.143 There is no critical load for acid deposition for the Fen habitat, therefore the acid deposition for the Acid Grassland has been calculated. The critical load for acid deposition from nitrogen is between 0.438 and 2.088 keq N/ha/yr with reference to APIS. For the purposes of this assessment, most conservative critical load for acid deposition has been used.

14.144 The change in acid deposition (against the minimum critical load for nitrogen derived acid) as a result of the '2026 Future Development Year + Development Traffic' scenario is above the 1% threshold at Transects E1 up to 130 m from edge of SSSI, and at Transects E2 up to 110 m from edge of SSSI. This indicates these areas require evaluation by a qualified ecologist. This is assessed in Chapter 9 (Biodiversity) of this ES.

Impacts at Hickleton

14.145 The magnitude of impact is considered to be minor to negligible for NO_2, PM_{10} and $PM_{2.5}$ at the majority of the modelled receptors, with concentrations remaining within their respective AQALs. The exception is the 6, The Mews, properties in Hickleton, which will experience a moderate impact for NO_2 and at the John O Gaunts property, which will experience a major impact for NO_2, in line with the EPUK & IAQM (2017) guidance and EIA magnitudes. The AQAL for NO_2 is exceeded at the façade of the John O Gaunts property, for both the annual mean and 1-hour mean objectives.

14.146 Therefore, it is predicted that there will be a permanent, adverse effect on NO_2, PM_{10} and $PM_{2.5}$ concentrations at the John O Gaunts receptor, which is considered to be 'Major adverse' (i.e 'Significant' in line with the EPUK & IAQM (2017) guidance) for NO_2 and 'Major-Moderate adverse' effect for 6, The Mews, in line with Table 14.5.

14.147 The Mews is not considered to be 'Significant' in line with the EPUK & IAQM (2017) guidance as, although a moderate adverse impact is predicted, the relevant air quality standards are not expected to be exceeded where the exposure is relevant, and the EPUK & IAQM (2017) guidance states: "*An individual property exposed to a moderately adverse impact might not be considered a significant effect, but many hundreds of properties exposed to a slight adverse impact could be. Such judgements will need to be made taking into account multiple factors and this guidance avoids the use of prescriptive approaches.*"

Mitigation Measures

Construction Phase – Dust Risk Assessment

14.148 A construction dust assessment has been undertaken for the Development and is presented in Appendix 14.5. The assessment has been used to identify the need for standard and best practice mitigation measures to be implemented during the construction phase of the Development. These measures will be controlled and implemented through plot-specific Framework Construction Environmental Management Plans (CEMPs), which will be required to accord with the submitted CEMP Framework document during the outline planning application.

14.149 A range of measures are suggested and summarised below, which will be utilised during the construction phases. Further best-practice general mitigation measures that will be adopted are detailed in Appendix 14.11.

14.150 The following mitigation measures are to be included within the Framework CEMP

- Earthworks
    - Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
    - Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable; and
    - Only remove the cover in small areas during work and not all at once.
- Construction
    - 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; and
    - For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.
- Trackout
    - Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
    - Avoid dry sweeping of large areas;
    - Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
    - Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;
    - Record all inspections of haul routes and any subsequent action in a site logbook;
    - 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; and
    - Access gates to be located at least 10 m from receptors where possible.

Construction Phase – Construction Traffic

14.151 In accordance with the EPUK & IAQM (2017) guidance, mitigation measures are not deemed necessary for the receptors modelled in Barnsley, as the impacts associated with construction traffic at these receptors are deemed temporary and 'Not Significant.' However, as per the impacts for construction traffic set out within Appendix 14.14, mitigation measures are required for one receptor within Hickleton (John O Gaunts), based on a substantial/major impact which results in a 'Significant' effect.

14.152 A number of mitigation measures have been proposed within Appendix 14.14.

Operational Phase - Development Operational Traffic

14.153 In accordance with the EPUK & IAQM (2017) guidance, mitigation measures are not deemed necessary as the effects associated with Development traffic are deemed permanent 'Not Significant' for the modelled receptors set out in Table 14.2.

14.154 However, it is noted that a 'Significant' adverse effect is predicted at one receptor within Hickleton, with the NO_2 annual mean, 1-hour mean and PM_{10} 24-hour mean exceeded. Therefore, in order to mitigate against significant adverse effects, the NPPF (Paragraph no.32) is clear that suitable mitigation measures should be proposed. A number of mitigation measures have been proposed within Appendix 14.14. To note, the PPG, states the following:

> *'Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact.'*

14.155 After a thorough assessment, review and consultation the impacts of the Development on the village of Hickleton, and specifically the John O Gaunts receptor, the following measures will be put forward to mitigate against the air quality impacts:

- Provide mechanical ventilation with filtration at the John O Gaunts property, which would aid in improving exposure at the specific receptor.
- Highways Improvement Scheme, which will aid in reducing queuing and idling at the Hickleton Road and A635 junction; and
- The remaining offsetting amount will be offered for air quality measures within Hickleton, which should be discussed with BMBC and DC, and could include a contribution towards an independent study, building on the initial emission study carried out by DC.

14.156 In accordance with the Barnsley (2021) SPG, a number of mitigation measures are required as the development is classified as 'Major,' which include the requirement for Type 1, Type 2 and Type 3 mitigation, with the latter in line with a pollution damage cost, which determines the level of mitigation compensation required to offset the impact of the Development. This is set out in Appendix 14.12. Examples of mitigation measures specific to a 'Major' Development that are recommended by the SPG include, but are not limited to:

Type 1 mitigation:

- Electric Vehicle Charging Points:
  - 10% of parking spaces
- Demolition/Construction Mitigation:
  - Adherence to the London Best Practice Guidance.

Type 2 mitigation:

- Travel Plan - discouraging high emission vehicle use and encouraging modal shift.
- Commercial vehicles comply with most recent European Emission Standards from scheme opening;
- Fleet operators should provide a strategy for reducing emissions;
- Fleet operators should consider joining schemes such as the South Yorkshire ECO Stars scheme.

Type 3 mitigation:

- Support measures to reduce the need to travel:
  - Local sourcing of staff, products and raw materials
- Support measures to reduce private car use:
  - Development of car clubs and car sharing with financial incentives and promotion.
- Measures to support improved public transport:
  - Provision of new or enhanced public transport services to the site.
- Further measures to promote cycling and walking:
  - Improvements to district walking and cycling networks including lighting, shelters, and information points and timetables.
- Further measures to promote sustainable travel plans:
  - Marketing aimed at encouraging a switch to sustainable modes with incentives.

14.157 As this is a hybrid planning application, a number of mitigation measures cannot be confirmed at this stage. However, it is understood that the following mitigation measures will be provided for the Development:

- Framework Travel Plan, which will include measures to promote sustainable transport and use of public transport;
- Occupiers Specific Travel Plans which will include measures to promote sustainable transport and use of public transport;
- Electric Vehicle Charging Points for each plot; and
- Cycle Storage for each plot.

14.158 It is expected that a suitably worded prior to occupation condition can be secured against each plot, which will provide a mitigation / low emission strategy, detailing the specific mitigation measures proposed in line with local policy and guidance. The implementation of such measures aims to reduce the emissions produced as a result of the operation of the proposed development and thus reduce the impacts on the impacted receptors.

Residual Effects

Construction Phase – Dust Risk Assessment

14.159 With the implementation of the mitigation set out above, in accordance with the IAQM (2023) guidance, residual construction dust effects will be Negligible Adverse (not significant in the IAQM (2023) guidance), subject to the correct implementation and management of the mitigation measures.

Construction Phase – Construction Traffic

14.160 The addition of the measures above will help reduce the impact of the Development on air quality, including the specific mitigation proposed for the receptor in Hickleton predicted to experience a 'Significant' effect. However, as the effectiveness of the type of mitigation proposed in Hickleton cannot be measured/quantified, a qualitative consideration of the significance has been derived based upon the effectiveness of the mitigation measures proposed and professional judgement.

14.161 The mitigation measures suggested for the specific impacted receptor (John O Gaunts) aims to reduce the impact of the Development and reduce the exposure of poor air quality. The mitigation measures follow the basic hierarchy principles, where prevention or avoiding cannot take place, but the reduction and minimisation (i.e. the recommendation for mechanical ventilation and filtration) and then Off-setting (by providing a damage cost).

14.162 A review of the indicative specification of a filtration system (Airclean - Indoor Air Quality Filtration System) indicates that up to 90% of NO_x/NO_2 emissions can be removed. Based upon a worst case assumption that the overall outside concentrations of 56.4 µg/m^3 will be experienced inside of the John O Gaunts receptor (due to the openable windows on the façade facing the A635), and the filtration system worked at optimal efficiency, the overall concentrations are anticipated to be well below the NO_2 air quality standards.

14.163 Based upon this and professional judgment, it is reasonable to assume the overall exposure concentrations would be less than the existing baseline position internally at the John O Gaunts property and below the NO_2 annual mean objective, as a result of the proposed filtration system. Therefore, using professional judgement, the overall 'Major to Moderate adverse' impact would be reduced to Negligible (Not Significant in line with the EPUK & IAQM (2017) guidance), as it is expected the overall receptor would experience betterment with the mitigation in place, compared to that within the pre mitigated baseline position.

Operational Phase - Development Operational Traffic

14.164 The addition of the measures above will help reduce the impact of the Development on air quality, including the specific mitigation proposed for the receptor in Hickleton predicted to experience a 'Significant' effect. However, as the effectiveness of the type of mitigation proposed in Hickleton cannot be measured/quantified, a qualitative consideration of the significance has been derived based upon the effectiveness of the mitigation measures proposed and professional judgement.

14.165 The mitigation measures suggested for the specific impacted receptor (John O Gaunts) aims to reduce the impact of the Development and reduce the exposure of poor air quality. The mitigation measures follow the basic hierarchy principles, where prevention or avoiding cannot take place, but the reduction and minimisation (i.e. the recommendation for mechanical ventilation and filtration) and then Off-setting (by providing a damage cost).

14.166 A review of the indicative specification of a filtration system (Airclean - Indoor Air Quality Filtration System) indicates that up to 90% of NO_x/NO_2 emissions can be removed. Based upon a worst case assumption that the overall outside concentrations of 60.0 µg/m^3 will be experienced inside of the John O Gaunts receptor (due to the openable windows on the façade facing the A635), and the filtration system worked at optimal efficiency, the overall concentrations are anticipated to be well below the NO_2 air quality standards.

14.167 Based upon this and professional judgment, it is reasonable to assume the overall exposure concentrations would be less than the existing baseline position internally at the John O Gaunts property and below the NO_2 annual mean objective, as a result of the proposed filtration system. Therefore, using professional judgement, the overall 'Major adverse' impact would be reduced to Negligible (Not Significant in line with the EPUK & IAQM (2017) guidance), as it is expected the overall receptor would experience betterment with the mitigation in place, compared to that within the pre mitigated baseline position.

Cumulative Effects

Construction Phase - Construction Dust Assessment

14.168 It is not known at the time of writing if any nearby committed development will be built out at the same time as this Development. However, it is reasonable to assume that any other Development coming forward would also be required to provide adequate mitigation (for example a CEMP secured by planning conditions, legal requirements or required by regulations). Based upon this, the cumulative impacts (if any), are anticipated to be, adverse, temporary, but not significant.

14.169 To note, the IAQM (2023) guidance advises:

> *"Hold regular liaison meetings with other high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes."*

Construction Phase – Construction Traffic

14.170 This section considers the impacts of the Development in conjunction with the traffic generated by other committed developments that have either already begun or completed construction, or those that have not been commenced but have a valid planning permission. The committed developments considered within this ES are set out in Chapter 13 – Transport and Access.

14.171 A review of the construction traffic (including cumulative traffic) data provided by the project transport consultants indicates that the EPUK & IAQM (2017) criteria for both LDV's and HDV's will be exceeded on a number of roads, and therefore a detailed impact assessment has been undertaken, which is set out below. The significance is then set out in paragraph 14.183

NO_2

14.172 The predicted annual mean NO_2 concentrations are set out in Table 14.9.1 in Appendix 14.9 for the '2025 Baseline' and '2025 Baseline + Development Construction Traffic + Cumulative Traffic' scenarios. The results of the assessment are outlined in more detail below.

14.173 The predicted annual mean NO_2 concentrations at all of the modelled sensitive human receptor locations are not predicted to exceed the AQAL of 40 µg/m^3, where the annual mean objective applies, in either assessment scenario.

14.174 Furthermore, the annual mean NO_2 concentrations predicted at all existing sensitive human receptors are below 60 µg/m^3 for both scenarios; if concentrations are above this, TG(22) regards this as an indicator that the NO_2 1-hour mean objective could be breached. Therefore, it is considered unlikely that the 1-hour objective will be exceeded at any of the existing sensitive receptors considered in this assessment.

14.175 The highest NO_2 concentration is predicted at R.13, representative of a residential dwelling located along the A635 Doncaster Road, west of the Cathill roundabout. The annual mean concentration predicted at this human receptor, in the '2025 Baseline + Development Construction Traffic + Cumulative Traffic' scenario, is 32.1 µg/m^3, which is 80% of the AQAL. The predicted increase in the NO_2 annual mean concentration at this human receptor is 1.2 µg/m^3 or 3% of the AQAL. Subsequently, the impact predicted at this human receptor is described as slight/minor, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.176 The largest predicted increase in NO_2 concentration from the '2025 Baseline' scenario to the '2025 Baseline + Development Construction Traffic + Cumulative Traffic' scenario is at R10, located at Rose Valley Cottage, along the Doncaster Road in Billingley. This human receptor is predicted to experience a 1.8 µg/m^3 increase, or a 5% increase compared against the AQAL. The concentration at this receptor as a result of the cumulative traffic is predicted to be 27.2 µg/m^3, which is 68% of the AQAL. The impact predicted is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.177 Overall, the impact on annual mean NO_2 concentrations is described as negligible at all modelled sensitive human receptors, with the exception of R.13 which is predicted to be slight/minor.

PM_{10}

14.178 The predicted annual mean PM_{10} concentrations are set out in Table 14.9.2 in Appendix 14.9 for the '2025 Baseline and '2025 Baseline + Development Construction Traffic + Cumulative Traffic' scenarios. The results of the assessment are outlined in more detail below.

14.179 The predicted annual mean PM_{10} concentrations at all of the modelled sensitive human receptor locations are not predicted to exceed the AQAL of 40 µg/m^3, where the annual mean objective applies, in either assessment scenario.

14.180 The highest PM_{10} concentration is predicted at R.13, representative of a residential dwelling located along the A635 Doncaster Road, west of the Cathill roundabout. The annual mean concentration predicted at this human receptor, in the '2025 Baseline + Development Construction Traffic + Cumulative Traffic' scenario, is 28.8 µg/m^3, which is 72% of the AQAL. The predicted increase in the PM_{10} annual mean concentration at this human receptor is 0.8 µg/m^3 or 2% of the AQAL. Subsequently, the impact predicted at this human receptor is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.181 The predicted number of PM_{10} 24 hour mean exceedances is calculated by using the following equation:

$$\text{Num. 24-hour exceedances} = -18.5 + 0.00145 \times \text{annual mean}^3 + \left(\frac{206}{\text{annual mean}}\right)$$

14.182 It should be noted that the number of exceedances can only be calculated if the modelled annual mean concentration at the receptors is above 14.8 µg/m^3, which is the case for this assessment. The highest PM_{10} concentration is predicted at R.13 (as set out above), which therefore predicts 23.2 exceedances, under the 35 permitted annually. On this basis, it is also reasonable to assume that the PM_{10} 24-hour concentration will not be exceeded at any of the modelled human receptor concentrations.

14.183 The largest predicted increase in PM_{10} concentration from the '2025 Baseline' scenario to the '2025 Baseline + Development Construction Traffic + Cumulative Traffic' scenario is at R10, located at Rose Valley Cottage, along the Doncaster Road in Billingley. This human receptor is predicted to experience a 1.0 µg/m^3 increase, or a 2% increase compared against the AQAL. The concentration at this receptor as a result of the cumulative traffic is predicted to be 26.4 µg/m^3, which is 66% of the AQAL. The impact predicted is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.184 Overall, the impact on annual mean PM_{10} concentrations is described as negligible at all modelled sensitive human receptors.

$PM_{2.5}$

14.185 The predicted annual mean $PM_{2.5}$ concentrations are set out in Table 14.9.3 in Appendix 14.9 for the '2025 Baseline' and '2025 Baseline + Development Construction + Cumulative Traffic' scenarios. The results of the assessment are outlined in more detail below.

14.186 The predicted annual mean $PM_{2.5}$ concentrations at all of the modelled sensitive receptor locations are not predicted to exceed the AQAL of 20 µg/m^3, where the annual mean limit applies, in either assessment scenario.

14.187 The highest $PM_{2.5}$ concentration is predicted at R.13, representative of a residential dwelling located along the A635 Doncaster Road, west of the Cathill roundabout. The annual mean concentration predicted at this human receptor, in the '2025 Baseline + Development Construction + Cumulative Traffic' scenarios, is 16.3 µg/m^3, which is 81% of the AQAL. The predicted increase in the $PM_{2.5}$ annual mean concentration at this human receptor is 0.5 µg/m^3 or 1% of the AQAL. Subsequently, the impact predicted at this human receptor is described as slight/minor, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.188 The largest predicted increase in $PM_{2.5}$ concentration from the '2025 Baseline' scenario to the '2025 Baseline + Development Construction + Cumulative Traffic' scenario is at R10, located at Rose Valley Cottage, along the Doncaster Road in Billingley. This human receptor is predicted to experience a 0.6 µg/m^3 increase, or a 3% increase compared against the AQAL. The concentration at this human receptor as a result of the with cumulative traffic is predicted to be 14.6 µg/m^3, which is 73% of the AQAL. The impact predicted is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.189 Overall, the impact on annual mean $PM_{2.5}$ concentrations is described as negligible at all modelled sensitive human receptors, with the exception of R.13 which is predicted to be slight/minor.

Summary

14.190 The magnitude of impact/change at the high sensitivity human receptors is considered to be slight/minor to negligible for NO_2 and $PM_{2.5}$ and negligible for $PM_{10,}$ with concentrations remaining within their respective AQALs. Therefore, it is predicted that there will be a temporary, adverse effect on NO_2, PM_{10} and $PM_{2.5}$ concentrations, which is considered to be 'Moderate – Minor adverse' to 'Negligible adverse' (i.e 'Not Significant' in line with the EPUK & IAQM (2017) guidance) for NO_2, in line with Table 14.5.

Ecological Impacts

14.191 A review of the construction traffic data in conjunction with the cumulative traffic provided by the project transport consultants in isolation will trigger the DMRB screening criteria for a requirement of an impact assessment at the identified ecological receptor, Deane Valley Park SSSI – Gypsy Marsh. Therefore, an assessment has been carried out to determine whether the 1% threshold will be exceeded. Should a process contribution of 1% or more of the critical level / load be predicted, it does not necessarily follow that there will be a consequent significant ecological effect; rather, it indicates the potential for such an effect to occur.

14.192 The process contribution to annual mean NO_x and NH_3 concentrations have been assessed as a percentage of the critical level. The modelled NO_x concentrations at the identified transect points are set out in Appendix 14.13 and illustrated in Figure 14.8. No background 24-hour mean nitrogen oxides concentrations are available, therefore baseline 24-hour mean concentrations have not been calculated. Notwithstanding this, the maximum changes in predicted concentrations of the 24-hour NO_X in 2025, as a result of the cumulative traffic PC has also been set out.

14.193 The greatest difference in annual mean concentrations between the '2025 Baseline' and '2025 Baseline + Development Construction Traffic + Cumulative Traffic' scenarios is an increase of 4.1 µg/m^3 at Transect E1_0 (0m from edge of the Deane Valley Park SSSI – Gypsy Marsh). This is greater than 1% of the critical level, indicating the potential for harm to habitats and species, therefore requiring further assessment by a qualified ecologist. The 1% criteria is exceeded up to 200 m on both Transects E1 and E2.

14.194 The highest 24-hour mean process contribution is seen at Transect E1 at 0m from edge of the SSSI, which is less than 10% of the short-term critical level, therefore a further detailed assessment on the NO_x 24-hour impacts at Deane Valley Park SSSI – Gypsy Marsh is not required.

14.195 Specific details of the SSSI are not listed on the APIS website, therefore, the more conservative critical level of 1 µg/m^3 (as opposed to 3 µg/m^3 at the higher end of the range) has been used to assess NH_3. The greatest increase in annual mean NH_3 concentrations is 0.07 µg/m3 at Transect E2 (0m from edge of the Deane Valley Park SSSI – Gypsy Marsh). This is greater than 1 % of the critical level and therefore does require a further assessment by a qualified ecologist. The 1% criteria is exceeded up to 200 m at Transect E1 and up to 150 m at Transect E2.

14.196 Due to exceedances of the screening criteria for annual mean NO_x concentrations, and the project ecologist reviewing the site and highlighting that the Fen habitat and the Acid Grassland habitat at the Deane Valley Park SSSI – Gypsy Marsh is sensitive to nitrogen and acid deposition, the nitrogen and acid deposition has been calculated. Appendix 14.13 sets out the predicted annual nutrient nitrogen deposition for the transects.

14.197 The minimum critical load of 5 kg N/ha/yr, as available from the APIS resource and based on the grid square of the SSSI, has been used for comparison to the predicted nitrogen deposition rates. As stated previously, this is not specific to the SSSI, as the APIS website did not have site specific loads or concentrations for the Deane Valley Park SSSI – Gypsy Marsh.

14.198 The change in nitrogen deposition (including nitrogen derived ammonia) against the minimum critical load for N as a result of the '2025 Baseline' and '2025 Baseline + Development Construction Traffic + Cumulative Traffic' scenario is above the 1% threshold at Transects E1 and E2, up to 200 m from edge of SSSI. This indicates these areas require evaluation by a qualified ecologist. This is assessed in Chapter 9 of this ES.

14.199 There is no critical load for acid deposition for the Fen habitat, therefore the acid deposition for the Acid Grassland has been calculated. The critical load for acid deposition from nitrogen is between 0.438 and 2.088 keq N/ha/yr with reference to APIS. For the purposes of this assessment, most conservative critical load for acid deposition has been used.

14.200 The change in acid deposition (against the minimum critical load for nitrogen derived acid) as a result of the '2025 Baseline + Development Construction Traffic + Cumulative Traffic' scenario is above the 1% threshold at Transects E1 (up to 120 m from edge of SSSI), and up to 90 m at Transect E2. This indicates these areas require evaluation by a qualified ecologist. This is assessed in Chapter 9 of this ES.

Impacts at Hickleton

14.201 The magnitude of impact is considered to be negligible for NO_2, PM_{10} and $PM_{2.5}$ at the majority of the modelled receptors, with concentrations remaining within their respective AQALs. The exception is the 6, The Mews, properties in Hickleton, which will experience a minor impact for NO_2 and at the John O Gaunts property, which will experience a major impact for NO_2, in line with the EPUK & IAQM (2017) guidance and EIA magnitudes. The AQAL for NO_2 is exceeded at the façade of the John O Gaunts property, for the annual mean objective.

14.202 Therefore, it is predicted that there will be a temporary, adverse effect on NO_2, PM_{10} and $PM_{2.5}$ concentrations at the John O Gaunts receptor, which, based on the use of the filtration system working at optimal efficiency (subject to the correct installation, operation and maintenance of the filtration system) is considered to be 'Negligible adverse' (i.e 'Not Significant' in line with the EPUK & IAQM (2017) guidance) for NO_2 and 'Moderate-Minor adverse' effect for 6, The Mews, ('Not Significant' based on no exceedance of the annual mean pollutant standards) in line with Table 14.5.

Operational Phase - Development Operational Traffic

14.203 A review of the operational traffic data (including cumulative traffic) provided by the project transport consultants indicates that the EPUK & IAQM (2017) criteria for both LDV's and HDV's will be exceeded on a number of roads, and therefore a detailed impact assessment has been undertaken, which is set out below. The significance is then set out in paragraph 14.215.

NO_2

14.204 The predicted annual mean NO_2 concentrations are set out in Table 14.9.4 in Appendix 14.9 for the '2026 Baseline' and '2026 Baseline + Development + Cumulative Traffic' scenarios. The results of the assessment are outlined in more detail below.

14.205 The predicted annual mean NO_2 concentrations at all of the modelled sensitive human receptor locations are not predicted to exceed the AQAL of 40 µg/m^3, where the annual mean objective applies, in either assessment scenario.

14.206 Furthermore, the annual mean NO_2 concentrations predicted at all sensitive human receptors are below 60 µg/m^3 for both scenarios; if concentrations are above this, TG(22) regards this as an indicator that the NO_2 1-hour mean objective could be breached. Therefore, it is considered unlikely that the 1-hour objective will be exceeded at any of the existing sensitive receptors considered in this assessment.

14.207 The highest NO_2 concentration is predicted at R.13, representative of a residential dwelling located along the A635 Doncaster Road, west of the Cathill roundabout. The annual mean concentration predicted at this human receptor, in the '2026 Baseline + Development Traffic + Cumulative' scenario, is 31.5 µg/m^3, which is 79% of the AQAL. The predicted increase in the NO_2 annual mean concentration at this human receptor is 2.6 µg/m^3 or 7% of the AQAL. Subsequently, the impact predicted at this human receptor is described as moderate, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.208 The largest predicted increase in NO_2 concentration from the 2025 Baseline scenario to the 2025 Baseline + Development + Cumulative Traffic scenario is at R10, located at Rose Valley Cottage, along the Doncaster Road in Billingley. This human receptor is predicted to experience a 3.3 µg/m^3 increase, or a 8% increase compared against the AQAL. The concentration at this human receptor as a result of the cumulative traffic is predicted to be 27.0 µg/m^3, which is 68% of the AQAL. The impact predicted is described as slight/minor, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.209 Overall, the impact on annual mean NO_2 concentrations is described as negligible at all modelled sensitive human receptors, other than at receptor R13, which is described as moderate, and a minor impact at R10, R12 and R30.

PM_{10}

14.210 The predicted annual mean PM_{10} concentrations are set out in Table 14.9.5 in Appendix 14.9 for the '2026 Baseline' and '2026 Baseline + Development + Cumulative Traffic' scenarios. The results of the assessment are outlined in more detail below.

14.211 The predicted annual mean PM_{10} concentrations at all of the modelled sensitive human receptor locations are not predicted to exceed the AQAL of 40 µg/m^3, where the annual mean objective applies, in either assessment scenario.

14.212 The highest PM_{10} concentration is predicted at R.13, representative of a residential dwelling located along the A635 Doncaster Road, west of the Cathill roundabout. The annual mean concentration predicted at this human receptor, in the '2026 Baseline + Development + Cumulative Traffic' scenario is 29.8 µg/m^3, which is 75% of the AQAL. The predicted increase in the PM_{10} annual mean concentration at this human receptor is 1.9 µg/m^3 or 5% of the AQAL. Subsequently, the impact predicted at this human receptor is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.213 The predicted number of PM_{10} 24 hour mean exceedances is calculated by using the following equation:

$$\text{Num. 24-hour exceedances} = -18.5 + 0.00145 \times \text{annual mean}^3 + \left(\frac{206}{\text{annual mean}}\right)$$

14.214 It should be noted that the number of exceedances can only be calculated if the modelled annual mean concentration at the receptors is above 14.8 µg/m^3, which is the case for this assessment. The highest PM_{10} concentration is predicted at R.13 (as set out above), which therefore predicts 26.9 exceedances, under the 35 permitted annually. On this basis, it is also reasonable to assume that the PM_{10} 24-hour concentration will not be exceeded at any of the modelled human receptor concentrations.

14.215 The largest predicted increase in PM_{10} concentration from the '2026 Baseline' scenario to the '2026 Baseline + Development + Cumulative Traffic' scenario is at R10, located at Rose Valley Cottage, along the Doncaster Road in Billingley. This human receptor is predicted to experience a 1.9 µg/m^3 increase, or a 5% increase compared against the AQAL. The concentration at this receptor as a result of the cumulative traffic is predicted to be 27.3 µg/m^3, which is 68% of the AQAL. The impact predicted is described as negligible, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.216 Overall, the impact on annual mean PM_{10} concentrations is described as negligible at all modelled sensitive human receptors.

$PM_{2.5}$

14.217 The predicted annual mean $PM_{2.5}$ concentrations are set out in Table 14.9.6 in Appendix 14.9 for the '2026 Baseline' and '2026 Baseline + Development + Cumulative Traffic' scenarios. The results of the assessment are outlined in more detail below.

14.218 The predicted annual mean $PM_{2.5}$ concentrations at all of the modelled sensitive human receptor locations are not predicted to exceed the AQAL of 20 µg/m^3, where the annual mean limit applies, in either assessment scenario.

14.219 The highest $PM_{2.5}$ concentration is predicted at R.13, representative of a residential dwelling located along the A635 Doncaster Road, west of the Cathill roundabout. The annual mean concentration predicted at this human receptor, in the '2026 Baseline + Development Traffic + Cumulative Traffic' scenarios, is 16.9 µg/m^3, which is 84% of the AQAL. Subsequently, the impact predicted at this human receptor is described as slight/minor, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.220 The largest predicted increase in $PM_{2.5}$ concentration from the '2026 Baseline' scenario to the '2026 Baseline + Development + Cumulative Traffic' scenario is at R10, located at Rose Valley Cottage, along the Doncaster Road in Billingley. This human receptor is predicted to experience a 1.2 µg/m^3 increase, or a 6% increase compared against the AQAL. The concentration at this receptor as a result of the cumulative traffic is predicted to be 15.2 µg/m^3, which is 76% of the AQAL. The impact predicted is described as moderate, in accordance with the EPUK & IAQM (2017) guidance and EIA magnitudes.

14.221 Overall, the impact on annual mean $PM_{2.5}$ concentrations is described as negligible at all modelled human sensitive receptors, with the exception of R10 which is moderate and a slight/minor impact at R12 and R13.

Summary

14.222 The magnitude of impact is considered to be negligible for NO_2 other than at four receptors, three of which (R10, R12 and R30) are predicted to experience a slight/minor impact, and one (R13) predicted to experience a moderate impact. Whilst all receptors for are predicted to experience a negligible impact for PM_{10}, two receptors (R12 and R13) are predicted to experience a slight/minor impact for $PM_{2.5}$ and one receptor (R10) is predicted to experience a moderate change (with the remaining predicted to experience a negligible change). All concentrations are predicted to be remaining within their respective AQALs.

14.223 Therefore, it is predicted that there will be a permanent, adverse effect on NO_2, PM_{10} and $PM_{2.5}$ concentrations, which is considered to be mostly 'Negligible adverse' other than at R13 for NO_2, which is expected to experience a 'Major-Moderate adverse' effect and a 'Moderate – Minor adverse' effect for R10, R12 and R30, in line with Table 14.5 (considered to be Not Significant in line with the EPUK & IAQM (2017) guidance.

14.224 R10 is also expected to experience a 'Major-moderate adverse' effect and a 'Moderate – minor adverse' effect for R12 and R13 for $PM_{2.5}$, in line with Table 14.5 (considered to be Not Significant in line with the EPUK & IAQM (2017) guidance.

Ecological Impacts

14.225 A review of the Development traffic data in conjunction with the cumulative traffic provided by the project transport consultants in isolation will trigger the DMRB screening criteria for a requirement of an impact assessment at the identified ecological receptor, Deane Valley Park SSSI – Gypsy Marsh. Therefore, an assessment has been carried out to determine whether the 1% threshold will be exceeded. Should a process contribution of 1% or more of the critical level / load be predicted, it does not necessarily follow that there will be a consequent significant ecological effect; rather, it indicates the potential for such an effect to occur.

14.226 The process contribution to annual mean NO_x and NH_3 concentrations have been assessed as a percentage of the critical level. The modelled NO_x concentrations at the identified transect points are set out in Appendix 14.13 and illustrated in Figure 14.8. No background 24-hour mean nitrogen oxides concentrations are available, therefore baseline 24-hour mean concentrations have not been calculated. Notwithstanding this, the maximum changes in predicted concentrations of the 24-hour NO_X in 2026, as a result of the Development traffic (Process Contributions, PC) has also been set out.

14.227 The greatest difference in annual mean concentrations between the '2026 Baseline' and '2026 Baseline + Development + Cumulative Traffic' scenarios is an increase of 9.8 µg/m^3 at Transect E1 (0m from edge of the Deane Valley Park SSSI – Gypsy Marsh). This is greater than 1% of the critical level, indicating the potential for harm to habitats and species, therefore requiring further assessment by a qualified ecologist. The 1% criteria is exceeded up to 200 m on both Transects E1 and E2.

14.228 The highest 24-hour mean process contribution is seen at Transect E1 at 0m from edge of the SSSI, which is less than 10% of the short-term critical level, therefore a further detailed assessment on the NO_x 24-hour impacts at Deane Valley Park SSSI – Gypsy Marsh is not required.

14.229 Specific details of the SSSI are not listed on the APIS website, therefore, the more conservative critical level of 1 µg/m^3 (as opposed to 3 µg/m^3 at the higher end of the range) has been used to assess NH_3. The greatest increase in annual mean NH_3 concentrations is 0.12 µg/m3 at Transect E2 (0m from edge of the Deane Valley Park SSSI – Gypsy Marsh). This is greater than 1 % of the critical level and therefore does require a further assessment by a qualified ecologist. The 1% criteria is exceeded up to 200 m at Transect E1 and Transect E2.

14.230 Due to exceedances of the screening criteria for annual mean NO_x and NH_3 concentrations, and the project ecologist reviewing the site and highlighting that the Fen habitat and the Acid Grassland habitat at the Deane Valley Park SSSI – Gypsy Marsh is sensitive to nitrogen and acid deposition, the nitrogen and acid deposition has been calculated. Appendix 14.13 sets out the predicted annual nutrient nitrogen deposition for the transects.

14.231 The minimum critical load of 5 kg N/ha/yr, as available from the APIS resource and based on the grid square of the SSSI, has been used for comparison to the predicted nitrogen deposition rates. As stated previously, this is not specific to the SSSI, as the APIS website did not have site specific loads or concentrations for the Deane Valley Park SSSI – Gypsy Marsh.

14.232 The change in nitrogen deposition (including nitrogen derived ammonia) against the minimum critical load for N as a result of the '2026 Baseline' and '2026 Baseline + Development + Cumulative Traffic' scenario is above the 1% threshold at Transects E1 and E2, up to 200 m from edge of SSSI. This indicates these areas require evaluation by a qualified ecologist. This is assessed in Chapter 9 of this ES.

14.233 There is no critical load for acid deposition for the Fen habitat, therefore the acid deposition for the Acid Grassland has been calculated. The critical load for acid deposition from nitrogen is between 0.438 and 2.088 keq N/ha/yr with reference to APIS. For the purposes of this assessment, most conservative critical load for acid deposition has been used.

14.234 The change in acid deposition (against the minimum critical load for nitrogen derived acid) as a result of the '2026 Baseline' and '2026 Baseline + Development + Cumulative Traffic' scenario is above the 1% threshold at Transects E1 and Transect E2, up to 200 m from the edge of the SSSI. This indicates these areas require evaluation by a qualified ecologist. This is assessed in Chapter 9 of this ES.

Impacts at Hickleton

14.235 The magnitude of impact is considered to be minor to negligible for NO_2, PM_{10} and $PM_{2.5}$ at the majority of the modelled receptors, with concentrations remaining within their respective AQALs. The exception is the 6, The Mews, properties in Hickleton, which will experience a moderate impact for NO_2 and at the John O Gaunts property, which will experience a major impact for NO_2, in line with the EPUK & IAQM (2017) guidance and EIA magnitudes. The AQAL for NO_2 is exceeded at the façade of the John O Gaunts property, for both the annual mean and 1-hour mean objectives.

14.236 As per the Residual Impact section, it is predicted that there will be a permanent, adverse effect on NO_2, PM_{10} and $PM_{2.5}$ concentrations at the John O Gaunts receptor, which, based on the use of the filtration system working at optimal efficiency (subject to the correct installation, operation and maintenance of the filtration system)is considered to be 'Negligible adverse' (i.e 'Not Significant' in line with the EPUK & IAQM (2017) guidance) for NO_2 and 'Major-Moderate adverse' effect for 6, The Mews ('Not Significant' based on no exceedance of the annual mean pollutant standards), in line with Table 14.5.

Summary

14.237 This Chapter has considered the potential impacts of dust emissions from the construction phase, and has also considered the potential impact of emissions from construction and operational road traffic (with and without the consideration of cumulative traffic) associated with the Development on NO_2, PM_{10} and $PM_{2.5}$ concentrations at sensitive human receptor locations adjacent to the impacted highways, both with and without the. Furthermore, a consideration of nitrogen and acid deposition at the Dearne Valley Park SSSI – Gypsy Marsh.

14.238 The impact of dust emissions arising from activities associated with the construction phase of the Development at existing sensitive receptors in the vicinity of the Site are considered 'Negligible adverse' (not significant in line with the IAQM (2023) guidance) with the inclusion of secondary mitigation set out in the 'Mitigation Measures' section.

14.239 The air quality impacts of emissions from road traffic emissions associated with the construction phase of the Development on NO_2, PM_{10} and $PM_{2.5}$ concentrations at modelled existing sensitive receptors within Goldthorpe, Barnsley are considered, at worst, 'Negligible adverse', without the inclusion of additional mitigation. It is, however, noted that 'Major adverse' effects are predicted at receptors within Hickleton, notably the John O Gaunts property. A qualitative assessment on the significance with mitigation (Further details on the mitigation approach in Hickleton has been set out in Appendix 14.4) in place has been undertaken, and with the proposed mitigation in place the level of exposure would be 'not significant.'

14.240 The air quality impacts of emissions from road traffic emissions associated with the operational phase of the Development on NO_2, PM_{10} and $PM_{2.5}$ concentrations at modelled existing sensitive receptors are considered 'Not Significant', without the inclusion of additional mitigation not considered within the Development. It is, however, noted that 'Major adverse' effects are predicted at receptors within Hickleton, notably the John O Gaunts property. A qualitative assessment on the significance with mitigation (Further details on the mitigation approach in Hickleton has been set out in Appendix 14.4) in place has been undertaken, and with the proposed mitigation in place the level of exposure would be 'not significant.' Based on the results of the assessment, and in accordance with the Barnsley (2021) SPG, Type 1, Type 2 and Type 3 mitigation measures are required for the Development, with a pollution damage cost determining the level of mitigation compensation required to offset the impact of the Development, as set out in Appendix 14.12. These mitigation measures are expected to be secured through a suitably worded

prior to occupation condition which can be secured against each plot, and will provide a mitigation strategy, detailing the specific mitigation measures proposed in line with local policy and guidance. As there is a bespoke issue within Hickleton, mitigation measures for receptors in the village are set out in Appendix 14.14.

14.241 The nitrogen deposition for the construction and operational phases, including the cumulative assessment, exceeds the 1% critical level and load criteria at the ecological receptor. The impact of the construction and operational phases on this ecological receptor are set out in Chapter 9 – Biodiversity, including the significance of the impacts as well as the mitigation that should be provided for both the Fen habitat and Acid Grassland habitat.

14.242 Table 14.10 contains a summary of the likely significant effects of the Development.

Table 14.10: Table of Significance – Air Quality

Potential Effect	Nature of Effect (Permanent/ Temporary)	Significance (Major/Moderate/Minor) (Beneficial/Adverse/Negligible)	Mitigation / Enhancement Measures	Geographical Importance*							Residual Effects (Major/Moderate/Minor) (Beneficial/Adverse/Negligible)
				I	UK	E	R	C	B	L	
Construction											
Human receptors exposed to elevated pollutant concentrations (PM_{10}) (construction dust emissions)	Temporary	-	Yes							x	Negligible Adverse (Not Significant)
Human receptors exposed to elevated pollutant concentration (NO_2, PM_{10} and $PM_{2.5}$ (emissions from vehicle exhausts) – Goldthorpe	Temporary	Negligible adverse for NO_2, PM_{10} and $PM_{2.5}$	Yes							x	The same as the pre mitigation scenario. Negligible adverse
Ecological receptors exposed to elevated pollutant concentration (NO_x, NH_3, nitrogen and acid deposition) (emissions from vehicle exhausts) – Goldthorpe	Temporary	The 1% screening criteria is exceeded at a number of transect points at the Deane Valley Park SSSI – Gypsy Marsh. The Significance is determined in Chapter 9.	Yes							x	Significance determined in Chapter 9.

Human receptors exposed to elevated pollutant concentration (NO_2, PM_{10} and $PM_{2.5}$) (emissions from vehicle exhausts) Hickleton	Temporary	Negligible adverse for NO_2, PM_{10} and $PM_{2.5}$ at the majority of receptors. A Major adverse effect is predicted at the John O Gaunts receptor for NO_2.	Yes							x	The effectiveness of the mitigation measures provided for the 'Significant' impact at the John O Gaunts receptor cannot be measures/quantified, therefore a qualitative assessment of the effectiveness of the mitigation measures has been undertaken. With the proposed filtration in place, which should be correctly fitted, operated and maintained, the mitigation aims to reduce to the exposure of poor air quality at the receptor, to a level that will be considered Negligible adverse (i.e. Not Significant).
Completed Development											
Human receptors exposed to elevated pollutant concentration (NO_2, PM_{10} and $PM_{2.5}$ (emissions from vehicle exhausts) – Goldthorpe	Permanent	Moderate to minor to negligible adverse for NO_2 and $PM_{2.5}$. Negligible for PM_{10}.	Yes							x	The same as the pre mitigation scenario. Moderate to minor to negligible adverse for NO_2 and $PM_{2.5}$. Negligible for PM_{10}.
Ecological receptors exposed to elevated pollutant concentration (NO_x, NH_3, nitrogen and acid deposition) (emissions from vehicle exhausts) – Goldthorpe	Permanent	The 1% screening criteria is exceeded at a number of transect points at the Deane Valley Park SSSI – Gypsy Marsh. The Significance is determined in Chapter 9.	Yes							x	Significance determined in Chapter 9.

Human receptors exposed to elevated pollutant concentration (NO_2, PM_{10} and $PM_{2.5}$) (emissions from vehicle exhausts) Hickleton	Temporary	Moderate – Minor to Negligible adverse effects for NO_2 at the majority of receptors, with Negligible adverse effects predicted at all receptors for PM_{10} and $PM_{2.5}$ A Major – Moderate effect is predicted at 6, The Mews receptor and a Major adverse effect is predicted at the John O Gaunts receptor for NO_2.	Yes							x	The effectiveness of the mitigation measures provided for the 'Significant' impact at the John O Gaunts receptor cannot be measures/quantified, therefore a qualitative assessment of the effectiveness of the mitigation measures has been undertaken. With the proposed filtration in place, which should be correctly fitted, operated and maintained, the mitigation aims to reduce to the exposure of poor air quality at the receptor, to a level that will be considered Negligible adverse (i.e. Not Significant).
Cumulative Effects											
Construction											
Human receptors exposed to elevated pollutant concentrations (PM_{10}) (construction dust emissions)	Temporary	-	Yes							x	Negligible Adverse (Not Significant)
Human receptors exposed to elevated pollutant concentration (NO_2, PM_{10} and $PM_{2.5}$ (emissions from vehicle exhausts) – Goldthorpe	Temporary	Moderate – Minor to Negligible adverse for NO_2, and $PM_{2.5}$. Negligible adverse for PM_{10}	Yes							x	The same as the pre mitigation scenario. Moderate – Minor to Negligible adverse for NO_2, and $PM_{2.5}$. Negligible adverse for PM_{10}

Ecological receptors exposed to elevated pollutant concentration (NO_x, NH_3, nitrogen and acid deposition) (emissions from vehicle exhausts) – Goldthorpe	Temporary	The 1% screening criteria is exceeded at a number of transect points at the Deane Valley Park SSSI – Gypsy Marsh. The Significance is determined in Chapter 9.	Yes							x	Significance determined in Chapter 9.
Human receptors exposed to elevated pollutant concentration (NO_2, PM_{10} and $PM_{2.5}$) (emissions from vehicle exhausts) Hickleton	Temporary	Negligible adverse for NO_2, PM_{10} and $PM_{2.5}$ at the majority of receptors. A Moderate - Minor adverse effect is predicted at 6 The Mews receptor, with a Major adverse effect predicted at the John O Gaunts receptor for NO_2.	Yes							x	The effectiveness of the mitigation measures provided for the 'Significant' impact at the John O Gaunts receptor cannot be measures/quantified, therefore a qualitative assessment of the effectiveness of the mitigation measures has been undertaken. With the proposed filtration in place, which should be correctly fitted, operated and maintained, the mitigation aims to reduce to the exposure of poor air quality at the receptor, to a level that will be considered Negligible adverse (i.e. Not Significant).
Completed Development											
Human receptors exposed to elevated pollutant concentration (NO_2, PM_{10} and $PM_{2.5}$ (emissions from vehicle exhausts) – Goldthorpe	Permanent	Major - Moderate to negligible adverse for NO_2 and $PM_{2.5}$. Negligible for PM_{10}.	Yes							x	The same as the pre mitigation scenario. Major - Moderate to negligible adverse for NO_2 and $PM_{2.5}$. Negligible for PM_{10}.

Ecological receptors exposed to elevated pollutant concentration (NO_x, NH_3, nitrogen and acid deposition) (emissions from vehicle exhausts) – Goldthorpe	Permanent	The 1% screening criteria is exceeded at a number of transect points at the Deane Valley Park SSSI – Gypsy Marsh. The Significance is determined in Chapter 9.	Yes							x	Significance determined in Chapter 9.
Human receptors exposed to elevated pollutant concentration (NO_2, PM_{10} and $PM_{2.5}$) (emissions from vehicle exhausts) Hickleton	Permanent	Moderate – Minor to Negligible adverse effects for NO_2 at the majority of receptors, with Negligible adverse effects predicted at all receptors for PM_{10} and $PM_{2.5}$ A Major – Moderate effect is predicted at 6, The Mews receptor and a Major adverse effect is predicted at the John O Gaunts receptor for NO_2.	Yes							x	The effectiveness of the mitigation measures provided for the 'Significant' impact at the John O Gaunts receptor cannot be measures/quantified, therefore a qualitative assessment of the effectiveness of the mitigation measures has been undertaken. With the proposed filtration in place, which should be correctly fitted, operated and maintained, the mitigation aims to reduce to the exposure of poor air quality at the receptor, to a level that will be considered Negligible adverse (i.e. Not Significant).

*** Geographical Level of Importance**
I = International; UK = United Kingdom; E = England; R = Regional; C = County; B = Borough; L = Local

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