UNIVERSAL DESTINATIONS & EXPERIENCES UK PROJECT

Former Kempston Hardwick Brickworks and adjoining land, Bedford

Environmental Statement Volume 1

Chapter 8 - Air Quality

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UNIVERSAL DESTINATIONS & EXPERIENCES

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TABLES

8. AIR QUALITY

8.1. INTRODUCTION

8.1.1. This chapter has been prepared in support of the planning proposal for the Proposed Development as described in **Chapter 2: Description of the Proposed Development (Volume 1)** of the Environmental Statement (ES).

SUPPORTING DOCUMENTATION

8.1.2. This chapter is intended to be read in conjunction with the following supporting chapters, figures and appendices:

- **Figure 8.1: Air Quality Assessment Study Area (Volume 2)**;
- **Figure 8.2: Air Quality Monitoring Sites (Volume 2)**;
- **Figure 8.3: Construction Dust and Receptors (Volume 2)**;
- **Figure 8.4: Traffic Emissions and Human Receptors (Volume 2)**;
- **Figure 8.5: Traffic Emissions and Ecological Receptors – Maulden Wood Ancient Woodland & Maulden Wood and Pennyfather's Hills Site of Special Scientific Interest (Volume 2)**;
- **Figure 8.6: Traffic Emissions and Ecological Receptors – County Wildlife Sites (Volume 2)**;
- **Appendix 8.1: Traffic Data (Volume 3)**;
- **Appendix 8.2: Air Quality Model Details (Volume 3)**;
- **Appendix 8.3: Background Air Pollution Data (Volume 3)**;
- **Appendix 8.4: Air Quality Monitoring Data (Volume 3)**;
- **Appendix 8.5: Details of Selected Human Receptors (Volume 3)**;
- **Appendix 8.6: Details of Ecological Receptor Transects (Volume 3)**;
- **Appendix 8.7: Results for Human Receptors (Volume 3)**;
- **Appendix 8.8: Results for Ecological Receptors (Volume 3)**;
- **Appendix 2.3: Outline Construction Environmental Management Plan (OCEMP) (Volume 3)**;
- **Chapter 5: Traffic and Transport (Volume 1)**; and
- **Appendix 5.1: Transport Assessment (Volume 3)**.

LEGISLATIVE FRAMEWORK, POLICY, AND GUIDANCE

8.1.3. The relevant legislation, policy, and guidance to the assessment of air quality effects associated with the Proposed Development are detailed in **Appendix 3.1: Legislation, Policy, and Guidance for all ES Technical Topics (Volume 3)**.

8.1.4. Statutory air quality standards as set out in *The Air Quality (England) Regulations 2000 (as amended in 2002)* (**Ref. 8.1** and **Ref. 8.2**), *The Air Quality Standards Regulations 2010 (as amended 2016*) (**Ref. 8.3** and **Ref. 8.4**), *The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020* (**Ref. 8.5**) and *The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023* (**Ref. 8.6**) that are relevant to the assessment are given in **Table 8-1**.

Table 8-1 - Relevant air quality standards

Pollutant	Concentration in micrograms per cubic metre (µg/m³)	Number of exceedances allowed in a calendar year	Set in regulations as
Annual mean nitrogen dioxide (NO_2)	40	None	Objective and limit value for the protection of public health
1-hour mean NO_2	200	No more than 18 (see note A)	Objective and limit value for the protection of public health
Annual mean nitrogen oxides (NO_x)	30	None	Critical level for the protection of vegetation
Annual mean PM_{10} (coarse particulate matter, less than 10 micrometres in diameter)	40	None	Objective and limit value for the protection of public health
24-hour mean PM_{10}	50	No more than 35 (see note B)	Objective and limit value for the protection of public health
Annual mean $PM_{2.5}$ (fine particulate matter, less than 2.5 micrometres in diameter)	20	None	Limit value for the protection of public health
Annual mean $PM_{2.5}$	12	None	Interim target for 2028 (non-statutory) for the protection of public health
Annual mean $PM_{2.5}$	10	None	Target for 2040 for the protection of public health

Notes:

A – Department of Environment, Food and Rural Affairs (Defra) Local Air Quality Management (LAQM) technical guidance LAQM.TG(22) (**Ref. 8.7**) advises that if the annual mean NO_2 concentration does not exceed 60µg/m³ then it is likely that the 1-hour mean NO_2 air quality standard is met.

B – Defra guidance LAQM.TG(22) (**Ref. 8.7**) indicates that if the annual mean PM_{10} concentration is less than 32µg/m³ then it is likely that the 24-hour mean PM_{10} air quality standard is met.

8.2. ASSUMPTIONS USED TO INFORM ASSESSMENT

8.2.1. The assessment presented in this chapter has been based on the Proposed Development as described in **Chapter 2: Description of the Proposed Development (Volume 1)**. This chapter has also used the following assumptions to build on the information in Chapter 2: Description of the Proposed Development (Volume 1) to support undertaking an assessment of a cautious worst case (where the phrase "cautious worst case" is used it means "a cautious worst case that provides a robust assessment of likely significant effects").

8.2.2. The air quality assessment is based on the following assumptions:

- Site boundary as shown in **Site Location Plan (Document Reference 1.6.0)**;
- Traffic data included in **Appendix 8.1: Traffic Data (Volume 3)**;
- Air quality model assumptions are given in **Appendix 8.2: Air Quality Model Details (Volume 3)**;
- As a cautious worst-case assumption, the traffic data assumes no East West Rail (EWR) Station;
- Routine and primary backup energy requirements for the UDX development will be provided by UK Power Networks and will be connected to the energy centre, which is located within the Lake Zone as shown in the **Parameter Plan - Utility Compound (Document Reference 1.14.0)**. A ten-megawatt (MW) Battery Energy Storage System (BESS) and/or standby diesel generators may also be required for life-safety purposes. Standby diesel generators will routinely be tested for approximately one hour per month with annual load testing over a period of approximately four hours. Such limited periods of operation are unlikely to give rise to a significant effect in terms of short- and long- term air quality impacts;
- The proposed Water Processing and Collection Plant, located within the Lake Zone as shown in the **Parameter Plan - Utility Compound (Document Reference 1.14.0)** is to process water for reuse within the Site for wash down, toilets etc and is not considered to be a potential source of odour that will give rise to a significant effect;
- Proposed foul water pumping stations, as shown in the **Parameter Plan - Utility Compound (Document Reference 1.14.0)** will incorporate odour abatement for venting air and as such are unlikely to give rise to a significant effect; and
- Within the theme park, day-to-day pyrotechnic effects such as gas flares are expected to operate in very short bursts and not continuously. Emissions from pyrotechnics will rapidly disperse and are unlikely to give rise to a significant effect at human and ecological receptors. No regular firework displays are anticipated as part of the day-to-day operation of the Proposed Development. The use of fireworks will be in accordance with existing regulatory requirements and committed limitations including that no more than ten fireworks shows are permitted each year (see CZ2.1 in **Design Standards (Document Reference 6.3.0)**).

8.3. ENGAGEMENT, SCOPE, AND STUDY AREA

ENGAGEMENT

8.3.1. **Table 8-2** provides a summary of the engagement activities undertaken in support of the preparation of this assessment.

Table 8-2 - Summary of engagement undertaken

Body/organisation	Individual/statutory body/organisation	Meeting dates and other forms of engagement	Summary of outcome of discussions
Bedford Borough Council (Bedford BC)	Regulatory Services	10 April 2024	Discussion and agreement of the approach to the air quality assessment - as subsequently undertaken and presented in this chapter.

SCOPE OF THE ASSESSMENT

8.3.2. This assessment has been undertaken in line with best practice guidance and using professional judgement with due regard to legal, policy and guidance, the available information, and associated limitations and uncertainties.

8.3.3. The assessment of air quality has considered the potential significant effects from emission releases during the Construction Phase and Operational Phase of the Proposed Development.

8.3.4. The elements shown in **Table 8-3** are considered to have the potential to give rise to likely significant effects during construction and/or operation of the Proposed Development and have therefore been considered within this assessment.

Table 8-3 - Elements scoped into the assessment

Element scoped in	Construction Phase	Operational Phase
Fugitive dust emissions affecting amenity, human health at residential premises, schools and hospitals (human receptors), and designated habitat sites (ecological receptors).	✓	
Road traffic emissions affecting air quality in terms of ambient concentrations of NO_2, PM_{10} and $PM_{2.5}$ at human receptors.	✓	✓
Road traffic emissions affecting air quality in terms of ambient concentrations of NOx and ammonia (NH_3), and nitrogen deposition rate (N-dep) at ecological receptors.		✓

Elements Scoped out of the Assessment

8.3.5. The elements shown in **Table 8-4** are not considered to give rise to likely significant effects as a result of the Proposed Development and have therefore not been considered within this assessment.

Table 8-4 - Elements scoped out of the assessment

Element scoped out	Justification
Emissions from operation of non-road mobile machinery (NRMM) affecting air quality at human receptors.	Operation of NRMM (e.g., cranes, excavators, dozers, graders, dump trucks, electrical generators etc) will be limited to working hours and only when and where required within the Site. Exhaust emissions are unlikely to have a substantial impact on pollutant concentrations at sensitive receptor locations.
Energy centre emissions affecting air quality at human and ecological receptors.	The location of the proposed energy centre is shown as shown in the **Parameter Plan - Utility Compound (Document Reference 1.14.0)**. Routine and primary backup electrical energy requirements for the UDX development will be provided by UK Power Networks. A BESS of up to 10MW capacity is proposed to provide further back-up electrical power supply in the event of a grid power outage. Any BESS will be equipped with a fire prevention and detection system including continuous off-gas monitoring. A fire event is therefore considered unlikely and therefore emissions from a BESS fire have been scoped out. Alternatively, or in addition to a BESS, fixed (non-mobile) back-up diesel generators may be required. These would be excluded from Specified Generator controls as testing would be less than 50 hours per generator per year. As the Site is not within 2km of a Site of Special Scientific Interest (SSSI) or 2.5km of a Special Area of Conservation, Special Protection Area or Ramsar wetland, a permit for a 'low risk' Medium Combustion Plant from the Environment Agency would be required (**Ref. 8.10**, **Ref. 8.11**, **Ref. 8.12**). If necessary, back-up diesel generator emissions are unlikely to cause a significant effect from short-term or long-term air quality impacts. It is possible that, for the Theme Park Opening Year in 2031, natural gas boilers capable of providing up to 18MW total thermal output (requiring less than 20MW thermal input) would be required for heat and hot water if a fully electric system is not available; however, this is considered an unlikely scenario and gas boilers would only be used for up to a year after Theme Park Opening Year. If such boilers are necessary, a permit for a 'low risk' Medium Combustion Plant from the Environment Agency would be required (**Ref. 8.10**, **Ref. 8.11**, **Ref. 8.12**). If necessary, natural gas boiler emissions are unlikely to cause a significant effect from short-term or long-term air quality impacts.
Construction Phase road traffic emissions affecting air quality in relation to ambient concentrations of NOx and NH_3, and N-dep at ecological receptors.	Construction traffic emissions are expected to peak in 2029 but are unlikely to be sufficient to have any noticeable short- or long- term air quality impacts at ecological receptors.
Operational Phase road traffic emissions affecting short-term air quality in relation to ambient concentrations of NOx and NH_3, and N-dep at ecological receptors.	Operational traffic emissions are unlikely to have any noticeable short-term air quality impacts at ecological receptors.

Element scoped out	Justification
Rail emissions affecting air quality at human receptors.	Routine train services stopping at Wixams Rail Station on the Midland Main Railway Line are expected to be electric. Train services on the Marston Vale Railway Line have been assumed to be diesel, with up to three trains stopping at the proposed EWR Station per hour in each direction. This stopping service frequency is insufficient for diesel trains to have a noticeable impact on air quality in the surrounding area.
Odour emissions from on-Site activities affecting amenity at human receptors.	On-Site sources of odour including commercial kitchen and waste holding areas will be designed to abate odour emissions using Best Practicable Means to avoid causing complaints and statutory nuisance. The proposed Water Processing and Collection Plant, in the southern part of the Lake Zone, is to process water for reuse within the Site for wash down, toilets etc and is not considered to be a potential source of odour that will give rise to a significant effect. The proposed foul water pumping stations within the Lake Zone will incorporate odour abatement for venting air and as such are unlikely to give rise to a significant effect.
Volatile organic compound (VOC) emissions from the proposed Highway Service Area within the West Gateway Zone affecting human receptors.	It will be necessary for the relevant Undertaker[1] to obtain a permit from Bedford BC for a Part B installation under *The Environmental Permitting Regulations* (**Ref. 8.10** and **Ref. 8.11**). The permit will require stage 1 and 2 petrol vapour recovery for refilling of storage tanks and filling of individual vehicles, respectively. On this basis, VOC emissions will be mitigated and not give rise to a significant effect.
Emissions from pyrotechnics and fireworks affecting air quality at human and ecological receptors.	Day-to-day pyrotechnic effects such as gas flares are expected to operate in very short bursts and not continuously. Emissions from pyrotechnics will rapidly disperse and are unlikely to give rise to a significant effect at human and ecological receptors. No regular firework displays are anticipated as part of the day-to-day operation of the Proposed Development. The use of fireworks will be subject to the requirements and restrictions of The Fireworks Regulations to mitigate against emissions from pyrotechnics and fireworks affecting air quality at human and ecological receptors. Firework and drone show locations will have a minimum horizontal clearance of 50m from any Ecological Enhancement Areas within which no Fireworks would be launched/detonated and no drone shows would take place. Fireworks launch locations will be positioned so that the fallout zone does not overlap with Ecological Enhancement Areas. No more than 10 Fireworks shows are permitted each year. Restrictions relating to the use of fireworks will be controlled by CZ2.1 in the **Design Standards (Document Reference 6.3.0)**.

[1] The persons (corporate or otherwise) who are permitted to carry out the Proposed Development (including their contractors and other persons appointed by them in connection with the carrying out of the Proposed Development).

EXTENT OF THE STUDY AREA

8.3.6. The study area is illustrated in **Figure 8.1: Air Quality Assessment Study Area (Volume 2)**. Beyond the study area any air quality impacts will be negligible and the effects not significant.

8.3.7. The extent of the study area has been determined with regard to the following:

- The spatial limits of traffic predictions for the Proposed Development;
- The Site boundary;
- The locations of potentially sensitive human and ecological receptors as shown by available map data, including:
  - Ordnance Survey OpenData (**Ref. 8.13**);
  - Google Earth Pro (**Ref. 8.14**) and Street View (**Ref. 8.15**);
  - Department for Environment, Food and Rural Affairs (Defra) Multi-Agency Geographic Information for the Countryside (MAGIC) website (**Ref. 8.16**);
  - Bedfordshire and Luton Biodiversity Recording and Monitoring Centre Information on County Wildlife Site (CWS) designations (**Ref. 8.17**);
- The Institute of Air Quality Management (IAQM) *Guidance on the assessment of dust from demolition and construction* (**Ref. 8.18**);
- Joint guidance from *Environmental Protection UK (EPUK) and IAQM Land-Use Planning & Development Control: Planning for Air Quality* (**Ref. 8.19**); and
- *Design Manual for Roads and Bridges LA 105 – Air Quality* (**Ref. 8.20**).

8.3.8. Predictions of baseline and future traffic movements without and with the Proposed Development have been made to support the Traffic and Transport assessment, as described in **Chapter 5: Traffic and Transport (Volume 1)**. A traffic model was developed for this purpose. Also, for the purposes of the air quality assessment only, traffic counts and predictions were made for roads within the Bedford Town Centre Air Quality Management Area (AQMA). In addition, the A6 adjacent to Maulden Wood and Pennyfather's Hills SSSI and Maulden Wood Ancient Woodland (AW) has been included. The extents of the road network considered in this assessment are shown in **Figure 8.1: Air Quality Assessment Study Area (Volume 2)**.

8.3.9. The study area has four components:

- The area within which dust impacts may occur extending out to a distance of 250m from the Site boundary and out to 50m alongside roads to 250m from Site entrance(s);
- The area within 200m of roads included in the traffic model (**Chapter 5: Traffic and Transport (Volume 1)**);
- The area within 200m of roads that are most likely to be affected within Bedford Town Centre AQMA; and
- The area within 200m of the Maulden Wood and Pennyfather's Hills SSSI and Maulden Wood AW, adjacent to the A6.

8.3.10. The extent of the study area for dust impacts has been informed by screening criteria in IAQM guidance (**Ref. 8.18**). The study area for roads has been limited to 200m either side of the road centreline, as informed by *Design Manual for Roads and Bridges guidance* (**Ref. 8.20**); the greatest impacts are likely to be at roadside with a rapid fall off within increasing distance such that beyond 200m there is unlikely to be a significant effect.

8.4. METHODOLOGY

METHOD OF BASELINE DATA COLLATION

Desk Study

8.4.1. The baseline conditions for air quality described in this chapter has been informed by the following data sources:

- Ordnance Survey OpenData (**Ref. 8.13**) for base map data showing different land characteristics;
- Google Earth (**Ref. 8.14**) and Street View (**Ref. 8.15**) to confirm receptor locations;
- Defra MAGIC website (**Ref. 8.16**) to identify ecological receptors;
- Bedfordshire and Luton Biodiversity Recording and Monitoring Centre (**Ref. 8.17**) for information on CWS;
- Bedford BC 2024 Air Quality Annual Status Report (ASR) (**Ref. 8.21**) for local air quality monitoring data and AQMA information;
- Central Bedfordshire Council (CBC) 2024 ASR (**Ref. 8.22**) for local air quality monitoring data and AQMA information;
- Environmental Permitting Regulations – Installations (**Ref. 8.23**) information on industrial sources of emissions to air that are regulated by the Environment Agency;
- Bedford BC Environmental Permit Register (**Ref. 8.24**) for information on industrial sources of emissions to air that are regulated by Bedford BC;
- CBC Environmental Permit Register (**Ref. 8.25**) for information on industrial sources of emissions to air that are regulated by Bedford BC;
- Defra UK AIR website (**Ref. 8.26**) for background pollutant concentrations of NOx, NO_2, PM_{10} and $PM_{2.5}$; and
- UK Centre for Ecology & Hydrology Air Pollution Information System (APIS) (**Ref. 8.27**) for modelled background concentrations of NH_3 and N-dep rates.

Surveys

8.4.2. No baseline air quality surveys were conducted. Sufficient baseline data for the assessment were available from published sources, as referenced above.

ASSESSMENT METHODOLOGY

8.4.3. **Table 8-5** sets out the methodology used in the assessment of the elements scoped in for air quality.

Table 8-5 - Assessment methodology

Elements scoped in	Methodology
Fugitive dust emissions affecting amenity and human health at human receptors, and ecological receptors.	A qualitative assessment has been undertaken following *IAQM Guidance on the assessment of dust from demolition and construction* (**Ref. 8.18**). This addresses the risks of impacts at human receptors within 250m of the Site, ecological receptors within 50m of the Site, and all receptors within 50m of the route(s) used by construction vehicles on the public highway, up to 250m from the Site entrance(s), in terms of deposited dust and airborne particulate matter (PM_{10} and $PM_{2.5}$). The potential effects at human receptors include annoyance due to loss of amenity from deposited dust soiling exposed surfaces, and adverse health effects due to increased ambient concentrations of PM_{10} and $PM_{2.5}$. The method followed has accounted for the scale of the works and nature of the activities in terms of demolition, earthworks, construction and trackout (movements of vehicles out of the Site which could transfer mud onto the public highway). It also considered the sensitivities of human and ecological receptors in the surrounding area to dust impacts. These factors are used to gauge the levels of risks posed by demolition, earthworks, construction and trackout so that proportionate requirements for additional mitigation measures can be determined.
Road traffic emissions affecting air quality in terms of ambient concentrations of NO_2, PM_{10} and $PM_{2.5}$ at human receptors. Details of traffic data used in the assessment are given in **Appendix 8.1: Traffic Data (Volume 3)**. Details of air quality modelling are given in **Appendix 8.2: Air Quality Model Details (Volume 3)**. Details of background annual mean pollutant levels are given in **Appendix 8.3: Background Air Pollution Data (Volume 3)**.	*EPUK/IAQM guidance* (**Ref. 8.19**) was followed in completing the assessment for human receptors. A quantitative assessment involving detailed dispersion modelling has been undertaken to predict the impacts on ambient air quality at selected human receptors within 200m of roads subject to changes in traffic due to the Proposed Development. The air quality assessment is based on traffic scenarios as described in **Table 3-3** within **Chapter 3: Approach to EIA (Volume 1)**. The applicable scenarios and how the traffic data have been used in the air quality assessment are set out below: ■ Scenario 1 - 2023 Existing. For air quality assessment, this represents existing baseline traffic conditions in 2023 (hereafter '2023 Base'). The Scenario 1 traffic data have also been used to model future baseline air quality conditions in 2029 (hereafter '2029 Base'); the reason for this is explained in Section 8.7; ■ Scenario 2 - 2023 Existing plus Peak Construction. For air quality assessment, this represents peak construction traffic in 2029 (hereafter '2029 Peak Construction'); ■ Scenario 3 – Opening Year Reference Case. For air quality assessment, this represents future baseline traffic conditions in 2031, 2041 and 2051 (hereafter '2031 DM', '2041 DM' and '2051 DM' respectively, where 'DM' = do-minimum);

Elements scoped in	Methodology
	▪ Scenario 4 – Opening Year Reference Case plus Development. For air quality assessment, this represents traffic conditions in the Primary Phase – Opening Year (hereafter '2031 DS', where 'DS' = do-something); ▪ Scenario 4a – Opening Year Reference Case plus Development plus Construction. For air quality assessment, this represents traffic conditions in 2041 with the Primary Phase plus traffic associated with construction activities in the Core Zone and Lake Zone (hereafter '2041 DS'); and ▪ Scenario 5 – Future Year - Reference Case plus Development. For air quality assessment, this represents traffic conditions with Full Buildout – Opening Year (hereafter '2051 DS'). Scenarios 5a, 5b and 5c have not been assessed as these are sensitivity tests and are include in **Appendix 5.1: Transport Assessment (Volume 3)**. 2029 Peak Construction impacts have been determined by comparison against a 2029 Base scenario, which assumes 2023 traffic but with 2029 background concentrations (**Ref. 8.26**) and emissions factors (**Ref. 8.28**). 2031, 2041 and 2051 DS impacts have been determined by comparison against the 2031, 2041 and 2051 DM scenarios respectively. (Note: Baseline traffic for 2051 is assumed unchanged from 2031, as advised in Section 6 of **Appendix 5.1: Transport Assessment (Volume 3**). *ADMS-Roads detailed dispersion modelling software* (**Ref. 8.29**) has been used to model the dispersion of NOx, PM_{10} and $PM_{2.5}$ emissions from the local road network and predict the contributions to total ambient annual mean concentrations at selected human receptors. These receptors include locations where the impacts are likely to be greatest, such as road junctions. Predicted traffic flows, fleet composition and average vehicle speeds have been used to estimate emissions of NOx, PM_{10} and $PM_{2.5}$ from the local road network (including the A421, A6 and adjoining roads) for each scenario. These emissions data have been input to ADMS-Roads, along with data and assumptions to represent traffic variations over a typical week, land surface and meteorological conditions, to enable pollutant concentrations due to emissions from the modelled road traffic sources to be predicted at the receptors. The model has two domains: one representing the conditions within Bedford town centre and the other representing the area to the south of Bedford. Pollutant contributions from the modelled road traffic sources have been combined with background pollutant data from the *Defra UK Air website* (**Ref. 8.26**) to give predictions of total annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$. These concentrations are comparable to the statutory air quality standards given in **Table 8-1**. To account for localised conditions and the difference in traffic data source between the Bedford Town Centre AQMA and the area to the

Elements scoped in	Methodology
	south of Bedford, two model domains have been created to reflect the differing land use characteristics. All modelling has been undertaken with regard to *Defra guidance LAQM.TG(22)* (**Ref. 8.7**) as well as supporting data and established methods. Dispersion models for roads tend to systematically underpredict concentrations. Adjustment is therefore usually required to correct for this bias so that the model can reproduce actual observations (i.e., monitored concentrations) as accurately as possible. The process of comparing modelled and monitored data is known as verification. If verification shows a substantial bias (greater than 25% difference) the model can be adjusted to minimise uncertainty in the modelled predictions assuming that the model configuration is robust. The 2023 base year model has been verified by comparing modelled and monitored concentrations at sites located in the Bedford BC area (**Ref. 8.21**). This resulted in the model being adjusted to account for initial systematic underprediction. (Note: It has only been possible to verify the model prediction of the road contribution annual mean NOx because of the absence of particulate matter monitoring (**Ref. 8.7**)). The potential for significant effects relating to road traffic emissions during the Construction Phase has not been assessed within the Bedford Town Centre AQMA model. This is because the projected construction vehicle flows do not exceed the indicative criteria for detailed assessment within the *EPUK/IAQM guidance* (**Ref. 8.19**).
Road traffic emissions affecting air quality in terms of ambient concentrations of NOx and NH_3, and N-dep at ecological receptors. Details of traffic data used in the assessment are given in **Appendix 8.1: Traffic Data (Volume 3)**. Details of air quality modelling are given in **Appendix 8.2: Air Quality Model Details (Volume 3)**. Details of background annual mean pollutant levels are given	For ecological receptors, the impacts have been determined with regard to *IAQM A guide to the assessment of air quality impacts on designated nature conservation sites* (**Ref. 8.30**). (Note: **Chapter 8: Air Quality (Volume 1)** only reports on the impacts for ecological receptors against critical levels and critical loads. The significance of effect has been determined by a suitably experienced Ecologist and is reported in **Chapter 6: Ecology and Nature Conservation (Volume 1)**). Concentrations of NOx and NH_3, and N-dep (with account of NO_2 and NH_3 dry deposition components) have been predicted for the following applicable scenarios ■ Scenario 1 - 2023 Existing. For air quality assessment, this represents existing baseline traffic conditions in 2023 (hereafter '2023 Base')[2]; ■ Scenario 3 – Opening Year Reference Case. For air quality assessment, this represents future baseline traffic conditions in

[2] The traffic model base year is 2023 **(Chapter 5: Traffic and Transport (Volume 1)**); however, for the air quality assessment it was necessary to assume a base year of 2023 since no suitable local authority ratified air quality monitoring data were available for 2023 to enable air quality model verification in that year - hence the '2023 Base'

Elements scoped in	Methodology
in **Appendix 8.3: Background Air Pollution Data (Volume 3)**.	2031, 2041 and 2051 (hereafter '2031 DM', '2041 DM' and '2051 DM' respectively); ■ Scenario 4 – Opening Year Reference Case plus Development. For air quality assessment, this represents traffic conditions in the Primary Phase – Opening Year (hereafter '2031 DS'); ■ Scenario 4a – Opening Year Reference Case plus Development plus Construction. For air quality assessment, this represents traffic conditions in 2041 with the Primary Phase + traffic associated with construction activities in the Core Zone and Lake Zone (hereafter '2041 DS'); and ■ Scenario 5 – Future Year - Reference Case plus Development. For air quality assessment, this represents traffic conditions with Full Buildout – Opening Year (hereafter '2051 DS'). Scenarios 5a, 5b and 5c have not been assessed as these are sensitivity tests and are include in **Appendix 5.1: Transport Assessment (Volume 3)**. *ADMS-Roads detailed dispersion modelling software* (**Ref. 8.29**) has been used to model the dispersion of NOx and NH_3 emissions from the local road network and predict the contributions to total ambient annual mean concentrations. The rate of loss of NH_3 from the dispersing emissions due to a process known as dry deposition has been predicted. (Note: Compared to NH_3, loss of NOx by dry deposition due to dispersion of road source emissions is negligible and has not been assessed further.) The pollutant concentrations have been predicted at receptor points arranged at 10m intervals in transects extending up to 200m from the centreline of the road into the adjacent ecological receptor. Pollutant contributions from these road sources have been combined with background pollutant data from the *APIS website* (**Ref. 8.27**) to give predictions of total annual mean NOx and NH_3 concentrations at ground level. The rate of N-dep has then been calculated from these concentrations. The concentrations of NO_x are compared to the statutory critical level given in **Table 8-1**. Standards for NH_3 and N-dep are not defined in legislation but are advised by nature conservation organisations for different habitat interest features. Critical levels for NH_3 and critical loads for N-dep are included on the *APIS website* (**Ref. 8.26**). For ecological receptors, as well as assessing the impacts for the Proposed Development alone (i.e., the DS scenario compared to the DM scenario), additional analysis of the impacts in-combination with other plans and projects has also been completed to inform the determination of the significance of effect (reported in **Chapter 6:**

scenario for the air quality assessment. The latest suitable monitoring data were for 2023 at the time of the assessment. As traffic levels for 2023 are not substantially different to 2023 this approach is considered reasonable.

Elements scoped in	Methodology
	Ecology and Nature Conservation (Volume 1)). To do this, projected base year – or do- nothing ('DN') – scenarios for 2031, 2041 and 2051 have been modelled. The DN scenario assumes no traffic growth from the 2023 base year, but that emissions factors (**Ref. 8.28** and **Ref. 8.32**) and background pollutant levels (**Ref. 8.26** and **Ref. 8.27**) change in-line with official forecasts. Inevitably, the magnitude of impacts for the Proposed Development in-combination are much greater than the impacts for the Proposed Development alone.

SIGNIFICANCE CRITERIA

Sensitive Receptors

8.4.4. The sensitivity of receptors for each of the potential effects resulting from the Proposed Development has been determined with reference to relevant guidance (**Ref. 8.7**, **Ref. 8.18**, **Ref. 8.19** and **Ref. 8.30**). Details are provided in **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)**.

Magnitude of Impact

Fugitive Dust Emissions

8.4.5. The magnitude of impact from fugitive dust emissions in the Construction Phase is described in relative terms as high risk, medium risk, low risk, or negligible (**Ref. 8.18**). The relative risk of potential dust soiling, human health and ecological impacts is determined using professional judgement – taking into consideration the dust emission magnitude (large, medium, or small) and sensitivity of the area (high, medium, or low) for demolition, earthworks, construction and trackout activities (**Ref. 8.18**).

Road Traffic Emissions

8.4.6. The magnitude of impact from road traffic emissions has been based on an adapted matrix from *EPUK/IAQM guidance* (**Ref. 8.19**) presenting impact descriptors for human receptors. Further details on this table are provided in **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)**. It should be noted that the EPUK/IAQM guidance was developed prior to the introduction of the annual mean $PM_{2.5}$ target for 2040 and non-statutory interim target for 2028. The current EPUK/IAQM guidance is not suitable for describing impacts on $PM_{2.5}$ in relation to these targets since compliance will not be materially affected by local, primary emissions of $PM_{2.5}$ that could be influenced by the Proposed Development. The magnitude of the impact of the development on $PM_{2.5}$ concentrations is quantified and presented in this chapter in the context of measures being introduced by the Proposed Development to limit emissions.

Significance of Effect

Fugitive Dust Emissions

8.4.7. Significance criteria is only assigned to the identified risk of dust impacts occurring from construction activities following implementation of appropriate mitigation measures. The significance criteria are only used to assess the significance of residual effects in line with *IAQM Guidance on the assessment of dust from demolition and construction* (**Ref. 8.18**). For almost all construction activities, the application of mitigation measures provided in the OCEMP (**Appendix 2.3: OCEMP (Volume 3)**) will prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be 'not significant'.

Road Traffic Emissions

8.4.8. Factors including sensitivity of receptors and magnitude of impact (as discussed above) have been considered to determine if the overall effect for human receptors is significant. Further details are provided in **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)**.

8.5. BASELINE CONDITIONS

8.5.1. For the 2023 Base, air quality conditions within the study area are generally considered to be good and improving. Neither Bedford BC nor CBC have highlighted any air quality issues in the immediate vicinity of the Site (**Ref. 8.21** and **Ref. 8.22**). Bedford BC and CBC monitoring data for years up to and including 2023 are included for reference in **Appendix 8.4: Air Quality Monitoring Data (Volume 3)** and monitoring locations are shown in **Figure 8.2: Air Quality Monitoring Sites (Volume 2)**.

8.5.2. The study area to the south of Bedford is semi-rural. The main local sources of air pollutants include:

- Road traffic, notably on the A421, A5141, A6 and B530 (along the eastern boundary of the Site) and associated with warehousing and distribution centres, local industry, business, and retail parks;
- Diesel passenger and freight train traffic on the Midland Main Railway Line (to the east of the Site). (Although the Marston Vale Railway Line operates diesel trains, the traffic is relatively light and is not considered to be a substantial source of air pollution);
- Large power and industrial sources regulated by the Environment Agency (**Ref. 8.23**), including: Millbrook Power Ltd (Drax Group) at Rookery South Pit (combustion) and Encyclis Ltd Rookery South Energy Recovery Facility (incineration of non-hazardous waste); and
- Industrial sources regulated by Bedford BC (**Ref. 8.24**), including: Tarmac Elstow Benninghoven Asphalt Plant and Tarmac Elstow Concrete Plant. There are no CBC regulated sources in the study area (**Ref. 8.25**).

8.5.3. The nearest AQMAs are Bedford BC's Bedford Town Centre AQMA at approximately 2.3km to the north on the A5141 Ampthill Road, and CBC's Air Quality Management Area No.3 Ampthill at approximately 5km to the south on the B530. Historically, annual mean NO_2 concentrations have exceeded the air quality standard (**Table 8-1**) in these AQMAs. Both Bedford BC and CBC have implemented Air Quality Action Plans to tackle the problems and have reported improving trends within these AQMAs. Monitored concentrations for 2022 met the annual and 1-hour mean air quality standards (**Table 8-1**), but for 2023 two monitoring locations within the Bedford Town Centre AQMA exceeded the annual mean NO_2 standard (40µg/m^3): at DT20 on Prebend Street (40.9µg/m^3), and DT89 at the junction of St Peter's Street and High Street (40.6µg/m^3).

8.5.4. Within Bedford, the main local sources of air pollutants include road traffic, domestic, commercial, and industrial combustion (generally natural gas fired boilers used for space heating and hot water provision, but also domestic open fires and log burners). Diesel passenger and freight train traffic on the Midland Main Railway Line is a relatively minor source of air pollutants. The Bedford Town Centre AQMA was declared due to high NOx emissions primarily from road vehicles along congested narrow streets. A notable hotspot is Prebend Street between Commercial Road and Midland Road which has experienced the highest concentrations exceeding the air quality standard for annual mean NO_2 in recent years (although meeting the standard in 2022).

8.5.5. Bedford BC does not undertake any reference (or equivalent) monitoring of PM_{10} and/or $PM_{2.5}$. However, Bedford BC reports in its 2024 ASR (**Ref. 8.21**) on concentrations of PM_{10} and $PM_{2.5}$ measured using five indicative (non-reference) sensors; three of these were located within the study area, including two on Ampthill Road (one near Morrisons supermarket and the other near Brittania Road) and one on Prebend Street (near NO_2 monitoring location DT20). The reported concentrations of PM_{10} and $PM_{2.5}$ on Ampthill Road meet - and are well below - the air quality standards (**Table 8-1**). The highest concentrations were indicated on Prebend Street, where the annual mean PM_{10} was 13.1µg/m^3 (well below the 40µg/m^3 standard) and annual mean $PM_{2.5}$ was 11.8µg/m^3 (below the interim target for 2028 of 12µg/m^3 but above the 2040 target for 10µg/m^3).

MODELLED 2023 BASELINE CONDITIONS

Human Receptors

8.5.6. Baseline air quality conditions have been modelled for the 2023 Base scenario. Details of receptors are given in **Appendix 8.5: Details of Selected Human Receptors (Volume 3)**. The locations are shown in **Figure 8.4: Traffic Emissions and Human Receptors (Volume 2)**. Modelling results are included in **Appendix 8.7: Results for Human Receptors (Volume 3)**.

8.5.7. Modelled annual mean NO_2 concentrations within 10% of, or exceeding the air quality standard of 40µg/m^3 (**Table 8-1**) occur within the Bedford Town Centre AQMA on Cauldwell Street (receptor BTC13), Prebend Street between Commercial Road and Midland Road (receptors BTC16, BTC23, BTC24, BTC25 and BTC27) and Bromham Road (receptor BTC20) near the junction with Ashburnham Road and Shakespeare Road. The maximum modelled annual mean NO_2 concentration for 2023 is 50.2µg/m^3 on Prebend Street, close to the junction with Midland Road (receptor BTC16).

8.5.8. Outside of Bedford Town Centre AQMA, the highest annual mean NO_2 concentration is 37.4µg/m^3 on Melrose Drive (receptor R59), immediately to the north of the westbound carriageway of the A421. Annual mean concentrations of NO_2 at all other human receptors within the study area meet the air quality standard.

8.5.9. Concentrations of PM_{10} and $PM_{2.5}$ meet the applicable air quality standards (**Table 8-1**) at all human receptors within the study area.

Ecological Receptors

8.5.10. Baseline air quality conditions are represented by the modelled 2023 Base scenario. Details of receptors are given in **Appendix 8.6: Details of Ecological Receptor Transects (Volume 3)**. The locations are shown in **Figure 8.5: Traffic Emissions and Ecological Receptors - Maulden Wood Ancient Woodland & Maulden Wood and Pennyfather's Hills Sites of Special Scientific Interest (Volume 2)** and **Figure 8.6: Traffic Emissions and Ecological Receptors – County Wildlife Sites (Volume 2)**. Modelling results are included in **Appendix 8.8: Results for Ecological Receptors (Volume 3)**.

8.5.11. **Table 8-3-2** in **Appendix 8.3: Background Air Pollution Data (Volume 3)** provides details on the background levels at each of the ecological receptors assessed. The background NOx and NH_3 concentrations are well below the critical levels for these pollutants of 30µg/m^3 and 3µg/m^3 respectively.

8.5.12. Across the seven ecological sites within the study area, the highest predicted annual mean NOx concentration is 98.5µg/m^3 at Kempston West End CWS, next to the A5141 Ampthill Road (transect ID 12_0). This substantially exceeds the NOx critical level of 30µg/m^3. The concentrations exceed the critical level right across to the western edge of the site at approximately 130m from Ampthill Road (transect ID 12_130).

8.5.13. Other ecological sites where the annual mean NOx critical level is exceeded include: Maulden Wood and Pennyfather's Hills SSSI, but only at the very edge of the site nearest the A6 (transect IDs 1_0, 2_0 and 3_0); and within Stewartby Lake CWS up to 50m from the edge of the site that is closest to Woburn Road and the A421 (transect IDs 4_0, 4_10, 4_20, 4_30, 4_40 and 4_50). There are no other predicted exceedances of the NOx critical level in the 2023 baseline.

8.5.14. There are no predicted exceedances of the NH_3 critical level (3µg/m^3) in the current baseline. The highest predicted concentration is 2.9µg/m^3 at Kempston West End CWS, next to the A5141 Ampthill Road (transect ID 12_0).

8.5.15. At Maulden Wood and Pennyfather's Hills SSSI/Maulden Wood AW and Kempston West End CWS where much of the vegetation is 'tall' (i.e., trees), the background N-dep ranges from 25.9 to 26.3 kilograms per hectare per year (kg/ha/yr). The background N-dep at these sites exceeds the applicable lower critical load of 15kg/ha/yr. The baseline modelling predicts that the highest total N-dep is 41.2kg/ha/yr at Kempston West End CWS (transect ID 12_0). At Maulden Wood and Pennyfather's Hills SSSI the highest modelled total N-dep is 34.1kg/ha/yr (transect ID 3_0).

8.5.16. For ecological sites with 'low' features (i.e., grass and low shrubs), the background N-dep ranges from 14.2 to 14.5 kg/ha/yr. The background N-dep at these sites exceeds the applicable lower critical load of 10kg/ha/yr. The modelling predicts that the highest total N-dep at these sites is 17.7kg/ha/yr at Stewartby Lake CWS (transect ID 4_0).

MODELLED FUTURE BASELINE CONDITIONS

8.5.17. At worst, future baseline air quality conditions will be similar to existing conditions. More likely, baseline air quality conditions will be better than at present, primarily due to increasing proportions of low and ultra-low/zero emissions vehicles within the local vehicle fleet. Expected emissions reductions of NOx, PM_{10} and $PM_{2.5}$ across all sectors (transport, housing, industry, etc.) are reflected in vehicle emissions factors which extend to and include 2050 (**Ref. 8.28** and **Ref. 8.32**), and predictions for background pollutant concentrations up to and including the year 2040 (**Ref. 8.26**).

Human Receptors

8.5.18. Future baseline air quality conditions are illustrated by the modelled scenarios 2029 Base, 2031 DM, 2041 DM and 2051 DM. Details of receptors are given in **Appendix 8.5: Details of Selected Human Receptors (Volume 3)**. The locations are shown in **Figure 8.4: Traffic Emissions and Human Receptors (Volume 2)**. All modelling results are included in **Appendix 8.7: Results for Human Receptors (Volume 3)**.

8.5.19. In all future baseline scenarios there are no predicted exceedances of the annual mean NO_2 air quality standard of 40µg/m^3 (**Table 8-1**) within the study area. In the 2031 DM scenario, the maximum annual mean NO_2 concentration is 27.9µg/m^3 on Prebend Street, close to the junction with Midland Road (receptor BTC16). In the 2041 DM scenario, the predicted concentration has fallen to is 17.1µg/m^3 and by 2051 it is 16.5µg/m^3. Future baseline concentrations within the study area to the south of the Bedford Town Centre AQMA are generally lower.

8.5.20. In all future baseline scenarios concentrations of PM_{10} meet the applicable air quality standards (**Table 8-1**) at all human receptors within the study area.

8.5.21. With regard to $PM_{2.5}$, in the interim target for annual mean concentrations of 12µg/m^3 is predicted to be met in the 2029 Base and 2031 DM scenarios at all human receptors and in the 2041 DM and in 2051 DM scenarios the 10µg/m^3 target is predicted to be met. The highest concentration of 8.3µg/m^3 is on Prebend Street, close to the junction with Midland Road (receptors BTC16 and BTC23).

Ecological Receptors

8.5.22. Future baseline air quality conditions have been modelled for the 2031 DM, 2041 DM and 2051 DM scenarios. Details of receptors are given in **Appendix 8.6: Details of Ecological Receptor Transects (Volume 3)**. The locations are shown in **Figure 8.5: Traffic Emissions and Ecological Receptors - Maulden Wood Ancient Woodland & Maulden Wood and Pennyfather's Hills Sites of Special Scientific Interest (Volume 2)** and **Figure 8.6: Traffic Emissions and Ecological Receptors – County Wildlife Sites (Volume 2)**. Modelling results are included in **Appendix 8.8: Results for Ecological Receptors (Volume 3)**.

8.5.23. **Table A8-3-2** in **Appendix 8.3: Background Air Pollution Data (Volume 3)** provides details on background pollutant levels at ecological receptors. Future background levels of NOx and N-dep are lower than for the 2023 Base, in-line with actual observed long-term downward trends in NOx emissions and as forecast by Defra for transport, power and industrial sectors (amongst others). In contrast, NH_3 concentrations were assumed to increase very slightly year on year, primarily due to uncertainties around the practicalities of future controls on emissions from the agricultural sector. Within the study area, the future background NOx and NH_3 concentrations are well below the critical levels for these pollutants of 30µg/m^3 and 3µg/m^3 respectively.

8.5.24. For all ecological receptors, the highest predicted annual mean NOx concentration in the 2031 DM, 2041 DM and 2051 DM scenarios are 44.4, 21.2 and 19.7µg/m^3 respectively, all Kempston West End CWS (transect ID 12_0). In the 2031 baseline, the NOx concentrations exceed the critical level (30µg/m^3) at Kempston West End CWS up to about 20m within the Site boundary on Ampthill Road, but with no exceedances predicted in the 2041 DM and 2051 DM scenarios.

8.5.25. There are no predicted exceedances of the NH_3 critical level (3µg/m^3) in the 2031 DM, 2041 DM or 2051 DM scenarios. The highest predicted 2031, 2041 and 2051 baseline concentrations are 2.9, 2.7 and 2.6 µg/m^3 respectively, all Kempston West End CWS (transect ID 12_0).

8.5.26. For ecological receptors with 'tall' features (such as trees), the predicted background N-dep ranges from 23.7 to 24.1kg/ha/yr for 2031, 2041 and 2051. For these ecological sites, the applied lower critical load for N-dep is 15kg/ha/yr. The future baseline modelling predicts that the highest total N-dep at these sites is 36.6kg/ha/yr in the 2031 DM scenario, 33.5kg/ha/yr in the 2041 DM scenario and 31.9kg/ha/yr in the 2051 DM scenario at transect receptor 12_0 (Kempston West End CWS).

8.5.27. At Maulden Wood and Pennyfather's Hills SSSI/Maulden Wood AW, the predicted background N-dep is 23.7kg/ha/yr for the 2031 DM scenario and 21.3kg/ha/yr for the 2041 and 2051 DM scenarios. At Kempston West End CWS, the predicted background N-dep is 24.1kg/ha/yr for the 2031 DM scenario and 21.6kg/ha/yr for the 2041 and 2051 DM scenarios. The background N-dep at these sites exceeds the applicable lower critical load of 15kg/ha/yr. The highest modelled total N-dep is 37.8kg/ha/yr in the 2031 DM scenario at Kempston West End CWS (transect ID 12_0), reducing to 32.0 kg/ha/yr by 2051. At Maulden Wood and Pennyfather's Hills SSSI the highest modelled total N-dep is 29.8kg/ha/yr (transect ID 3_0), reducing to 27.5kg/ha/yr by 2051.

8.5.28. For ecological receptors with 'low' features (such as grasses), the predicted background N-dep ranges from 13.0 to 13.3kg/ha/yr for 2031, 2041 and 2051. For these ecological receptors, the applied lower critical load for N-dep is 10kg/ha/yr. The future baseline modelling predicts that the highest total N-dep at these sites is 15.7kg/ha/yr in the 2031 DM scenario, 15.2kg/ha/yr in the 2041 DM scenario and 15.0 kg/ha/yr in the 2051 DM scenario at receptor 4_0 (Stewartby Lake CWS).

8.5.29. For ecological sites with 'low' features (i.e., grass and low shrubs), the background N-dep ranges from 13.0 to 13.3kg/ha/yr in the 2031 DM scenario, reducing to between 11.7 and 11.9kg/ha/yr in the 2041 and 2051 DM scenarios, respectively. The background N-dep at these sites exceeds the applicable lower critical load of 10kg/ha/yr. The modelling predicts that the highest total N-dep at these sites is 15.6kg/ha/yr at Stewartby Lake CWS (transect ID 4_0) in the 2031 DM scenario, reducing to 15.0 and 14.8kg/ha/yr in the 2041 and 2051 DM scenarios, respectively.

SENSITIVE RECEPTORS

8.5.30. Human and ecological receptors that are sensitive to changes to dust impacts and changes in ambient air quality have been identified within the study area (see also **Table 3-1** in **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)** which discusses sensitivity of receptors).

Fugitive Dust Emissions

8.5.31. Two hundred and fifty-six human receptors have been identified within 250m of the Site boundary which could be affected by fugitive dust emissions during construction. These are shown in **Figure 8.3: Construction Dust and Receptors (Volume 2)**. These include 210 high sensitivity residential premises and two schools (Blue Orkids Wootton Nursery and Wootton Lower School). There is one high sensitivity commercial receptor (BCA Bedford Car Auctions, off Ampthill Road in Kempston Hardwick). Other receptors are of medium or low sensitivity, including: a public recreation area to the north of Fields Road in Wootton; commercial warehousing adjacent to the A421; light industrial premises in Kempston Hardwick; and commercial/retail and light industrial premises off Wolseley Road and at Interchange Retail Park, Kempston, and Progress Park, Elstow.

8.5.32. There are three ecological receptors within 250m of the Site boundary, including: Kempston Hardwick Pit CWS, Coronation Pit CWS and Stewartby Lake CWS. These are considered to have low sensitivity to dust impacts. These are shown in **Figure 8.3: Construction Dust and Receptors (Volume 2)**.

Road Traffic Emissions

8.5.33. Ninety-eight human receptors which have high sensitivity have been selected within 200m of the modelled road network, including receptors which are most likely to experience the greatest impacts (e.g., receptors nearest to road junctions). These are shown in **Figure 8.4: Traffic Emissions and Human Receptors (Volume 2)** and comprise of:

- Twenty-six locations within Bedford Town Centre AQMA including: 24 residential properties (five on Prebend Street where annual mean NO_2 concentrations are just below the air quality standard), Bedford Hospital and Bedford Free School; and
- Seventy-two locations outside of the AQMA to the south of Bedford including: 67 residential properties within Marston Moretaine, Caulcott/Lower Shelton Wootton, Kempston Hardwick, Wixams, Stewartby, and along Woburn Road and Ampthill Road; and schools including Blue Orkids Wootton Nursery, Lakeview School, Wixams, Kimberley Sixth Form College on Green Lane and Busy Bees day nursery at Progress Park, Elstow.

8.5.34. There are eight ecological receptors within 200m of the modelled road network that are considered to have high sensitivity to air quality impacts due to changes in road traffic emissions, including: Stewartby Lake CWS, Rookery Clay Pit CWS, Quest Pit CWS, Kempston Harwick Pit CWS, Elstow Pit CWS, Kempston West End CWS, Maulden Wood and Pennyfathers Hills SSSI and Maulden Wood AW. These are shown in **Figure 8.5: Traffic Emissions and Ecological Receptors - Maulden Wood Ancient Woodland & Maulden Wood and Pennyfather's Hills Site of Special Scientific Interest (Volume 2)** and **Figure 8.6: Traffic Emissions and Ecological Receptors - County Wildlife Sites (Volume 2)**.

8.6. ASSESSMENT OF POTENTIAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS

CONSTRUCTION PHASE

8.6.1. **Table 8-6** provides the key findings of the Construction Phase fugitive dust emissions assessment.

Table 8-6 - Fugitive dust emissions: assessment of potential effects, additional mitigation, residual effects, and monitoring during construction

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
Residential properties in Kempston Hardwick and Stewartby. Commercial premises in Kempston Hardwick. Kempston Hardwick Pit CWS and Coronation Pit CWS. **Figure 8.3: Construction Dust and Receptors (Volume 2)**	**Potential Effects**	The potential dust emission magnitude of four key activities has been determined: ▪ Demolition: there will be limited demolition activities involving the removal of small structures including two small buildings and a brick chimney within the Lake Zone, breaking out and removal of existing hardstanding areas, and use of mobile crushing and screening plant (which will be subject to environmental permit dust controls). There is also likely to be removal of Vine Cottages 1 and 2 to support realignment of the eastern end of Manor Road. The potential dust emission magnitude for demolition is 'medium'. ▪ *Earthwork*s: extensive earthworks and grading will take place across the Site. The potential dust emission magnitude for earthworks is 'large'; ▪ *Construction*: extensive building works will take place. The potential dust emission magnitude for construction is 'large'; and ▪ *Trackout*. The number of heavy goods vehicle deliveries are set out in **Appendix 2.3: OCEMP (Volume 3).** The potential dust emission magnitude for trackout is 'large'. There are approximately 33 high sensitivity receptors within 20m of the Site boundary, including 19 on Manor Road adjacent to the Lake Zone and the Core Zone, 12 on Kempston Hardwick Caravan Site on Ampthill Road adjacent to the East Gateway Zone, one at Broadmead Farm on Broadmead Road adjacent to the Core Zone, and one on Woburn Road adjacent to the West Gateway Zone. In addition, there is a high sensitivity commercial premises (BCA Bedford Car Auctions) within 20m of the Core Zone (to the east of the Site boundary off Ampthill Road) and 50m from Manor Road realignment. Annual mean particulate levels within the construction dust study area, as indicated by background concentrations for PM_{10} from the *Defra UK Air website* (**Ref. 8.26**), are low (less than 20µg/m^3). Given the numbers and locations of high sensitivity receptors within 20m of the Site boundary, the Kempston Hardwick area is considered to have high sensitivity to dust soiling effects. Elsewhere, the area is considered to have low sensitivity to dust soiling effects. With regard to human health, since background PM_{10} concentrations are low, the sensitivity of all areas can be considered to be low.

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
		There are two ecological receptors within 20m of the Site boundary: Kempston Hardwick Pit CWS, and Coronation Pit CWS. These areas are considered to have medium sensitivity to dust impacts. Taking the above factors into account, the following risks from dust impacts have been determined: ▪ *Demolition* – There is a medium risk for dust soiling at residential premises on Manor Road during dry conditions, with low risk elsewhere. Risks for human health and ecological receptors are low; ▪ *Earthworks* – There is a high risk for dust soiling at residential premises on Manor Road during dry conditions, with low risk elsewhere. Risks for human health and ecological receptors are low; ▪ *Construction* – There is a high risk for dust soiling at residential premises on Manor Road during dry conditions, with low risk elsewhere. Risks for human health and ecological receptors are low; and ▪ *Trackout* – Assuming temporary Site access points off Broadmead Road and Manor Road there is low to medium risk for dust soiling. Risks for human health and ecological receptors are low. For human receptors (residential premises) on Manor Road and at Kempston Hardwick Caravan Site, without mitigation there are likely to be direct, temporary, short-term **Major/Moderate Adverse** effects of loss of amenity due to surface soiling **(Significant)**. For all human receptors, without mitigation there are likely to be direct, temporary, short-term **Negligible Adverse** effects on health from elevated PM_{10} and $PM_{2.5}$ concentrations **(Not Significant)**. For ecological receptors at Kempston Hardwick Pit CWS and Coronation Pit CWS, without mitigation there are likely to be direct, temporary, short-term **Minor/Negligible Adverse** effects from elevated dust levels **(Not Significant)** during earthworks.
	Mitigation	Additional mitigation measures to minimise the risk of dust impacts are set out in the OCEMP (**Appendix 2.3: OCEMP (Volume 3)**). The Principal Contractor will be required to demonstrate use of Best Practicable Means at all times during the works in mitigating emissions from construction sites and activities. Based on *IAQM guidance* (**Ref. 8.18**), measures are required for Site management, monitoring, preparation and maintenance of the Site, operating vehicles/machinery and sustainable travel, general operations, earthworks, construction and trackout. The requirements of the OCEMP (**Appendix 2.3: OCEMP (Volume 3)**) will be secured by planning requirement for detailed CEMPs to be prepared.
	Residual Effects and Monitoring	For human receptors, there are likely to be direct, temporary, short-term **Minor/Negligible Adverse** residual effects of loss of amenity due to surface soiling **(Not Significant)** following the implementation of mitigation measures.

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
		For human receptors, there are likely to be direct, temporary, short-term **Negligible Adverse** residual effects on health from elevated PM_{10} and $PM_{2.5}$ concentrations **(Not Significant)** following the implementation of mitigation measures. For ecological receptors, there are likely to be direct, temporary, short-term **Negligible Adverse** residual effects from elevated dust levels **(Not Significant)** following the implementation of mitigation measures. Monitoring requirements for dust are set out in the OCEMP (**Appendix 2.3: OCEMP (Volume 3)**).

8.6.2. **Table 8-7** provides the key findings of the Construction Phase road traffic emissions assessment at human receptors. The assessment considers the impacts in the 2029 Peak Construction scenario against the 2023 Base scenario.

Table 8-7 - Road traffic emissions: assessment of potential effects, additional mitigation, residual effects, and monitoring for human receptors for 2029 (peak construction traffic)

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
Residential, school, and medical premises in Bedford, Elstow, Kempston, Wooton, Kempston Hardwick, Stewartby, Marston Mortaine and Wixams. **Figure 8.4: Traffic Emissions and Human Receptors (Volume 2)**	**Potential Effects**	The predicted annual mean NO_2 concentrations are well below the air quality standard of 40µg/m³ (**Table 8-1**) in the 2029 Peak Construction scenario. The highest concentration is 24.1µg/m³ at receptor 59 (residential property on Melrose Drive, Elstow). This also means that the air quality standard for 1-hour mean NO_2 is likely to be met (**Table 8-1**) at all receptors. The impacts in-terms of the percentage change relative to the air quality standard are between +8% and -2%, with most receptors – including all those within the Bedford Town Centre AQMA – experiencing an imperceptible change of less than 1%. Reductions in concentration occur at receptors 9 to 14 (residential properties) on Manor Road due road alignment changes, and at receptor 18 (residential property) on Bedford Road in Kempston Hardwick. Consequently, the impacts on NO_2 concentrations with the 2029 Peak Construction scenario are **Negligible** at all receptors. The predicted annual mean PM_{10} concentrations are well below the air quality standard of 40µg/m³ (**Table 8-1**) in the 2029 Peak Construction scenario. The highest concentration is 16.0µg/m³ at receptor 69 (day care centre in Progress Park, Elstow). This also means that the air quality standard for 24-hour mean PM_{10} (**Table 8-1**) is likely to be met at all receptors. The impacts in-terms of the percentage change relative to the air quality standard are at worst +8% at receptor 6 (residential property on Woburn Road, Kempston Hardwick), with most receptors experiencing an imperceptible change of less than 1%. Consequently, the impacts on PM_{10} concentrations with the 2029 Peak Construction scenario are **Negligible** at all receptors. The predicted annual mean $PM_{2.5}$ concentrations are below the air quality standard of 20µg/m³ (**Table 8-1**) in the 2029 Peak Construction scenario. The highest concentration is 7.9µg/m³

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
		at receptor 53 (residential property on Ampthill Road, Elstow), which is below the Government's target of 12µg/m^3 for 2028 (**Table 8-1**). The changes in $PM_{2.5}$ concentrations are very small and range between +0.23 and -0.05 µg/m^3. The impacts in-terms of the percentage change relative to the air quality standard of 20µg/m^3 are at worst +1%, with most receptors experiencing a change of less than 1%. Consequently, the impacts on $PM_{2.5}$ concentrations with the 2029 Peak Construction scenario are **Negligible** at all receptors. The magnitude of change and the associated judgement of significance of effects has been considered in conjunction with difficulties and uncertainties which are discussed in Section 8.7. The sensitivity of human receptors is high, however, even without mitigation the direct, temporary, short-term impact of increased vehicle emissions is likely to be **Negligible (Not Significant)**.
	Additional Mitigation	Additional best practice mitigation measures to minimise air quality impacts are set out in the OCEMP (**Appendix 2.3: OCEMP (Volume 3)**) which includes measures such as route restrictions and travel planning which will to help minimise air quality impacts from construction traffic. The requirements of the OCEMP (**Appendix 2.3: OCEMP (Volume 3)**) will be secured by planning requirement for detailed CEMPs to be prepared.
	Residual Effects and Monitoring	The magnitude of change and the associated judgement of significance of effects has been considered in conjunction with difficulties and uncertainties which are discussed Section 8.7. The sensitivity of human receptors is high, there is likely to be a direct, temporary, short term **Negligible Adverse** residual effect due to increased vehicle emissions **(Not Significant)** following the implementation of mitigation measures. The assessment does not indicate the need for air quality monitoring in relation to traffic emissions during the Construction Phase.

OPERATIONAL PHASE

8.6.3. **Table 8-8** provides the key findings of the Operational Phase road traffic emissions assessment at human and ecological receptors. The assessment considers the 2031 DS scenario against the 2031 DM scenario, 2041 DS scenario against the 2041 DM scenario, and the 2051 DS scenario against the 2051 DM scenario.

Table 8-8 - Road traffic emissions: assessment of potential effects, additional mitigation, residual effects and monitoring for human receptors for years 2031, 2041 and 2051

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
Residential, school, and medical premises in Bedford, Elstow, Kempston, Wooton, Kempston Hardwick, Stewartby, Marston Moretaine and Wixams. **Figure 8.4: Traffic Emissions and Human Receptors (Volume 2)**	**Potential Effects**	**2031 DS vs 2031 DM** The predicted annual mean NO_2 concentrations are well below the air quality standard of 40µg/m^3 (**Table 8-1**) in all scenarios. The highest concentration is 27.9µg/m^3 at BTC16 and BTC23 (residential properties on Prebend Street, Bedford), in the 2031 DS scenario. This also means that the air quality standard for 1-hour mean NO_2 is likely to be met (**Table 8-1**) at all receptors. The impacts in terms of percentage change relative to the air quality standard are between +2% and -5%, with most receptors – including all those within the Bedford Town Centre AQMA - experiencing an imperceptible change of less than 1%. Reductions in concentration are primarily due to the proposed alterations to Manor Road. Consequently, the impacts on NO_2 concentrations are **Negligible** at all receptors. The predicted annual mean PM_{10} concentrations are well below the air quality standard of 40µg/m^3 (**Table 8-1**) in all scenarios. The highest concentration is 15.9µg/m^3 at receptor 69 (day care centre in Progress Park, Elstow), in the 2031 DS scenario. This also means that the air quality standard for 24-hour mean PM_{10} is likely to be met (**Table 8-1**) at all receptors. The impacts in terms of percentage change relative to the air quality standard are less than 1% (i.e., imperceptible) at all receptors, except at receptor 14 (residential property on Manor Road) which has -1% change (i.e., imperceptible). Reductions in concentration are primarily due to the proposed alterations to Manor Road. Consequently, the impacts on PM_{10} concentrations are **Negligible** at all receptors. The predicted annual mean $PM_{2.5}$ concentrations are below the air quality standard of 20µg/m^3 (**Table 8-1**) in all scenarios. The highest concentration is 8.3µg/m^3 at BTC23 (residential property on Prebend Street, Bedford), in the 2031 DS scenario, which is below the Government's target of 12µg/m^3 for 2028 and years up to 2040 (**Table 8-1**). The changes in $PM_{2.5}$ concentrations are very small and range between +0.06 and -0.18 µg/m^3. The impacts in terms of percentage change relative to the air quality standard of 20µg/m^3 are less than 1% (i.e., imperceptible), except at receptor 14 (residential property on Manor Road) which has -1% change (i.e., imperceptible). Reductions in concentration are primarily due to the proposed alterations to Manor Road. Consequently, the impacts on $PM_{2.5}$ concentrations are **Negligible** at all receptors. The magnitude of change and the associated judgement of significance of effects has been considered in conjunction with difficulties and uncertainties which are discussed in Section 8.7. The sensitivity of human receptors is high, without mitigation there is likely to be a direct, permanent, medium term **Negligible Adverse** effect due to increased vehicle emissions **(Not Significant)**. **2041 DS vs 2041 DM**

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
		The predicted annual mean NO_2 concentrations are well below the air quality standard of 40µg/m³ (**Table 8-1**) in all scenarios. The highest concentration is 17.1µg/m³ BTC16 (residential property on the corner of Prebend Street and Midland Road, Bedford). This also means that the air quality standard for 1-hour mean NO_2 is likely to be met (**Table 8-1**) at all receptors. The impacts in terms of percentage change relative to the air quality standard are between +1% and -1%, with most receptors experiencing an imperceptible change of less than 1%. Reductions in concentration are primarily due to the proposed alterations to Manor Road. The changes at receptors within the Bedford Town Centre AQMA are all imperceptible. Consequently, the impacts on NO_2 concentrations with the 2041 DS scenario are **Negligible** at all receptors. The predicted annual mean PM_{10} concentrations are well below the air quality standard of 40µg/m³ (**Table 8-1**) in all scenarios. The highest concentration is 15.8µg/m³ at receptor 69 (day care centre in Progress Park, Elstow). This also means that the air quality standard for 24-hour mean PM_{10} is likely to be met (**Table 8-1**) at all receptors. The impacts in terms of percentage change relative to the air quality standard are less than 1% (i.e., imperceptible), except at receptor 14 (residential property on Manor Road) which has -1% change (i.e., imperceptible). Reductions in concentration are primarily due to the proposed alterations to Manor Road. Consequently, the impacts on PM_{10} concentrations with the 2041 DS scenario are **Negligible** at all receptors. The predicted annual mean $PM_{2.5}$ concentrations are below the air quality standard of 20µg/m³ (**Table 8-1**) in all scenarios. The highest concentration is 7.8µg/m³ at receptor BTC23 (residential property on Prebend Street), which is below the Government's target of 10µg/m³ for 2040 (**Table 8-1**). The changes in $PM_{2.5}$ concentrations are very small and range between +0.06 and -0.55 µg/m³. The impacts in terms of percentage change relative to the air quality standard of are between 0% and -1%, with most receptors experiencing an imperceptible change of less than 1%. Reductions in concentration are primarily due to the proposed alterations to Manor Road. Consequently, the impacts on $PM_{2.5}$ concentrations with the 2041 DS scenario are **Negligible** at all receptors. The Proposed Development would not affect compliance with the Government's $PM_{2.5}$ target for 2040. The magnitude of change and the associated judgement of significance of effects has been considered in conjunction with difficulties and uncertainties which are discussed in Section 8.7. The sensitivity of human receptors 20µg/m³ is high, without mitigation there is likely to be a direct, permanent, long term **Negligible Adverse** effect due to increased vehicle emissions **(Not Significant)**. **2051 DS vs 2051 DM** The predicted annual mean NO_2 concentrations are well below the air quality standard of 40µg/m³ (**Table 8-1**) in all scenarios. The highest concentration is 16.5µg/m³ BTC16 (residential

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
		property on the corner of Prebend Street and Midland Road, Bedford). This also means that the air quality standard for 1-hour mean NO_2 is likely to be met (**Table 8-1**) at all receptors. The impacts in terms of percentage change relative to the air quality standard are between +1% and -1%, with most receptors experiencing an imperceptible change of less than 1%. The reductions in concentration are primarily due to the proposed alterations to Manor Road. The changes at receptors within the Bedford Town Centre AQMA are all imperceptible. Consequently, the impacts on NO_2 concentrations with the 2051 DS scenario are **Negligible** at all receptors. The predicted annual mean PM_{10} concentrations are well below the air quality standard of 40µg/m^3 (**Table 8-1**) in all scenarios. The highest concentration is 15.9µg/m^3 at receptor 69 (day care centre in Progress Park, Elstow). This also means that the air quality standard for 24-hour mean PM_{10} is likely to be met (**Table 8-1**) at all receptors. The impacts in terms of percentage change relative to the air quality standard are less than 1% (i.e., imperceptible), except at receptor 14 (residential property on Manor Road) which has -1% change (i.e., imperceptible). Reductions in concentration are primarily due to the proposed alterations to Manor Road. Consequently, the impacts on PM_{10} concentrations with the 2051 DS scenario are **Negligible** at all receptors. The predicted annual mean $PM_{2.5}$ concentrations are below the air quality standard of 20µg/m^3 (**Table 8-1**) in all scenarios. The highest concentration is 7.8µg/m^3 at receptor 53 (residential property on Ampthill Road, Elstow). The changes in $PM_{2.5}$ concentrations are very small and range between +0.08 and -0.16 µg/m^3. The impacts in terms of percentage change relative to the air quality standard of 20µg/m^3 are between 0% and -1%, with most receptors experiencing an imperceptible change of less than 1%. Reductions in concentrations are primarily due to the proposed alterations to Manor Road. Consequently, the impacts on $PM_{2.5}$ concentrations with the 2051 DS scenario are **Negligible** at all receptors. The Proposed Development would not affect compliance with the Government's $PM_{2.5}$ target for 2040. The magnitude of change and the associated judgement of significance of effects has been considered in conjunction with difficulties and uncertainties which are discussed in Section 8.7. The sensitivity of human receptors is high, without mitigation there is likely to be a direct, permanent, long term **Negligible Adverse** effect due to increased vehicle emissions **(Not Significant)**.
	Additional Mitigation	No additional mitigation is required.
	Residual Effects and Monitoring	The magnitude of change and the associated judgement of significance of effects has been considered in conjunction with difficulties and uncertainties which are discussed in Section 8.7.

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
		The sensitivity of human receptors is high, there is likely to be a direct, permanent, long term **Negligible Adverse** residual effect due to increased vehicle emissions **(Not Significant)**. The assessment does not indicate the need for air quality monitoring in relation to traffic emissions and human receptors during the Operational Phase.
Maulden Wood and Pennyfather's Hills SSSI and AW **Figure 8.5: Traffic Emissions and Ecological Receptors - Maulden Wood Ancient Woodland & Maulden Wood and Pennyfather's Hills Site of Special Scientific Interest (Volume 2)** Ecological receptors at six CWS within the study area. **Figure 8.6: Traffic Emissions and Ecological Receptors - County Wildlife Sites (Volume 2)**	**Potential Effects**	The interpretation of the potential effects associated with road traffic emissions on ecological receptors can be found in **Chapter 6: Ecology and Nature Conservation (Volume 1)**. However, a summary of the results in relation to the relevant critical levels and loads, and changes as a result of the Proposed Development in 2031, 2041 and 2051 is outlined below. There are eight ecological receptors within 200m of the modelled road network that are considered to have high sensitivity to air quality impacts due to changes in road traffic emissions, including: Maulden Wood and Pennyfathers Hills SSSI, Maulden Wood AW, Stewartby Lake CWS, Rookery Clay Pit CWS, Quest Pit CWS, Kempston Harwick Pit CWS, Elstow Pit CWS and Kempston West End CWS. The distance to which the change in concentration/deposition rate is greater than 1% of the relevant critical level/load was based on consideration of the data rounded to the nearest percentage point, regardless of whether the critical level/load is exceeded. **2031 DS vs 2031 DM** As outlined in the baseline sections, the NOx concentrations are below the critical level of 30µg/m^3 at the majority of ecological receptors in all 2031 scenarios. The exception is Kempston West End CWS between 0 and 20m within the Site (transect IDs 12_0 to 12_20). There are no changes of greater than 1% relative to the critical level past the edge of Maulden Wood and Pennyfather's Hills SSSI and AW, nearest the A6. At CWSs, there are exceedances of the 1% threshold beyond 0m at two transects: ▪ Transect 4 at Stewartby Lake CWS to 130m; and ▪ Transects 9 and 10 at Kempston Hardwick Pit CWS to 200m. NH_3 concentrations are below the critical level in all 2031 DS scenarios. There are no increases in concentration that are greater than 1% of the critical level of 3µg/m^3 with the 2031 DS scenario. N-dep exceeds the applied lower critical load at all transect points in all 2031 scenarios. At Maulden Wood and Pennyfather's Hills SSSI and AW, the impacts are greater than 1% of the lower critical load of 15kg/ha/yr at the very edge of the Site, nearest the A6. At CWS, the impacts are greater than 1% of the lower critical load of 10kg/ha/yr beyond 0m at one transect:

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
		▪ Transect 4 at Stewartby Lake CWS to 10m. All other CWS experience no increase greater than 1% beyond 0m, with the 2031 DS scenario. **2041 DS vs 2041 DM** As outlined in the baseline sections, the NOx concentrations are below the critical level of 30µg/m^3 at all ecological receptors with the 2041 DS scenario. There are no changes of greater than 1% relative to the critical level at the Maulden Wood and Pennyfather's Hills SSSI and AW. At CWSs, there are exceedances of the 1% threshold beyond 0m at three transects: ▪ Transect 4 at Stewartby Lake CWS to 20m; ▪ Transect 9 at Kempston Hardwick Pit CWS to 60m; and ▪ Transect 10 Kempston Hardwick Pit CWS to 40m. NH_3 concentrations are below the critical level of 3µg/m^3 in all 2041 DS scenarios. There are no increases in concentration that are greater than 1% of the critical level with the 2041 DS scenario. N-dep exceeds the applied lower critical load at all transect points in all 2041 scenarios. At Maulden Wood and Pennyfather's Hills SSSI and AW, the impacts are not greater than 1% of the lower critical load of 15kg/ha/yr. At CWS, the impacts are not greater than 1% of the lower critical load beyond 0m, with the 2041 DS scenario. **2051 DS vs 2051 DM** As outlined in the baseline sections, the NOx concentrations are below the critical level at all ecological receptors with the 2051 DS scenario. There are no changes of greater than 1% relative to the critical level at the Maulden Wood and Pennyfather's Hills SSSI and AW. At CWS, there are exceedances of the 1% threshold beyond 0m at one transect: ▪ Transect 4 at Stewartby Lake CWS to 20m. NH_3 concentrations are below the critical level in all 2051 DS scenarios. There are no increases in concentration that are greater than 1% of the critical level of 3µg/m^3 with the 2051 DS scenario. N-dep exceeds the applied lower critical load at all transect points in all 2051 scenarios. At Maulden Wood and Pennyfather's Hills SSSI and AW, the impacts are not greater than 1% of the lower critical load of 15kg/ha/yr. At CWS, the impacts are greater than 1% of the lower critical load of 10kg/ha/yr beyond 0m at one transect: ▪ Transect 4 at Stewartby Lake CWS to 20m.

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
		All other CWS experience no increase greater than 1% beyond 0m, with the 2051 DS scenario. For significance of effect, please refer to **Table 6-11** of **Chapter 6: Ecology and Nature Conservation (Volume 1)**.
	Additional Mitigation	Please refer to **Table 6-11** of **Chapter 6: Ecology and Nature Conservation (Volume 1)**. No mitigation measures are required.
	Residual Effects and Monitoring	For significance of residual effect, please refer to **Table 6-11** of **Chapter 6: Ecology and Nature Conservation (Volume 1)**. The assessment does not indicate the need for air quality monitoring in relation to traffic emissions and ecological receptors during the Operational Phase.

CUMULATIVE EFFECTS

8.6.4. As referred to in **Chapter: 3 Approach to EIA (Volume 1)**, the cumulative assessment for Air Quality is set out in **Chapter 18: Cumulative Effects (Volume 1)**. Cumulative effects have been addressed in the findings presented in **Table 8-7** and **Table 8-8** with committed development accounted for in the traffic data that have been used in the air quality assessment.

8.7. DIFFICULTIES AND UNCERTAINTIES

8.7.1. This section sets out the difficulties and uncertainties experienced in undertaking the air quality assessment that were considered when reporting on the impacts and effects of the Proposed Development. For assumptions used to inform the assessment, please refer to Section 0.

ADMS-ROADS

8.7.2. For the assessment of Operational Phase impacts, there are uncertainties associated with both measured and predicted concentrations. The ADMS-Roads model software (**Ref. 8.29**) used in this assessment relies on input data (such as predicted traffic flows), which are subject to inherent uncertainty. The model itself simplifies complex physical systems into a range of algorithms. In addition, local micro-climatic conditions may affect the concentrations of pollutants that ADMS-Roads does not consider.

DATASET PROJECTIONS

Road Traffic Flows

8.7.3. The method for the projection of traffic datasets has been agreed with National Highways as described in **Chapter 5: Traffic and Transport (Volume 1)**. Such projections are representations of reality based on the best available scientific consensus at the time and the assumptions of what traffic generating development will be consented in the future. The projections are influenced by market forces, technical advances, planning decisions and funding availability that may not be accounted for within the projections.

8.7.4. In the assessment of the 2029 Peak Construction scenario, comparison has been made with the 2029 Base scenario. Both scenarios assume no growth in background traffic from the traffic assessment base year of 2023 and do not include any mitigation which may come forward; consequently, the road network is assessed in its most constrained state. It also ensures the percentage impact of construction traffic, which is the key metric from an ES perspective, is maximised, and not masked by the addition of any background traffic. The 2029 Peak Construction scenario also does not include for any mitigation which may be introduced as a result of **Appendix 2.3: OCEMP (Volume 3)**), which can control the number, routing, and timing of construction vehicle movements as may be required.

Background Air Pollution

8.7.5. In the absence of the projection of background NO_2, PM_{10} and $PM_{2.5}$ pollution to 2051, data for the latest available year of 2040 have been used (**Ref. 8.26**). Therefore, the background air pollution concentrations don't account for potential changes in transport, industrial, agriculture and trans-boundary pollution sources beyond 2040. For NH_3 and N-dep the *Joint Nature Conservation Committee's Nitrogen Futures* (**Ref. 8.31**) 'business as usual' scenario has been assumed as the cautious worst case in order to provide a robust assessment of likely significant effects, which means that background NH_3 progressively increases due to expansion of intensive agriculture and, as a consequence, progressive reduction in background N-dep is diminished.

MODEL VERIFICATION

8.7.6. To reduce the uncertainty associated with predicted concentrations, model verification has been carried out following *LAQM.TG(22) guidance* (**Ref. 8.7**). As the model has been verified against local monitoring data for NO_2 and adjusted accordingly, there can be reasonable confidence in the predicted NO_2 concentrations for the future baseline and do-something scenarios. However, verification of particulate matter concentrations is rarely possible due, in part, to an absence of suitable monitoring and, where data are available, the very small contribution made by emissions from road traffic to total concentrations. The latter effect means that attributing a difference in concentration between a roadside monitored concentration and an area average background concentration (such as provided by the Defra background maps used in the verification of NOx/NO_2) to road emissions is difficult. Moreover, there are examples within Defra's Automatic Urban and Rural Network (**Ref. 8.33**), where monitored roadside concentrations are lower than the corresponding background concentration and/or concentrations monitored at nearby urban background sites. In contrast, for NOx/NO_2, the road increment to local concentrations is readily identifiable.

8.7.7. For these reasons, it is not appropriate to generate verification factors for PM_{10} and $PM_{2.5}$ using the same methodology as for NO_2 verification. Historically, studies have applied the model adjustment factor; however, there is little scientific basis for this since the mechanisms for generation of these pollutant species are different.

8.7.8. Notwithstanding, where $PM_{10}/PM_{2.5}$ specific verification factors have been calculated, the value obtained is less than one. There is widespread evidence for the under-prediction of NOx emissions from vehicles, but no equivalent evidence base for particulate matter emissions. In the absence of strong evidence for the necessity to apply model adjustment to modelled outputs of particulate matter, predicted concentrations of PM_{10} and $PM_{2.5}$ have not been adjusted.

8.8. SUMMARY OF LIKELY SIGNIFICANT EFFECTS AND PROPOSED MITIGATION

8.8.1. **Table 8-9** below presents a summary of the likely significant effects relating to Air Quality as a result of the Proposed Development, and the mitigation measures proposed to avoid, prevent, reduce or offset (if possible and required) any identified significant adverse effects. The table summarises those effects that were identified within the assessment as likely to be significant prior to the consideration of mitigation. Significant effects are identified as **major or moderate**. Effects that are identified as **negligible or minor** are not considered to be significant, and therefore, are not listed in the summary table below.

Table 8-9 - Summary of Likely Significant Air Quality Effects and Proposed Mitigation

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

Receptor	Description of effect	Classification of effect	Additional mitigation	Classification of residual effect	Significant/not significant
Construction Phase					
Residential properties in Kempston Hardwick (on Manor Road and at Kempston Hardwick Caravan Site).	Loss of amenity due to surface soiling due to construction dust (fugitive dust emissions).	**Major/Moderate Adverse** T/D/ST	Additional mitigation measures to minimise the risk of dust impacts are set out in **Appendix 2.3: OCEMP (Volume 3)**. Measures to mitigate dust emissions are required for Site management, monitoring, preparation and maintenance of the Site, operating vehicles/machinery and sustainable travel, general operations, earthworks, construction and trackout.	**Minor/Negligible Adverse** T/D/ST	**Not Significant**

8.9. REFERENCES

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