Air Quality Assessment

Banbury Phase 3, Junction 11

July 2021

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Abbreviations and Acronyms

AADT	Annual Average Daily Traffic
ADMS	Air Dispersion Modelling Software
AQAL	Air Quality Assessment Level
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
BAT	Best Available Technology
CDC	Cherwell District Council
CHP	Combined Heat and Power
CEMP	Construction Environmental Management Plan
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emissions Factor Toolkit
GEA	Gross External Area
GIA	Gross Internal Area
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LAQM.TG(16)	Local Air Quality Management: Technical Guidance (16)
LDV	Light Duty Vehicle
NAQO	National Air Quality Objective
NO_2	Nitrogen dioxide
NOx	Oxides of Nitrogen
NPPF	National Planning Policy Framework
NRMM	Non-road mobile machinery
OCC	Oxfordshire County Council
OS	Ordinance Survey
PM_{10} and $PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 10 microns (µm) (PM_{10}) or less than 2.5µm ($PM_{2.5}$), expressed in units of $\mu g/m^3$.
RES	Residential Receptor
ULSD	Ultra-Low Sulphur Diesel

1.0 Introduction

TRC Companies Limited (TRC) was commissioned by Monte Blackburn Limited (the 'Client') to undertake an air quality assessment (AQA) to support the planning application for the mixed-use development located at land located north-east of Junction 11 of the M40 within Banbury, Oxfordshire (hereafter referred to as the 'Site').

TRC previously provided an AQA (document ref: 272739.0001.0000) for Monte Blackburn Limited in support of a hybrid planning application (planning ref: 19/00128/HYBRID) as follows:

- Part A: Full Planning Application for the development of a new priority junction to the A361, internal roads and associated landscaping with 2no. commercial buildings having a maximum floorspace of 33,110m^2 and with a flexible use within Class B2 or B8, and ancillary Class B1 offices;
- Part B: Outline Planning Application for the development of up to 2no. commercial buildings having a maximum floorspace of 16,890m^2 and having flexible use within Class B2 or B8 and ancillary Class B1 offices, with all other matters reserved for future approval.

It is understood that approval of the hybrid application was granted and that construction of Part A (Phase 1 & 2) has begun, however the intention is to submit a new planning application for Part B (Phase 3), which differs from the original proposal. The new proposals include for:

- A 240 bed hotel;
- 4-storey office building (circa 5,200m^2 GIA);
- Petrol filling station;
- Coffee and hot-food drive-thru(s); and
- Associated car parking, hard and soft landscaping.

The parking provision for the Site includes for a total of 416 parking spaces, of which 36 will be disabled bays and 24 will be Electric Vehicle Charging Points (EVCP). A hydrogen fuel pump for HGVs will also be introduced to move towards a low emission future ('Proposed Development'). The layout of the Proposed Development is shown in Figure 1.

1.1 Existing Site and Wider Area

The existing Site is located at the approximate National Grid Reference (NGR) 447200 (m) Easting, 242060 (m) Northing within the jurisdiction of Cherwell District Council ('CDC') and is located adjacent to the north-east corner of Junction 11 of the M40. The surrounding area is predominantly agricultural and industrial in nature with the town of Banbury located to the south-west. The location of the Site is shown in Figure 2.

The Site is bound by Phase 1 and Phase 2 of the wider development to north, the M40 southbound off slip to Junction 11 to the west and the A361 follows the eastern and southern boundary of the Site to Junction 11 of the M40.

CDC have declared 4no. Air Quality Management Areas (AQMAs) for exceedances of the annual mean Nitrogen Dioxide (NO_2) national air quality objective (NAQO) of which one is further declared for exceedances of the hourly mean NO_2 NAQO. The Site is not located within an AQMA, however the closest AQMA is located approximately 500m west of the Site, covering an area of the A422 Hennef Way between Concorde Avenue and Ermont Way. This AQMA is the most severe with regards to exceedance of the annual mean NO_2 NAQO and is therefore also declared for exceedances of the hourly mean NO_2 NAQO. Additional transport emissions associated with the Proposed Development therefore have the potential to impact upon the AQMA and sensitive receptors located within or adjacent.

1.2 Site Background Information

The development site forms part of a preferred employment allocation site (Strategic Development Site Reference - 15) within the Adopted Cherwell Local Plan 2011-2013 (Part 1) which was formally adopted by the Council on 20th July 2015.

Policy Banbury 15 within the Local Plan relates specifically the development, namely "Employment Land North East of Junction 11", and allocates the land for commercial development within the Use Classes B1, B2, and B8.

The site was subject to a previous planning application in 2017 (CDC Planning Reference 17/01044/F), which sought approval for the development of a 22,150m^2 industrial building (Class B8); two office buildings of 3716m^2 each (Class B1); Motorway Services Area with amenity building, Petrol Filling Station (with canopy, fuel pump islands, ancillary convenience store and food to go outlet) and HGV Parking; creation of a new vehicular accesses off the A361 together with associated alterations to the highway; parking and circulation; landscaping, drainage and associated works.

The 17/01044/F application was ultimately refused on 25th June 2018, including the following reasoning with respect to air quality:

> *'The proposed development would result in increases over and above an existing exceedance of national air quality objectives for nitrogen dioxide for residential receptors in Hennef Way within Cherwell District Council's Air Quality Management Area No.1. In the absence of adequate measures to ensure that this increase is satisfactorily mitigated through appropriate, specific, enforceable and deliverable measures that could be secured as part of the development then it must be concluded that the proposed development would be at odds with both local and national air quality objectives contrary to the requirements of Policy BSC8 of the Cherwell Local Plan 2011-2031 Part 1 and Policy ENV1 of the Cherwell Local Plan 1996 as well as Government guidance contained in the National Planning Policy Framework.'*

As noted, development proposals were submitted to Cherwell District Council (CDC) in January 2019 in the form of a hybrid planning application, with the application ultimately approved (subject to conditions) in May 2019. The approval was subject to a S106 Agreement/Undertaking which within the district obligations included the following commentary in relation to air quality:

> '*1.1 "Air Quality Mitigation Scheme" means a scheme of air quality mitigation measures to offset the impact on air quality based on the environmental damage cost of the Development*

2. Air Quality Scheme

2.1 Not to cause or permit first occupation of a Building until the Air Quality Mitigation Scheme relating to that Building has been submitted to the County Council and the District Council and has been approved in writing by the County Council and District Council.

2.2 Not to cause or permit first occupation of a Building until and unless the Air Quality Mitigation Scheme relating to that Building has been implemented.

2.3 From the date of its approval to implement each of the approved Air Quality Schemes and to comply fully with such schemes.

1.3 Assessment Scope

This assessment considers the air quality impacts associated with both the construction and operation of the development. Likely changes to air quality in the area, as a result of the proposed development have been considered in relation to the national air quality objectives to determine their significance. Also, where required, the air quality assessment considers mitigation measures to reduce the effect of the proposed development upon local air quality.

In terms of the construction impacts, the development proposal will have the potential to generate dust, particulate matter (PM_{10}), and oxides of nitrogen (NOx) emissions during the construction phase. These impacts are assessed in accordance with the Institute of Air Quality Management (IAQM) best practice guidance (Holman et al., 2016).

Traffic movements, generated by the proposed development during its operation, will give rise to NOx and PM_{10} emissions. The impact of these emissions on local air quality will be assessed in accordance with IAQM Guidance on Land-Use Planning & Development Control: Planning for Air Quality (Moorcroft et al., 2017). Traffic emissions will also be considered in an Air Quality Neutral Assessment. Furthermore, NOx plant emissions are considered in the air quality neutral assessment.

This air quality assessment report covers the following sections:
- Legislation, Planning Policy and Standards;
- Baseline Conditions;
- Construction Impact Assessment;
- Operational Impact Assessment;
- Environmental Damage Cost Calculations;
- Mitigation Measures; and
- Summary, Conclusions and Recommendations.

1.4 Significant Assumptions

This report presents TRCs observations, findings, and conclusions as they existed on the date that this report was issued. This report is subject to modification if TRC becomes aware of additional information after the date of this report that is material to its findings and conclusions.

The report has been prepared in line with the policy and guidance which is discussed within Section 2 of this report.

The reliability of information provided by others to TRC cannot be guaranteed to be accurate or complete. Performance of this assessment is intended to reduce, but not eliminate, uncertainty regarding environmental conditions associated with the subject site; therefore, the findings and conclusions made in this report should not be construed to warrant or guarantee the subject site, or express or imply, including without limitation, warranties as to its marketability for a particular use. TRC found no reason to question the validity of information received unless explicitly noted elsewhere in this report.

2.0 Legislation, Planning Policy and Guidance

This assessment takes account of the following national, regional and local planning guidance.

2.1 National Legislation

Part IV of the Environment Act 1995 requires local authorities to review and assess the air quality within their boundaries. As a result, the first Air Quality Strategy was adopted in 1997, with national health-based standards and objectives set out for the then, key eight air pollutants of benzene, 1-3 butadiene, carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter and sulphur dioxide.

The purpose of the Air Quality Strategy was to identify areas where air quality was unlikely to meet the objectives prescribed in the regulations. The strategy was reviewed in 2000 and the amended Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2000) was published. This was followed by an Addendum in February 2003 and in July 2007, an updated Air Quality Strategy was published (Defra, 2007).

The pollutant standards relate to ambient pollutant concentrations in air, set on the basis of medical and scientific evidence based on how each pollutant affects human health.

The air quality objectives applicable in LAQM in England are set out in the Air Quality (England) Regulations 2000, (SI 928), The Air Quality (England) (Amendment) Regulations 2002, (SI 3043) and are shown in Table 2.1 below.

The main air quality pollutants of concern with regards to new developments such as the one proposed at this application Site, are the traffic-related pollutants namely NO_2 and PM_{10}.

Table 2.1: National Air Quality Objectives (NAQO)

Air Quality Objectives			
Pollutant	**Concentrations**	**Measured as**	**Date to be achieved by and maintained thereafter**
Nitrogen Dioxide (NO_2)	200 $\mu g/m^3$	1-hour mean not to be exceeded more than 18 times per year	31.12.2005
	40 $\mu g/m^3$	Annual mean	31.12.2005
Particulate Matter (PM_{10})	50 $\mu g/m^3$	24-hour mean not to be exceeded more than 35 times per year	31.12.2004
	40 $\mu g/m^3$	Annual mean	31.12.2004

Air Quality Standards Regulations, 2010

The air quality limit values set out in EU Directive (2008/50/EC, 2008) are transposed in English law by the Air Quality Standards Regulations (2010). This imposes duties on the Secretary of State relating to achieving the limit values.

In most cases the air quality limit values and air quality objectives have the same pollutant concentration threshold. The key difference is that the Secretary of State for the Environment is required under European Law to ensure the air quality limit values are complied with whereas local authorities are only obliged under national legislation to undertake best efforts to comply with the air quality objectives.

Dust Nuisance

Under provisions in the Environmental Protection Act 1990, dust nuisance is defined as a statutory nuisance:

> *"Any dust or effluvia arising from an industrial, trade or business premises and being prejudicial to health or a nuisance"*

There are currently no standards or guidelines for the nuisance of dust in the UK, nor are formal dust deposition standards specified.

2.2 National Planning Policy

National Planning Policy Framework (2019)

The aim of this document is to set out the Government's requirements for the planning system. It also aims to enable local people and councils to produce their own distinctive local and neighbourhood plans.

Chapter 15, paragraph 181 of the NPPF "Conserving and Enhancing the Natural Environment" states:

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

2.3 Local Planning Policy

Adopted Cherwell Local Plan 2011 – 2031 (Part 1)

The Adopted Cherwell Local Plan 2011-2031 (Part 1) contains strategic planning policies for development and the use of land up to 2031. It forms part of the statutory Development Plan for Cherwell. The Plan was formally adopted by the Council on 20 July 2015. With regards to the Site the plan states:

> ***'Policy Banbury 15: Employment Land North East of Junction 11***
>
> *Development Description: Located on the north eastern edge of Banbury in*

an important position adjoining the M40 and the A361, this strategic site comprises 13 hectares of land for mixed employment generating development. A variety of employment types will be sought to reflect the need for diversity and resilience in the local economy expressed in the Economic Development Strategy.

Employment:

- *Jobs created – approximately 1,000*
- *Use classes – B1 (Office), B2 (General Industrial) and B8 (Storage and Distribution).*

Infrastructure Needs:

- *Open space - Incidental*
- *Access and Movement – access to A361 and M40 via Junction 11. Necessary contributions to other transport improvements will be sought, including improvements to bus services, walking and cycling routes. Contributions will also be required to improve operation of Junction 11 and Hennef Way junctions and to improved bus services.*

Key site specific design and place shaping principles:

- *Proposals should comply with Policy ESD15;*
- *A high quality commercial District for the east of Banbury that has high connectivity to major transport routes and is well integrated with the adjacent commercial uses;*
- *Layout of development that enables a high degree of integration and connectivity between new and existing development, including adjoining employment areas, nearby residential areas and the town centre;*
- *Provision of new footpaths and cycleways that link to existing networks to link the site with the Banbury urban area;*
- *Protection of the amenity of the public footpath network including satisfactory treatment of existing footpaths on the site and diversion proposals where appropriate;*
- *Good accessibility to public transport services should be provided to link the site with the Banbury urban area and provide an alternative to travel by car;*
- *Satisfactory access arrangements including a detailed transport assessment and Travel Plan given the location of the site close to the strategic road network;*
- *A high quality, well designed approach to the urban edge which functions as a high profile economic attractor but which also achieves a successful transition between town and country environments;*
- *Development that respects the landscape setting, that demonstrates the enhancement, restoration or creation of wildlife corridors, and the creation of a green infrastructure network for Banbury;*
- *Development proposals to be accompanied and influenced by landscape/visual and heritage impact assessments;*
- *A comprehensive landscaping scheme including on-site provision to enhance the setting of buildings onsite and to limit visual intrusion into the wider landscape, particularly given the key views afforded into the site from higher ground in the wider vicinity;*

- *Include planting of vegetation along strategic route ways to screen the noise;*
- *Adequate investigation (through an ecological survey) treatment and management of priority habitats and protected species onsite to preserve and enhance biodiversity;*
- *A high quality design and finish, with careful consideration given to layout, architecture, materials and colourings to reduce overall visual impact;*
- *The height of buildings to reflect the scale of existing employment; development in the vicinity;*
- *Take account of the Council's Strategic Flood Risk Assessment for the site;*
- *Full mitigation of flood risk in compliance with Policy ESD 6: Sustainable Flood Risk Management including the use of SuDS (Policy ESD 7: Sustainable Drainage Systems (SuDS)), specifically attenuation SuDS techniques, taking account of the recommendations of the Council's Strategic Flood Risk Assessment;*
- *Adoption of a surface water management framework to reduce run off to greenfield rates;*
- *Demonstration of climate change mitigation and adaptation measures including demonstration of compliance with the requirements of policies ESD 1 – 5;*
- *An assessment of whether the site contains best and most versatile agricultural land, including a detailed survey where necessary.'*

With regards to air quality the local plan states:

> ***'Policy ESD10: Protection and Enhancement of Biodiversity and the Natural Environment***
>
> *Protection and enhancement of biodiversity and the natural environment will be achieved by the following: […]*
>
> - *Air quality assessments will also be required for development proposals that would be likely to have a significantly adverse impact on biodiversity by generating an increase in air pollution […]'*

Cherwell District Council Air Quality Action Plan 2017

CDC's Air Quality Action Plan (AQAP) 12 was updated in March 2017 to cover the period 2017 to 2020. Actions can be considered under five broad topics:

- Policy guidance and development control;
- Promoting low emission transport;
- Promoting travel alternatives to private vehicle use;
- Transport planning; and
- Public information.

The key priorities are outlined as follows:

- Priority 1 – Strengthening local policy to improve air quality and its role in protecting health;
- Priority 2 – Reducing NOx emissions from cars in all AQMAs;

- Priority 3 – Ensuring new developments encourage and facilitate low emission and alternative transport;
- Priority 4 – Ensuring transport infrastructure delivery takes account of air quality improvement potential within AQMAs;
- Priority 5 – Raising awareness of poor air quality and encouraging improvement actions by vehicle users and fleet managers.

Any low emission strategies formulated in support of planning applications can be readily aligned with the AQAP to ensure that emission reduction strategies are addressed in a mutually acceptable fashion.

2.4 Assessment Guidance

IAQM Guidance on the Assessment of Dust from Demolition and Construction (2014)

The document (Holman et al, 2014) provides guidance on how to undertake a construction impact assessment. The impacts of dust depend on the mitigation measures adopted. The emphasis in this document is on classifying the risk of dust impacts from a site, which will then allow appropriate mitigation measures to be identified.

The assessment procedure follows the following four-step framework:

- Step 1: Need for Detailed Assessment;
- Step 2: Assess the Risk of Dust Effect;
- Step 3: Identify the Need for Site-Specific Mitigation; and
- Step 4: Define Effects and their Significance.

Details of this assessment framework are discussed in Section 4.0 of this report.

IAQM Guidance on Land-Use Planning & Development Control: Planning for Air Quality (2017)

This guidance document (Moorcroft et al, 2017) from the IAQM focuses on consideration of air quality within the land-use planning and development control processes.

It provides a two-stage approach for assessing the impacts of a development on local air quality. Stage 1 is intended to screen out smaller development and/or developments where impacts can be considered to have insignificant effects

Stage 1:

- If any of the following apply:
  - 10 or more residential units or a site area of more than 0.5ha; or
  - More than 1,000 m^2 of floor space for all other uses or a site area greater than 1ha.
- Coupled with any of the following:
  - the development has more than 10 parking spaces; or
  - the development will have a centralised energy facility or other centralised combustion process.

Stage 2 relates to specific details regarding the proposed development and the likelihood of air quality impacts. These criteria are detailed in Table 2.2. If none of the criteria are met then there should be no requirement to carry out an air quality assessment for the impact of the proposed development on the local area, and the impacts can be considered to have insignificant effects.

This guidance also includes a suggested framework for describing the impacts. This framework is set out in Table 2.3. The assessment framework allows for a practical way of assigning a meaningful description to the degree of an impact from a development. Impact is described by expressing the magnitude of incremental change as a proportion of a relevant assessment level and then to examine this change in the context of the new total concentration and its relationship with the assessment criterion (or Air Quality Assessment Level (AQAL)).

Table 2.2: Indicative criteria for requiring an air quality assessment

The development will:	Indicative Criteria to Proceed to an Air Quality Assessment
1. Cause a significant change in Light Duty Vehicle (LDV) traffic flows on local roads with relevant receptors. (LDV = cars and small vans <3.5t gross vehicle weight).	A change of LDV flows of: - more than 100 AADT within or adjacent to an AQMA - more than 500 AADT elsewhere.
2. Cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors. (HDV = goods vehicles + buses >3.5t gross vehicle weight).	A change of HDV flows of: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.
3. Realign roads, i.e. changing the proximity of receptors to traffic lanes.	Where the change is 5m or more and the road is within an AQMA.
4. Introduce a new junction or remove an existing junction near to relevant receptors.	Applies to junctions that cause traffic to significantly change vehicle accelerate/decelerate, e.g. traffic lights, or roundabouts.
5. Introduce or change a bus station.	Where bus flows will change by: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.
6. Have an underground car park with extraction system	The ventilation extract for the car park will be within 20 m of a relevant receptor. Coupled with the car park having more than 100 movements per day (total in and out).
7. Have one or more substantial combustion processes, where there is a risk of impacts at relevant receptors. NB. this includes combustion plant associated with standby emergency generators (typically associated with centralised energy centres) and shipping.	Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec* is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.

The development will:	Indicative Criteria to Proceed to an Air Quality Assessment
	Conversely, where existing NO_2 concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable.

*As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NOx gas boiler or a 30kW CHP unit operating at <95mg/Nm3. Users of this guidance should quantify the NOx mass emission rate from the proposed plant, based on manufacturers' specifications and operational conditions.

Table 2.3: Long term impact descriptors for individual receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

3.0 Baseline Conditions

Baseline data were gathered from the following sources:

- UK AIR: Air Information Resource;
- Defra's national air quality background maps;
- Cherwell District Council's (CDC) Air Quality Annual Status Report (ASR) 2020;

3.1 Local Air Quality Management

The Environment Act 1995 introduced the Local Air Quality Management (LAQM) regime which places responsibility on local authorities to review and assess air quality in their areas of jurisdiction. Where national air quality objectives (NAQOs) are not likely to be met, local authorities are required to and designate Air Quality Management Areas (AQMAs) and produce an air quality action plan describing the air pollution reduction measures they will put in place.

CDC have declared 4no. AQMAs within their jurisdiction. Table 3.1 provides further details of the AQMAs within Banbury and the proximity to the Proposed Development.

Table 3.1: Current AQMAs near the Development Site

AQMA Name	Description	Pollutants Declared	Declaration Date	Proximity to Site (km)
AQMA No.1 Banbury	Three residential property facades backing onto Hennef Way between roundabouts with Ermont Way and Concorde Avenue.	NO_2 annual mean NO_2 hourly mean	17/01/2011	0.5
AQMA No. 2 Banbury	The South Bar junction with Oxford Road to the North Bar junction with Southam Road, including a section of High Street.	NO_2 annual mean	29/10/2014	2.5

3.2 Air Quality Monitoring Data

<u>Automatic Monitoring</u>

According to CDC's latest Air Quality ASR (2020), CDC did not undertake any automatic monitoring in 2019.

<u>Non - Automatic Monitoring</u>

Non-automatic monitoring of NO_2 utilising passive diffusion tubes was undertaken at 42 locations within CDC in 2019. Historic monitoring data for the years 2016 – 2019 at monitoring locations within 1km of the Site is presented in Table 3.2 below. The location of the local authority run diffusion tubes and AQMAs is shown in Figure 3.

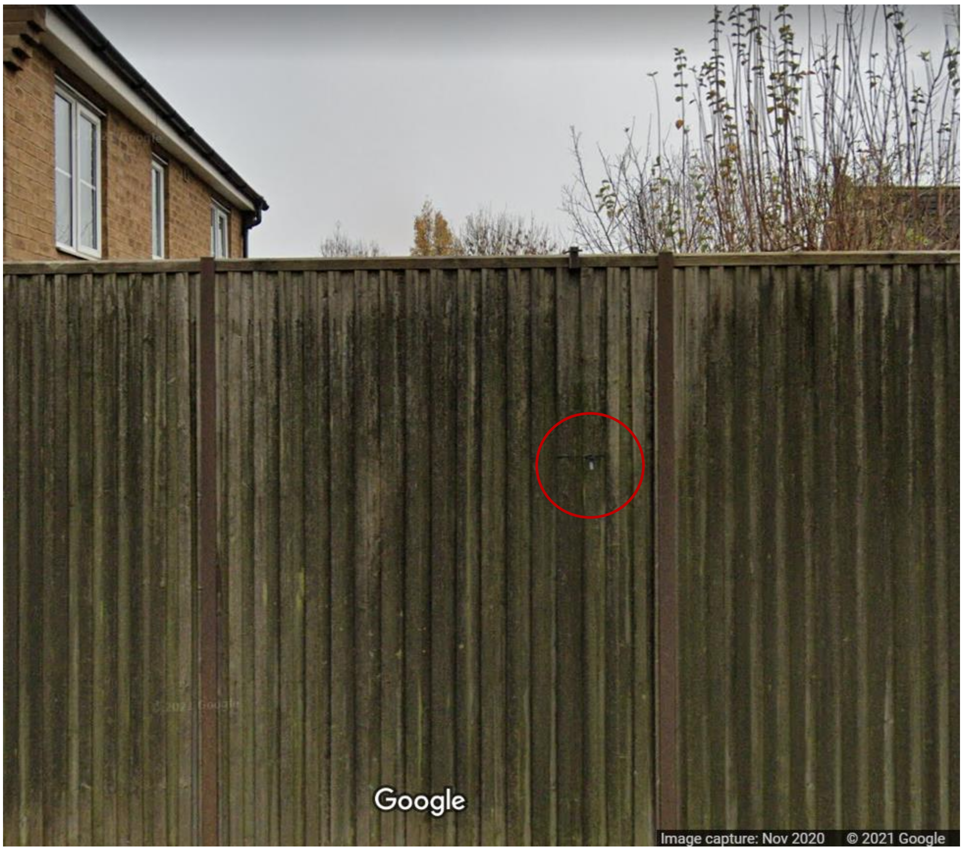
Table 3.2 Monitoring Data from Non - Automatic Monitoring Stations for the Years 2015 - 2019

Site ID	Site Type	Distance to Site (km)	Annual Mean Concentration (µg/m^3)			
			2016	2017	2018	2019
Ermont Way 1	Roadside	0.52	31.0	28.5	30.9	28.0
Ermont Way 2	Roadside	0.68	31.4	27.2	29.7	27.1
Hennef Way	Roadside	0.69	**89.9**	**91.6**	**81.2**	**77.5**
Stroud Close	Roadside	0.89	28.1	24.9	25.7	23.5
*Bold denotes exceedance of annual mean national air quality objective: NO_2 - 40µg/m^3. Underline denotes likely exceedance of the hourly mean air quality objective: NO_2 - 200 µg/m^3 not to be exceeded more than 18 times per year.						

The data presented in Table 3.2 shows that at the majority of roadside locations within 1km of the Site show NO_2 concentrations below the annual mean NAQO. Furthermore, the concentration change between 2016 and 2019 shows a decline of approximately 10% at each monitoring location, thus presenting long term improvement in pollutant concentrations.

Hennef Way is a complicated monitor that is representative of a small but significant area, rather than Hennef Way as a whole, as seen by the significant drop off to Stroud Close without a significant increase in distance from Hennef Way. The Hennef Way diffusion has been located on an acoustic fence on the southern side of Hennef Way as shown in insert one below, taken from Google Street View Imagery.

Insert 1 – Location of Hennef Way Diffusion Tube – November 2020



The predominant wind direction in the UK is from the south-west and as such the acoustic barrier protects the diffusion tube from the wind, thus creating a space whereby the mixing of emissions from the nearby carriageway is unable to disperse in the same way as other areas and pollutants will not mix as much as in other areas. During spells of north-easterly winds associated with high pressure systems, the fence will further act to block the dispersion of pollutants. In combination with the congested nature of Hennef Way, this leads to the extremely high concentrations recorded in Table 3.2.

The diffusion tube is indicative though of the likely pollutant concentrations at the facades of the properties located on Fisher Close with the rear façade approximately 5m from Hennef Way. These properties provide the same effect as the acoustic fence and thus it is likely that there is a build up of pollutants concentrations at these properties.

3.3 Background Pollutant Concentrations

Defra's website includes estimated background air pollution data for NOx, NO_2, PM_{10} and PM_{10} centred on 1x1km OS grid squares. Background pollutant concentrations are modelled on the most recent available data which is the base year of 2018, and this has been based on ambient monitoring and meteorological data from that year. The maps include pollutant concentration projections for future years up to 2030.

Table 3.3 shows the annual mean background concentrations for NO_2, PM_{10} and $PM_{2.5}$ for the years 2019 (the latest year of monitoring), 2021 (current year) and 2026 (the proposed opening year) based on the grid square centred on the co-ordinates 447500, 242500. The data shows that for all pollutants annual mean concentrations are within their respective annual mean NAQOs and are predicted to decrease in the long term.

Table 3.3 Background Pollutant Concentrations Within the Vicinity of the Site for 2019, 2021 and 2026

Pollutant	Annual Mean Concentration (µg/m^3)		
	2019	2021	2026
NO_2	15.5	14.4	12.3
PM_{10}	16.7	16.2	15.5
$PM_{2.5}$	11.5	11.1	10.5
*__Bold__ denotes exceedance of annual mean national air quality objective: NO_2 / PM_{10} - 40µg/m^3 and $PM_{2.5}$ - 25µg/m^3			

4.0 Construction Impact Assessment

4.1 Methodology

The construction effects have been assessed using the qualitative approach described in the latest IAQM guidance (Holman et al, 2014) and the GLA's 'Control of Dust and Emissions During Construction and Demolition' SPG (2014). The guidance applies to the assessment of dust from construction activities.

The main impacts that may arise during construction of the proposed development are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes;
- Elevated PM_{10} concentrations as a result of dust generating activities on-Site; and
- An increase in NO_2 and PM_{10} concentrations due to exhaust emissions from NRMM and vehicles accessing the Site.

The IAQM guidance considers the potential for dust emissions from four dust generating activities:

- Demolition of existing structures or breaking of ground;
- Earthworks: Process of soil stripping, ground levelling, excavation and land capping;
- Construction of new structures; and
- Trackout: The transport of dust and dirt from the Site onto the public road network where it may be deposited and then re-suspended by vehicles using the network.

For each of these dust-generating activities, the guidance considers three separate effects:

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

The receptors can be human or ecological and are chosen based on their sensitivity to dust soiling and PM_{10} exposure.

The methodology takes into account the scale to which the above effects are likely to be generated (classed as small, medium or large), along with the levels of background PM_{10} concentrations and the distance to the closest receptor, in order to determine the sensitivity of the area. This is then taken into consideration when deriving the overall risk for the Site. Suitable mitigation measures are also proposed to reduce the risk of the Site.

The assessment steps are summarised below:

Step 1: Need for Assessment

The first step is the initial screening for the need for a detailed assessment. According to the IAQM guidance, an assessment is required where there are sensitive receptors within 350m of the Site boundary (for ecological receptors that is 50m) and/or within 50m of the route(s) used by the construction vehicles on the public highway and up to 500m from the Site entrance(s).

Step 2: Assess the Risk of Dust Impacts

This step is split into three sections as follows:

- 2a. Define the potential dust emission magnitude
- 2b. Define the sensitivity of the area
- 2c. Define the risk of impacts

Each of the dust-generating activities is given a dust emission magnitude depending on the scale and nature of the works (step 2a) based on the criteria shown in Table A1 (Appendix A).

The sensitivity of the surrounding area is then determined (step 2b) for each dust effect from the above dust-generating activities, based on the proximity and number of receptors, their sensitivity to dust, the local PM_{10} background concentrations and any other site-specific factors. Tables A2 to Table A5 (Appendix A) show the criteria for defining the sensitivity of the area to different dust effects.

The overall risk of the impacts for each activity is then determined (step 2c) prior to the application of any mitigation measures (Table A3, Appendix A) and an overall risk for the Site derived.

Step 3: Determine the site-specific mitigation

Once each of the activities is assigned a risk rating, appropriate mitigation measures are identified. Where the risk is negligible, no mitigation measures beyond those required by legislation are necessary.

Step 4: Determine any significant residual effects

Once the risk of dust impacts has been determined and the appropriate dust mitigation measures identified, the final step is to determine whether there are any residual significant effects.

Step 5: Prepare a dust assessment report

The last step of the assessment is the preparation of a Dust Assessment Report which is covered within this report.

4.2 Results

Earthworks and Construction Dust Sensitive Receptors

The precise behaviour of dust, its residence time in the atmosphere, and the distance it may travel before being deposited would depend upon several factors. These include wind direction and strength, local topography and the presence of intervening structures (buildings, etc.) that may intercept dust before it reaches sensitive locations. Furthermore, dust would be naturally suppressed by rainfall.

Figure 4 shows a graphical representation of the 20m, 50m, 100m, 200m and 350m earthworks and construction dust buffer zones around the Site while Table 4.1 summarises the receptors that may be affected during these phases. It is assumed that the Phase 1 & 2 buildings are complete at the time of construction for a worst case assessment.

Table 4.1: Earthworks and Construction Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Residential Receptors (High Sensitivity)	Approximate Number of Non-Residential Receptors (Med – Low Sensitivity)
Less than 20	0	0
20 - 50	0	1 – 10
50 - 100	0	1 – 10
100 - 200	0	1 – 10
200 – 350	0	10-100

Potential Dust Emission Magnitude

Following the methodology outlined in section 4.1 and the criteria presented in Table A1 (see Appendix A), each dust-generating activity has been assigned a dust emission magnitude as shown in Table 4.2. It is assumed that Phase 1 & Phase 2 are simultaneously constructed with Phase 3 for a worst-case assessment, combining the likely dust emissions of each development.

Table 4.2: Dust Emission Magnitude for Construction Activities

Activity	Dust Emission Magnitude	Justification
Demolition	N/A	There are no existing buildings to be demolished, nor any hard slab ground to be broken in significant quantities.
Earthworks	Large	The total site area is >10,000m^2 and it is likely that 5 – 10 earthmoving vehicles could be in operation at any one time with significant earthworks required.
Construction	Large	The total building volume will be >100,000 m^3 and the materials utilised could have high dust potential.
Trackout	Medium	It is anticipated during peak periods the Site will generate 10 – 50 HDV (>3.5t) outward movements in any one day and the unpaved length of road onsite will be >100m.

Sensitivity of the Area

The sensitivity of the area to dust soiling has been assigned as medium as there are <10 residential properties (high sensitivity) and <10 commercial premises (medium sensitivity) within 50m from the Site.

According to Defra's background maps (Section 3.4), the annual mean PM_{10} concentration for the Site area is 16.2µg/m^3. Given that there are 0 residential properties (high sensitivity) and <10 commercial premises (medium sensitivity) within 50m from the Site the sensitivity to the human health impacts has been designated as low.

Trackout impacts may occur up to 50m from the edge of a road utilised by construction traffic up to 500m from the exit of a large Site. Accessing the Site from the A361 via the M40 there are no receptors within 50m of the road.. As such the sensitivity of nearby receptors to dust soiling impacts from trackout is considered to be negligible.

The overall sensitivity of the area to dust soiling and human health is summarised in Table 4.3

Table 4.3: The Sensitivity of the Area

Activity	Sensitivity of the Surrounding Area	
	Dust Soiling	Human Health
Demolition	Negligible	Negligible
Earthworks	Medium	Low
Construction	Medium	Low
Trackout	Negligible	Negligible

Risk of Impacts

The risk of dust impacts for relevant construction activities are summarised in Table 4.4. These results consider both the potential dust emission magnitude and the sensitivity of the area. Results show that the impact is considered **medium** in terms of dust soiling and **low** in terms of impact on human health. It is acknowledged these activities are temporary in nature and will be mitigated through implementation of good industry practices, appropriate to the level of risk. Section 6.0 of this report sets out appropriate mitigation measures to ensure the impact from construction activities will not be significant.

Table 4.4: The Risk of Dust Impacts

Activity	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Negligible	Medium	Medium	Negligible
Human Health	Negligible	Low	Low	Negligible

4.3 Construction Traffic and Plant

The greatest impact on air quality due to emissions from construction vehicles and plant associated with the construction phase will be in areas immediately adjacent to the Site. The exact route that construction traffic will take to the Site is unknown, however the volume of transport and short term nature of the works is unlikely to impact upon local air quality. The permission for the hybrid application included for the production of a Construction Transport Management Plan (CTMP) and it is advised that that document is modified where necessary to be suited to the Proposed Development. Given the limited number of receptors located between the M40 and the Site via the A361, the impact on local air quality from construction related transport will be negligible.

Details of the plant to be utilised on Site and there specific location are not currently available, however they should meet the relevant emissions standards for Non Road Mobile Machinery and detailed in the Construction Environmental Management Plan (CEMP).

5.0 Operational Traffic Impacts

Traffic movements generated by the development during its operation will give rise to NOx and PM_{10} emissions. The likelihood of air quality impacts has been assessed in accordance with the IAQM criteria set out in Table 2.3 of this report.

Traffic-related air pollutant concentrations (namely NOx and PM_{10}) were predicted at the nearest sensitive locations using the dispersion model ADMS-Roads (version 5.0.0.1). This model is a new generation dispersion modelling system developed by Cambridge Environmental Research Consultants (CERC) which can be used to assess the impact of road vehicle emissions on local air quality. The model is widely used by Local Authorities in the UK as part of their review and assessment obligations.

5.1 Modelling Inputs

Assessment Receptors

Pollutant concentrations were predicted at locations where exposure to traffic emissions from additional vehicle movements are expected to be the highest, such as in close proximity to roads and junctions. The selected sensitive receptor coordinates and heights are detailed in Table 5.1 and their locations are shown in Figure 5.

Table 5.1: Location of Assessment Receptors

Receptor ID	Receptor Description	OS Coordinates (m)		
		X	Y	Z
PR01	Proposed Office Building	447153.4	242009.6	1.5
PR02	Proposed Hotel Building	447202.4	241944.5	1.5
PR03	Proposed Restaurants	447110.4	242082.9	1.5
R01	Residential Dean Close	446088.9	241603.9	1.5
R02	Residential Fisher Close Hennef Way Facade	446575.8	241723.4	1.5
R03	Residential Stroud Close Hennef Way Facade	446327.4	241681.5	1.5
R04	Residential Fisher Close Hennef Way Facade	446559.5	241720.8	1.5
R05	Residential Fisher Close	446663.8	241720.1	1.5
R06	Residential Daventry Road	446689.9	241714.3	1.5
R07	Residential Brinkburn Grove Ermont Way Facade	446775.4	241616.9	1.5
R08	Residential Brinkburn Grove Ermont Way Facade	446889.0	241709.1	1.5
R09	Residential Farmhouse Banbury Lane / A422	447911.4	241565.5	1.5
R10	Residential Banbury Lane	448210.4	241737.3	1.5

The receptors PR01 – PR03 are associated with the Proposed Development. Each of these receptors cannot be considered to be areas where the users would spend much more than a short period of time located at and as such, only the short term air quality objectives would apply. For receptors R01 – R10, both the long term annual mean and short term pollutant objectives would apply.

Traffic Data and Assessment Scenarios

The previous air quality assessment submitted alongside the Hybrid Planning application assessed traffic across all three phases of the development with an opening year of 2021. The new proposals for Phase 3 include an increase of operational phase trip generation when compared with the hybrid application. Assessing just the uplift in traffic generated between the Hybrid Application and the Proposed Development would not provide a true representation of the impact of the development. Furthermore, the opening year of the full Site, as per the Transport Assessment (TA) produced by Curtins Consulting Engineers PLC (Curtins) is 2026, and as such the uplift in baseline traffic generation needs to be taken into account. Thus a reassessment of the operational phase transport impacts has been undertaken and supersedes the previous assessment.

Transport data for the assessment has been provided by Curtins and the assessment considers the following traffic scenarios:

1) Scenario 1 :Baseline 2019 for the purpose of model verification;
2) Scenario 2: Worst case assessment utilising 2021 emission factors:
   a) Without Development 2026: future traffic flows during the year of opening *without* development in place but *with* cumulative development; and
   b) With Development 2026: future traffic flows during the year of opening *with* development in place but *with* cumulative development.
3) Scenario 3: Sensitivity Analysis utilising 2026 emission factors:
   a) Without Development 2026: future traffic flows during the year of opening *without* development in place but *with* cumulative development; and
   b) With Development 2026: future traffic flows during the year of opening *with* development in place but *with* cumulative development.

Traffic data utilised within the assessment is presented in Appendix B. Transport links included within the model domain are shown in Figure 5.

Speed data were not provided in the data set and therefore speed limits minus 5mph to account for slower moving and turning traffic were used in this assessment. Areas close to junctions or in known congestion areas were reduced to 20kph in line with the LAQM.TG(16) guidance document.

Road widths were determined utilising GIS and Satellite imagery. A national diurnal transport .fac file for 2019 was input into the model domain to account for variations in traffic volumes throughout the day. The diurnal profile utilised is shown in Figure 6.

Emission Factors

Road transport emissions of NOx, PM_{10} and $PM_{2.5}$ were calculated using the latest UK vehicle emission factors toolkit (EFT) (version 10.1) provided by Defra, and then input into the ADMS-Roads model (version 5.0.0.1). Emission factors for the year 2019 were used for the baseline scenario (Scenario 1).

For a worst case assessment (Scenario 2) current year emission factors for 2021 were utilised for the future year 2026, assuming that no improvement in vehicle emission technology or fleet turnover between 2021 – 2026. This is a cautious approach given the uptake in electric vehicles, national, regional and local policy drive to improve air quality and restrictions to vehicle emissions imposed on manufacturers and consumers within Clean Air Zones (CAZ).

As such a sensitivity test has been undertaken utilising future year 2026 emissions factors. Previously the projected emissions factors were criticised for being overly optimistic, with monitoring data not reflecting the predicted improvements in fleet turnover and emission technology. However in recent years, due to amendments to the EFT and through positive action to improve air quality, a noted downward trend inline with the projections has been seen. Thus this scenarios prediction carries weight.

Meteorological Data

Hourly sequential 2019 meteorological data from the meteorological station based at Church Lawford were used in the dispersion modelling. The station is located approximately 34km north of the modelling Site, however this is the closest Site with sufficient representative data. The data provides information on hourly wind speed and direction and the extent of cloud cover. A wind rose of meteorological data at this station is shown in Figure 7.

Surface Roughness and Monin-Obukhov Length

Surface roughness represents the extent of mechanical turbulence in the atmosphere caused by the roughness of the ground over which the air is passing. A surface roughness length of 1 was used at the study area and 0.3m at the meteorological measurement site.

The Monin-Obukhov length represents the stability of the atmosphere. In very stable conditions such as rural areas, the value is typically between 2-20m. For large urban areas, there is a significant amount of heat generated by buildings and traffic which warms the air above the city creating an effect called urban heat island. A Monin-Obukhov length of 30m was used for the study area and 1m for the meteorological measurement site.

Background Concentrations and NOx Chemistry

The model was used to predict NOx and PM_{10} road contribution concentrations at the selected receptor points. These values were then added to relevant ambient background concentrations to enable the comparison with air quality objectives. NOx, NO_2 and PM_{10} background concentrations were obtained from Defra's national background maps (see section 3.3). Background concentrations for the year 2019, 2021 and 2026 were used in the respective Scenarios 1, 2 and 3 as per the reasoning stated for the choice of emissions factors.

Background concentrations were added to the predicted road increment to give the total pollutant concentrations at receptor points. The NOx to NO_2 conversion spreadsheet (version 8.1, available from Defra's LAQM website, has been used to calculate NO_2 concentrations from established NOx concentrations.

Model Output

This assessment has focused on the modelling of the long term annual mean pollutant concentrations. The reason being is that it is inherently more difficult to make satisfactory predictions for short-term behaviour of pollutants as these will be highly variable from year to year, and from site to site.

5.2 Model Verification and Adjustment

It is necessary to compare the modelled results versus monitored results at relevant locations to enable the adjustment of model outputs and minimise the inherent uncertainties associated with dispersion modelling.

Model verification and adjustment were undertaken, in accordance with the LAQM.TG (16) (Defra, 2016). Three monitoring locations were chosen as representative of roadside concentrations within the study area and utilised for model verification as follows:

- Ermont Road 1;
- Hennef Way; and,
- Stroud Close.

Annual Mean NO_2 concentrations measured at these sites were compared against modelled concentrations predicted from traffic emissions modelling at the same points. The traffic data used in this modelling is presented in Appendix B and the following assumptions and inputs were included:

- 2019 monitoring data from CDC's Air Quality Annual Status Report 2020;
- 2019 traffic data provided by Curtins (see Appendix B);
- 2019 meteorological data from Church Lawford;
- EFT v10.1 2019 vehicle emission factors; and
- 2019 annual mean NOx, NO_2 background concentrations from Defra's national background maps

As explained in Section 3.2, the Hennef Way diffusion tube is located in a unique place that impacts dispersion around the tube and is representative of the nearby residential receptors on Fisher Close with rear facades in close proximity to Hennef Way. To account for the unique nature of the monitoring Site, a minor street canyon was added at a height of 4m for the fenced area and 10m for the residential properties for the short section of representative road on Hennef Way in all scenarios.

Two separate verification factors have thus been created as follows:

- Factor 1: utilising Ermont Way 1 and Stroud Close and representative of all modelled receptors with the exception of R02 and R04;
- Factor 2: utilising Hennef Way and representative of modelled receptors R02 and R04.

The results of model verification are presented in Appendix C. Results indicate that the model underpredicted annual mean NO_2 concentrations and therefore an adjustment factors of 2.386 and 5.641 were calculated respectively. This factor was applied to all modelled NOx, PM_{10} and $PM_{2.5}$ road increments for all assessment scenarios.

5.3 Assessment Results

Scenario 2 – Worst Case Assessment

Predicted annual mean NO_2 and PM_{10} concentrations, at the modelled receptors are presented in Table 5.2. Concentrations are included for the 'Without Development' 2026 and 'With Development' 2026 scenarios utilising 2021 emission factors and Defra background concentrations.

Table 5.2: Model Results and Impact

Receptor ID	Background (µg/m^3)	Do Nothing 2023 (µg/m^3)	Do Something 2023 (µg/m^3)	% Change in Concentration Relative to AQAL	Significance of Impact
Nitrogen Dioxide (NO_2)					
PR01	11.0	-	35.3	-	-
PR02	15.5	-	**50.9**	-	-
PR03	11.0	-	34.2	-	-
R01	14.4	23.0	23.3	0.3	Negligible
R02	14.4	**54.6**	**55.6**	1.1	**Substantial**
R03	14.4	27.1	27.5	0.4	Negligible
R04	14.4	**51.7**	**52.7**	1.0	**Substantial**
R05	14.4	29.0	29.4	0.4	Negligible
R06	14.4	30.5	31.0	0.5	Negligible
R07	14.4	20.4	20.6	0.2	Negligible
R08	14.4	25.5	25.8	0.3	Negligible
R09	15.5	19.5	19.8	0.3	Negligible
R10	15.5	18.4	18.7	0.3	Negligible
Particulate Matter (PM_{10})					
PR01	14.5	-	18.8	-	-
PR02	16.7	-	24.2	-	-
PR03	14.5	-	18.5	-	-
R01	16.2	17.9	17.9	0.1	Negligible
R02	16.2	27.8	28.1	0.4	Negligible
R03	16.2	19.5	19.6	0.1	Negligible
R04	16.2	26.8	27.2	0.4	Negligible
R05	16.2	19.0	19.1	0.1	Negligible
R06	16.2	19.2	19.3	0.1	Negligible
R07	16.2	17.4	17.4	0.0	Negligible
R08	16.2	18.5	18.6	0.1	Negligible
R09	16.7	17.5	17.6	0.1	Negligible
R10	16.7	17.3	17.4	0.1	Negligible

Values in **bold** exceed the NAQS of 40µg/m^3

Long-term pollutant concentrations

The long term objective for exceedances of the annual mean NO_2 NAQO is 40µg/m^3. The objective is predicted to be exceeded at two locations R02 and R04, the locations highlighted as facades in close proximity to Hennef Way. The increase in pollution at these receptors is 2-3% of the air quality assessment level (AQAL), which given the elevated levels of baseline NO_2 concentrations represents a Substantial Adverse impact without mitigation. The increase in annual mean NO_2 concentrations relative to the AQAL at all other residential receptors is 1-2%, which when placed in the context of the baseline concentration levels, represents a Negligible impact. It is noted that the assessment has been undertaken in a conservative manner.

Annual mean PM_{10} concentrations are predicted to be well below the NAQO of 40µg/m^3 at all the modelled sensitive receptors in the 'Without Development' (2026) and 'With Development' (2026) scenarios. The maximum increase in annual mean PM_{10} concentrations relative to the AQAL at all other residential receptors is 1%, which when placed in the context of the baseline concentration levels, represents a Negligible impact. All $PM_{2.5}$ concentrations were significantly below the annual mean NAQO and the impact is considered to be Negligible at all receptors.

Short-term pollutant concentrations

The LAQM.TG (16) guidance suggest that exceedances of the hourly NO_2 objective are unlikely to occur where the annual mean is below 60µg/m^3. Furthermore, it suggests that 32µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} concentration is possible.

Accordingly, the NO_2 hourly mean concentrations and PM_{10} 24-hour mean concentrations are predicted to be below their relevant objectives at all receptors. Therefore it can be concluded that under worst-case criteria, the Proposed Development is considered suitable with regards to the proposed future uses.

Scenario 3 – Sensitivity Analysis

Predicted annual mean NO_2 and PM_{10} concentrations, at the modelled receptors are presented in Table 5.3. Concentrations are included for the 'Without Development' 2026 and 'With Development' 2026 scenarios utilising 2026 emission factors and Defra background concentrations.

Table 5.3: Model Results and Impact

Receptor ID	Background ($\mu g/m^3$)	Do Nothing 2023 ($\mu g/m^3$)	Do Something 2023 ($\mu g/m^3$)	% Change in Concentration Relative to AQAL	Significance of Impact
Nitrogen Dioxide (NO_2)					
PR01	9.2	-	23.3	-	-
PR02	12.3	-	33.5	-	-
PR03	9.2	-	22.6	-	-
R01	12.3	17.2	17.4	0.2	Negligible
R02	12.3	36.8	37.5	0.6	**Slight**
R03	12.3	19.7	19.9	0.2	Negligible
R04	12.3	35.0	35.5	0.6	**Slight**
R05	12.3	20.7	21.0	0.3	Negligible
R06	12.3	21.6	21.9	0.3	Negligible
R07	12.3	15.8	15.8	0.1	Negligible
R08	12.3	18.6	18.8	0.2	Negligible
R09	12.3	14.6	14.8	0.2	Negligible
R10	12.3	14.0	14.1	0.2	Negligible
Particulate Matter (PM_{10})					
PR01	13.9	-	17.9	-	-
PR02	16.0	-	23.2	-	-
PR03	13.9	-	17.5	-	-
R01	15.5	17.1	17.1	0.1	Negligible
R02	15.5	26.7	27.0	0.4	Negligible
R03	15.5	18.7	18.8	0.1	Negligible
R04	15.5	25.8	26.1	0.3	Negligible
R05	15.5	18.1	18.2	0.1	Negligible
R06	15.5	18.3	18.4	0.1	Negligible
R07	15.5	16.6	16.6	0.0	Negligible
R08	15.5	17.7	17.8	0.1	Negligible
R09	16.0	16.8	16.9	0.1	Negligible
R10	16.0	16.6	16.6	0.1	Negligible

Values in **bold** exceed the NAQS of 40$\mu g/m^3$

Long-term pollutant concentrations

The long term objective for exceedances of the annual mean NO_2 NAQO is 40µg/m^3. The objective is not exceeded at any receptor location. The maximum increase in pollution is 2% of the air quality assessment level (AQAL) at receptors R02 and R04, which given the levels of baseline NO_2 concentrations represents a Slight Adverse impact without mitigation. The increase in annual mean NO_2 concentrations relative to the AQAL at all other residential receptors is 1%, which when placed in the context of the baseline concentration levels, represents a Negligible impact. It is noted that the assessment has been undertaken in a conservative manner.

Annual mean PM_{10} concentrations are predicted to be well below the NAQO of 40µg/m^3 at all the modelled sensitive receptors in the 'Without Development' (2026) and 'With Development' (2026) scenarios. The maximum increase in annual mean PM_{10} concentrations relative to the AQAL at all other residential receptors is 1%, which when placed in the context of the baseline concentration levels, represents a Negligible impact. All $PM_{2.5}$ concentrations were significantly below the annual mean NAQO and the impact is considered to be Negligible at all receptors.

Short-term pollutant concentrations

The LAQM.TG (16) guidance suggest that exceedances of the hourly NO_2 objective are unlikely to occur where the annual mean is below 60µg/m^3. Furthermore, it suggests that 32µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} concentration is possible.

Accordingly, the NO_2 hourly mean concentrations and PM_{10} 24-hour mean concentrations are predicted to be below their relevant objectives at all receptors. Therefore it can be concluded that under worst-case criteria, the Proposed Development is considered suitable with regards to the proposed future uses.

Summary

The worst case and sensitivity scenario assessments present that road transport emissions resulting from the operational phase will increase pollutant concentrations across the study area at all receptors in close proximity to the main road network. Notably at receptors R02 and R04, where due to the orientation of the buildings and proximity to Hennef Way, as seen at the Hennef Way diffusion tube, pollutant concentrations are elevated. The worst case assessment predicts a Substantial Adverse impact at these receptors, whilst the sensitivity analysis predicts a Slight Adverse impact. The results predict that the operational phase of the Proposed Development will have an adverse impact of a significant degree without mitigation measures at this location. Across the rest of the study area, the impact is considered to be 'not significant'.

6.0 Mitigation Measures

6.1 Construction Phase

Construction Dust

The mitigation measures outlined below should make up part of a Construction Environmental Management Plan (CMP) that should be implemented to minimise the potential of adverse construction dust impacts throughout all the relevant construction stages.

Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces.
- Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil.
- Only remove secure covers in small areas during work and not all at once.

Construction

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out unless required for a particular process;
- Mix large quantities of cement, grouts and other similar materials in enclosed areas remote from site boundaries and potential receptors;
- 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 small supplies of fine powder ensure bags are sealed after use and are stored appropriately to prevent dust release.

General Mitigation Measures

- Ensure regular cleaning of hard standing surfaces using wet sweeping methods;
- Display the head or regional office contact information, and the name and contact details of person(s) accountable for air quality on the Site boundary;
- Log all air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record all measures taken. Make the complaints log available to the Local Authority when asked;
- Carry out regular on-Site and off-Site inspections to monitor dust soiling effects, with cleaning to be provided if necessary. Increase the frequency of inspections when activities with a high potential to produce dust are being carried out;
- Erect barriers around the Site, any dusty activities and stockpiles (to be covered);
- Screen areas of the building, where dust producing activities are taking place, with debris screens or sheeting;
- Fully enclose Site or specific operations where there is a high potential for dust production and the Site is active for an extensive period;
- Remove materials that have a potential to produce dust as soon as possible, unless being re-used. If they are to be re-used, on-Site covers should be used;
- Ensure all vehicles switch off engines when stationary, no idling vehicles;
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine sprays on such equipment wherever possible; and
- Avoid bonfires and the burning of waste materials.

It is important that attention is paid to any construction activity that takes place near the Site boundary, particularly at the location closest to sensitive receptors.

The implementation of the specific mitigation measures given above within a CEMP will ensure that the potential adverse impacts from construction dust during all construction stages are avoided. It is noted in the IAQM Guidance (Holman et al, 2014) that through the use of effective mitigation, the effects of dust associated with construction activity will not normally be significant.

Construction Traffic and Plant

Due to the location of the Site and lack of receptors located close to construction transport routes and close to the Site boundary, the impact is considered to be Negligible. Therefore it is proposed that the required Construction Transport Management Plan required by condition for the permitted Hybrid Application is modified to include for the Proposed Development and should at least include the following best practice techniques (BAT):

The recommended construction traffic and plant mitigation measures are as follows:

- All vehicles should switch off engines when stationary, no idling vehicles;
- All non-road mobile machinery (NRMM) should use ultra-low sulphur diesel (ULSD) where available;
- Minimise the movement of construction traffic around the Site;
- Maximise efficiency (this may include alternative modes of transport and maximising vehicle utilisation by ensuring full loading and efficient routing);
- Vehicles should be well maintained and kept in a high standard of working order;
- Avoid the use of diesel or petrol-powered generators by using mains electricity or battery powered equipment where possible; and
- Locate plant away from boundaries close.

Following the implementation of the measures recommended for inclusion within the CEMP and CTMP the impact of emissions during construction of the proposed development would be **Non-significant**.

6.2 Operational Phase

The scheme includes inherent sustainable design measures which contribute towards mitigating air quality impacts. These measures include cycle parking, electric vehicle charging points and measures to reduce energy consumption. The Proposed Development will provide 24no. EVCP, 20 of which will be located within proximity to the Petrol Filling Station (PFS) which will also provide a Hydrogen Fuel Pump for HGVs. The proposals therefore are designed with the future in mind and encourage the use of low emissions vehicles.

The assessment indicates the impacts of the development during operation is '**Slight-Substantial Adverse**' and therefore mitigation is required, primarily focussed on the area of Hennef Way.

The Oxfordshire Growth Board has recently agreed a grant of public funding which will deliver highway improvements along a number of roads local to the development. More specifically

schemes to reduce congestion along Hennef Way will also be included, at a cost to the Growth Board of about £18.5m, with another £1.5m to be taken from developers' contributions, to which a reasonable financial contribution would be made by the Proposed Development.
The TA has demonstrated that the development is sustainable with good accessibility to the site provided to those travelling by foot and by bicycle and a bus service currently runs along the A361 in both directions.

As part of the Phase One works, it is understood that work has been ongoing to provide two new bus stops located at the entrance of Frontier Park. Safe pedestrian access will be provided to these bus stops through the introduction of additional footways and uncontrolled pedestrian crossing points on the main pedestrian desire lines, which will benefit from dropped kerbs and tactile paving.

Work has been completed to provide a pedestrian and cycle access to the site from the northwest corner of the development via an underpass beneath the M40 which connects to the Banbury Gateway Shopping Park. A contribution will be provided to improve the surfacing, lighting and general environment of this pedestrian link.

Policies to encourage travel by sustainable modes are developed further within the Framework Travel Plan (FTP) that accompanied the Hybrid Application. The FTP has been submitted to encourage future employees to use alternative transport modes rather than private vehicles, with an aim to further reduce traffic levels generated by the Proposed Development. The FTP provides a long-term strategy aimed at encouraging future employees to reduce their dependency on travelling by single occupancy vehicles (SOVs) in favour of the more sustainable modes such as car sharing, public transport, walking and cycling.

The general aims of the plan are as follows:

- Raise awareness of sustainable travel modes, including distribution of information packs to employees;
- Promote healthy lifestyles and sustainable, vibrant local communities;
- Encourage good urban design principles that maximise the permeability of the development for walking and cycling;
- Improve existing infrastructure and ensure connectivity and assimilation both within the development and between the existing wider community; and
- Avoid reliance on car usage, especially single occupancy vehicles.

The FTP will be updated to reflect the Phase Three proposals.

In line with the S106 agreement in place for the permitted Hybrid application, an Air Quality Mitigation Strategy should be implemented including an environmental damage cost assessment based on the revised traffic generation and conclusions within this assessment. The damage cost analysis is provided in Section 7 below.

7.0 Environmental Damage Cost Assessment

Any financial contribution is expected to be spent on measures to mitigate any residual impacts which could potentially contribute towards small incremental changes in pollutant emissions within the CDC AQMAs and the wider area.

The assessment is based on the revised cost damage impacts associated with the guidance document produced by Ricardo AEA on behalf of Defra "Air Quality Damage Cost Update 2020" which provides an annual damage cost (based in 2017) for NOx and $PM_{2.5}$ emissions from a variety of different sectors.

The assessment has been undertaken following the Government's "Air Quality Appraisal: Damage Cost Guidance" and utilising the provided damage cost toolkit spreadsheet. Details of the inputs and methodology are provided below.

The assessment is based on the increase in road transport resulting from the Proposed Development. Based on the data provided by the transport consultant Curtins, the combined traffic flow increase from the whole development area will be 3443 AADT, of which 15.1% will be HGVs. The chosen appraisal period for the damage cost assessment is 5 years between 2022 – 2026 (the opening year), in which measures can be put in place prior to the full operation of the Site.

As such the following inputs were entered into Defra's EFT v10.1 to estimate the annual emissions (tonnes) of NOx and $PM_{2.5}$:

- 3443 AADT;
- 15.1% HGV:
- Speed 50kph
- A trip length of 10 km used was derived from the Department of Transport (DfT) National Travel Surveys which is an estimation of average trip length; and
- Emissions Factors were utilised from each year represented between 2022 and 2026.

Table 7.1 provides the output annual emissions (tonnes/year).

Table 7.1 Annual Emissions (tonnes per year)

Pollutant	2022	2023	2024	2025	2026
NO_x	3.857	3.392	2.987	2.634	2.346
$PM_{2.5}$	0.324	0.319	0.315	0.311	0.309

A central damage cost is then applied to the annual emissions as applied by the relevant sector. For the assessment the generic 'Road Transport' sector was applied. This has a base 2017 damage cost per tonnes (£/tonnes) of £9,066 for NOx and £81,581 for $PM_{2.5}$. An interest rate of 2% is applied from 2017 to the relevant assessment year. Table 7.2 and 7.3 outlines the central damage cost for each year and applies the Proposed Development's annual emissions for NO_x and $PM_{2.5}$ respectively.

Table 7.2 Central Damage Cost Calculations (NOx)

Pollutant	2022	2023	2024	2025	2026
Central Damage Cost (£)	10010	10210	10414	10622	10835
Cost Benefit (£/tonnes)	38606	34632	31104	27975	25423

Table 7.3 Central Damage Cost Calculations ($PM_{2.5}$)

Pollutant	2022	2023	2024	2025	2026
Central Damage Cost (£)	90002	91803	93639	95511	97422
Cost Benefit (£/tonnes)	29205	29285	29466	29735	30095

The total cost damage, summing the five years, for NOx is £157,740 and for $PM_{2.5}$ is £147,786 creating a total damage cost of £305,526.

The toolkit provides a discount value of 3.5% per year after the base year (2022), on the assumption that the costs are paid in full at the start of the appraisal and not annually. Where this is the case, Table 7.4 and Table 7.5 demonstrate the discounted damage cost values.

Table 7.4 Discounted Central Damage Cost Calculations (NOx)

Pollutant	2022	2023	2024	2025	2026
Central Damage Cost (£)	10010	10210	10414	10622	10835
Cost Benefit (£/tonnes)	38606	34632	31104	27975	25423
Discounted Cost Benefit (£/tonnes)	38606	33461	29036	25232	22154

Table 7.5 Discounted Central Damage Cost Calculations ($PM_{2.5}$)

Pollutant	2022	2023	2024	2025	2026
Central Damage Cost (£)	90002	91803	93639	95511	97422
Cost Benefit (£/tonnes)	29205	29285	29466	29735	30095
Discounted Cost Benefit (£/tonnes)	29205	28295	27506	26819	26226

The discounted values total £148,489 for NOx and £138,051 for $PM_{2.5}$ totalling £286,540. Screenshots of the assessment toolkit spreadsheet are provided in Appendix D.

8.0 Summary and Conclusions

This assessment considers the air quality impacts associated with both the construction and operation of the development. Likely changes to air quality in the area, as a result of the proposed development have been considered in relation to the National Air Quality Objectives (NAQO). Where required, the air quality assessment considers mitigation measures to reduce the effect of the proposed development upon local air quality.

A baseline study of existing air quality concentrations within the study area showed that across much of the study area concentrations were generally acceptable and below the respective annual mean NAQOs. However, one area, located within AQMA No.1 on Hennef Way, showed NO_2 concentrations far in exceedance of the annual mean NAQO and likely in exceedance of the hourly mean NAQO. It was determined that this is exceedance, whilst due to the associated nearby road transport emissions and congested road network, was likely also due to the nature and orientation of the monitoring location, creating a barrier to slow and reduce dispersion and mixing of the road transport emissions.

The impacts of construction activities on local air quality have been assessed in accordance with the IAQM best practice guidance. This assessment indicated that the risk of the different activities towards dust soiling is medium and that for human health impact is low. Following implementation of the appropriate mitigation measures as outlined in the report, the residual impacts during construction would be **not significant**. These mitigation measures should make up part of a Construction Environmental Management Plan (CEMP) that should be implemented to minimise the potential of adverse construction dust impacts throughout all the relevant construction stages.

A qualitative review of the likely impacts arising from construction transport and plant has been undertaken and the impact is considered to be **not significant**. The Proposed Development should be incorporated into the wider Construction Traffic Management Plan (CTMP) for the Site.

The impact of emissions associated with operational traffic movement on local air quality were assessed using the air dispersion model ADMS-Roads. The impact significance was assessed in accordance with the relevant IAQM Guidance. Traffic-related pollutant concentrations (NO_2, PM_{10} and $PM_{2.5}$) were predicted at selected sensitive receptors. A worst case scenario was applied, assuming no improvement in emission factors or background concentrations between 2021 and the opening year 2026. The impact on local sensitive receptors was generally negligible, however at the aforementioned area on Hennef Way, Substantial Adverse impacts were predicted.

A sensitivity scenario was applied, assuming improvements in emission factors from road transport and background concentrations did improve to the opening year 2026. The results of the assessment again showed negligible impacts throughout much of the study area, and slight adverse impacts at receptors along Hennef Way. Therefore, it is determined that without mitigation measures put in place, a **Significant** impact upon the receptors in the vicinity of Hennef Way would occur.

An Air Quality Mitigation Scheme is therefore proposed to reduce the impact upon those receptors and a Damage Cost Assessment has been undertaken and a package of operational mitigation measures has been proposed to assist in the reduction of residual air quality impacts.

The scheme includes inherent sustainable design measures which contribute towards mitigating air quality impacts. These measures include cycle parking, electric vehicle charging points and measures to reduce energy consumption. The Proposed Development will provide 24no. EVCP, 20 of which will be located within proximity to the Petrol Filling Station (PFS) which will also provide a Hydrogen Fuel Pump for HGVs. The proposals therefore are designed with the future in mind and encourage the use of low emissions vehicles.

Oxfordshire Growth Board has recently agreed a grant of public funding which will deliver highway improvements along a number of roads local to the development. More specifically schemes to reduce congestion along Hennef Way will also be included, at a cost to the Growth Board of about £18.5m, with another £1.5m to be taken from developers' contributions, to which a reasonable financial contribution would be made by the proposed development.

A number of policies have been implemented to improve sustainable transport methods as a result of the hybrid application and to reduce the need for private vehicle use. Two new bus stops with shelters and raised kerbs have been implemented at the entrance to Frontier Park with safe access provided for pedestrians. Furthermore, an improved footway and cycleway provided under the M40 that has been delivered through the Phase 1 works.

Policies to encourage travel by sustainable modes are developed further within the Framework Travel Plan (FTP) that accompanies the Hybrid Application. The FTP was submitted to encourage future employees to use alternative transport modes rather than private vehicles, with an aim to further reduce traffic levels generated by the proposed development. The FTP provides a long term strategy aimed at encouraging future employees to reduce their dependency on travelling by single occupancy vehicles (SOVs) in favour of the more sustainable modes such as car sharing, public transport, walking and cycling. The existing FTP will be updated to account for the change in Phase 3 proposals.

A formalised damage cost calculation and package of agreed mitigation measures can be further developed into a formal Low Emission Strategy in conjunction with CDC, should this be required by planning condition

9.0 Limitations and Exclusions

9.1 Reliance

The recommendations contained in this report represent TRC's professional opinions, based upon the currently available information, and are arrived at in accordance with currently acceptable professional standards. This report is based upon a specific scope of work requested by the Client. The contract between TRC and its Client outlines the scope of work, and only those tasks specifically authorized by that contract or outlined in this report were performed. This report is intended only for the use of TRC's Client and anyone else specifically identified in writing by TRC as a user of this report. TRC will not and cannot be liable for unauthorized reliance by any other third party. Other than as contained in this paragraph, TRC makes no express or implied warranty as to the contents of this report.

9.2 Third Party Information

TRC has been provided with information from third parties for information purposes only and without representation or warranty, express or implied as to its accuracy or completeness and without any liability on such third parties part to revise or update the information. Where reliance has been provided by third parties to potential purchasers, this is noted in our report.

In performing the services to which this report relates, TRC has relied upon the information obtained from third parties. TRC makes no representation or warranty, express or implied as to the accuracy or completeness of any statement or advice contained within this report that is based upon the information obtained from third parties and to the fullest extent permissible by law we hereby exclude any and all liability we may have in respect of the same, provided that nothing shall be taken as limiting TRC's liability in respect of personal injury (including death) caused by its negligence.

9.3 Interpretation of Findings

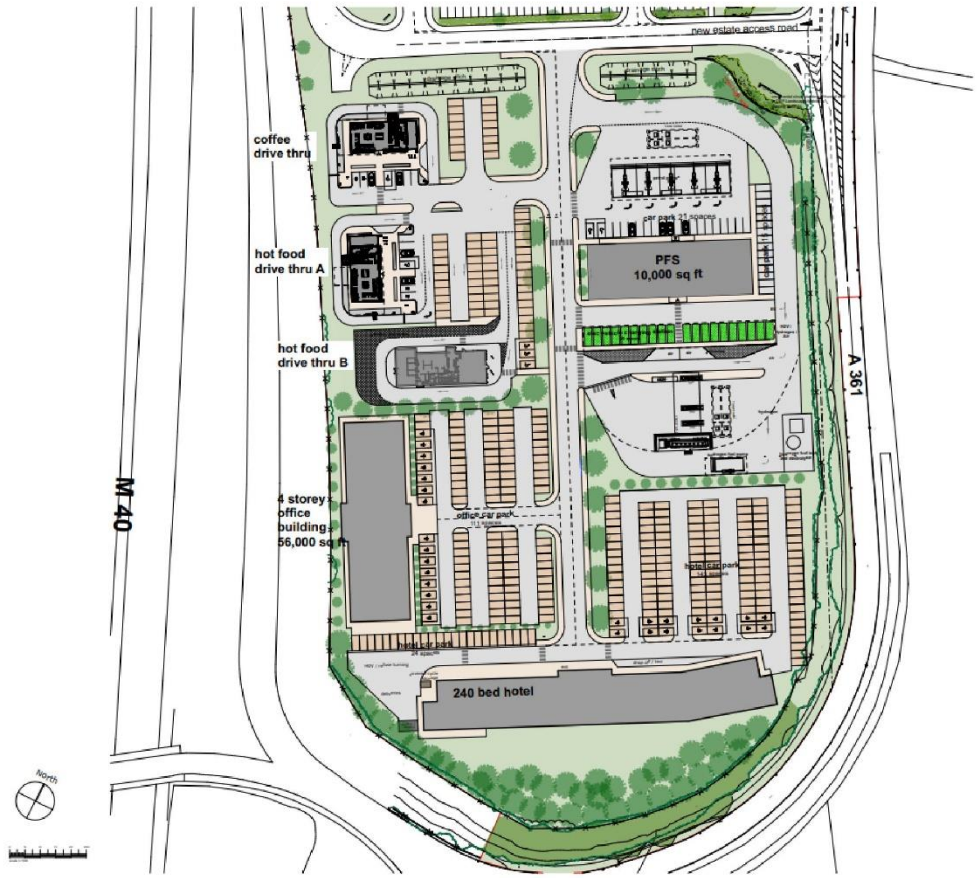
TRC's report is based upon the information provided to TRC and TRC's observations made during the subject property reconnaissance. Given the inherent limitations of environmental assessment work, TRC does not guarantee that the subject property is free of additional air pollution sources or considerations, or that latent or undiscovered conditions will not become evident in the future. TRC's report is prepared in accordance with the proposal and the standard terms and conditions agreed between the Client and TRC, and no other warranties, representations, or certifications are made.

10.0 References

The following documents/website were consulted in preparing this report:

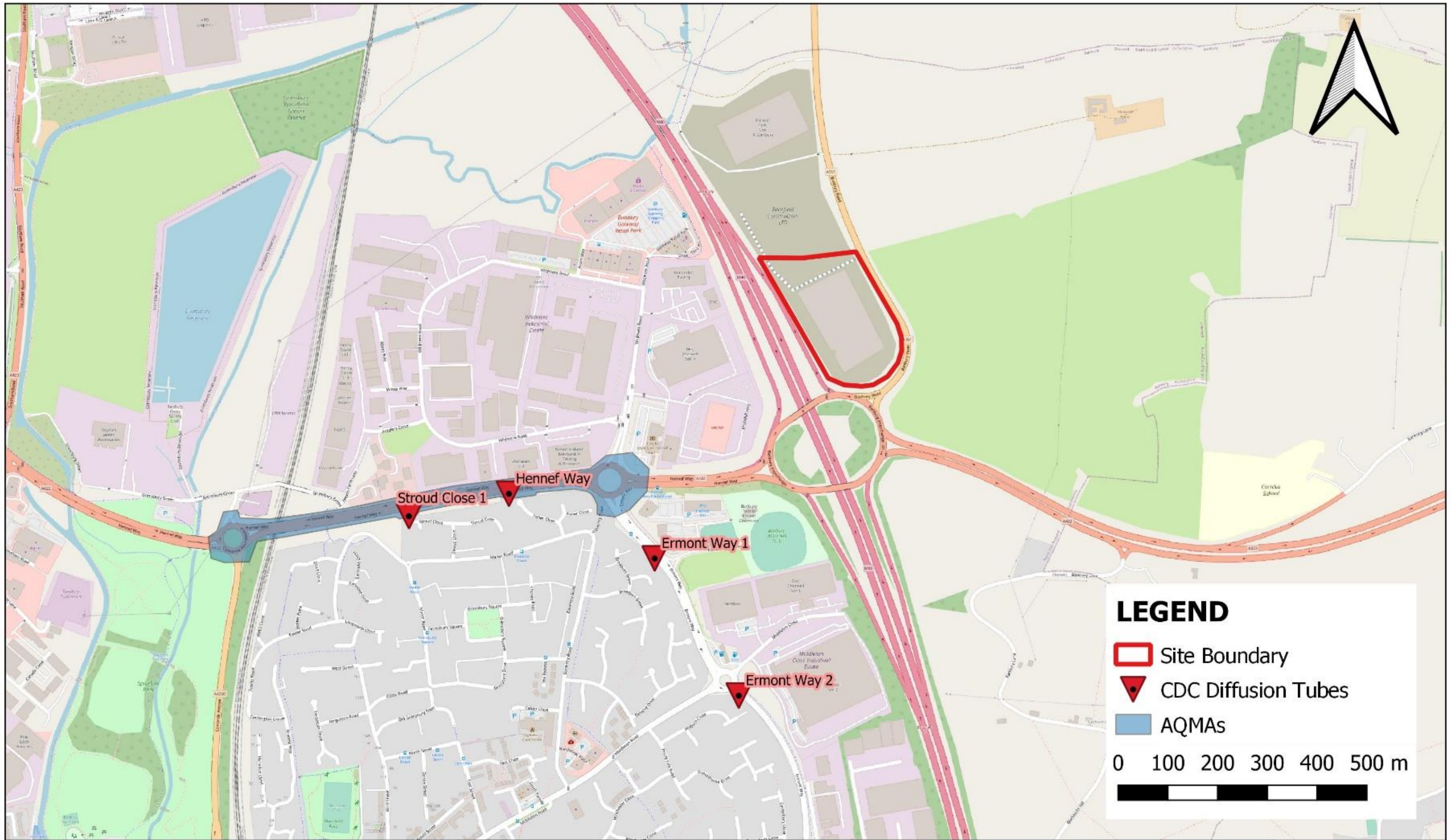
- Air Quality (England) (Amendment) Regulations 2002 No. 4034. Stationary Office.
- Air Quality (England) Regulations 2000 no. 928. Stationary Office
- Air Quality Regulations 2010 - Statutory Instrument 2010 No. 1001
- Air Quality Damage Cost Appraisal https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance
- Air Quality Damage Cost Appraisal Toolkit Assess the impact of air quality - GOV.UK (www.gov.uk)
- Cherwell District Council, 2020. Cherwell District Council Air Quality Annual Status Report for 2019
- Cherwell District Council, 2015. Adopted Cherwell Local Plan 2011 – 2031 (Part 1)
- Cherwell District Council, 2017. Cherwell District Council Air Quality Action Plan
- Defra (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland
- Defra (2016). Local Air Quality Management Technical Guidance LAQM.TG (16). April 2016
- Defra (2018). Background Maps. See: Background Mapping data for local authorities - 2018 - Defra, UK
- Directive 2008/50/EC of the European Parliament and of the Council. May 2008 Official Journal of the European Union
- Environment Act 1995. HMSO, London
- Environment Protection Act 1990. HMSO, London
- Holman et al (2016). IAQM Guidance on the Assessment of Dust from Demolition and Construction. V1.1. Institute of Air Quality Management, London
- Ministry of Housing, Communities and Local Government (2019). National Planning Policy Framework.
- Moorcroft and Barrowcliffe et al (2017). Land-Use Planning & Development Control: Planning For Air Quality. V.1.2. Institute of Air Quality Management, London.
)

Figures

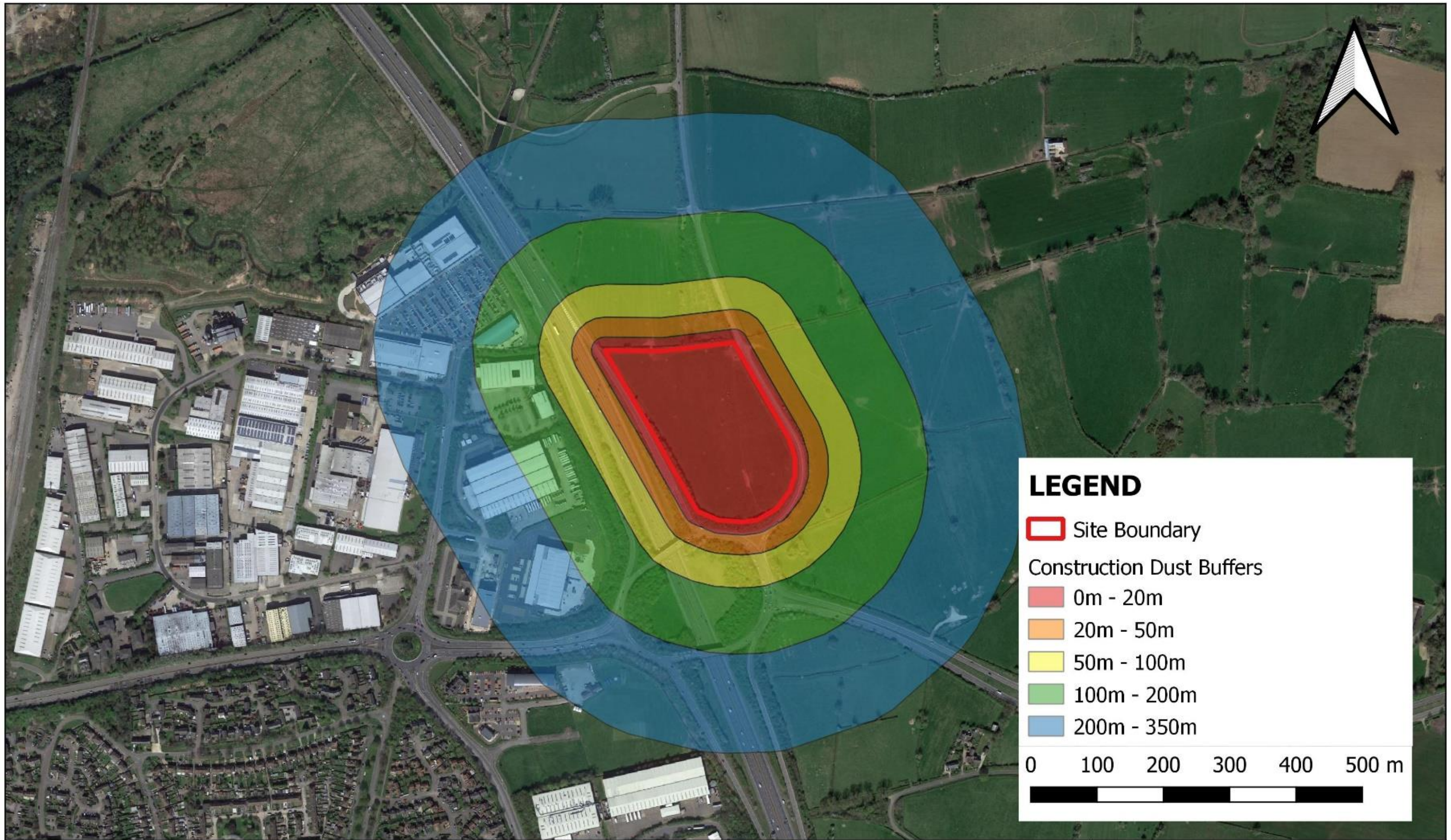


Project Title	Figure Title	Image Source	Map Scale	Author
Phase 3 Banbury	Proposed Site Layout	N/A	N/A	
Client	**Figure Reference**	**Date**	**Version No.**	**Approver**
Monte Blackburn Limited	Figure 1	13/07/2021	01	

Project Title	Figure Title	Image Source	Map Scale	Author
Phase 3 Banbury	Site Location	OSM Standard, Google Satellite	1:7500	
Client	**Figure Reference**	**Date**	**Version No.**	**Approver**
Monte Blackburn Limited	Figure 2	13/07/2021	01	

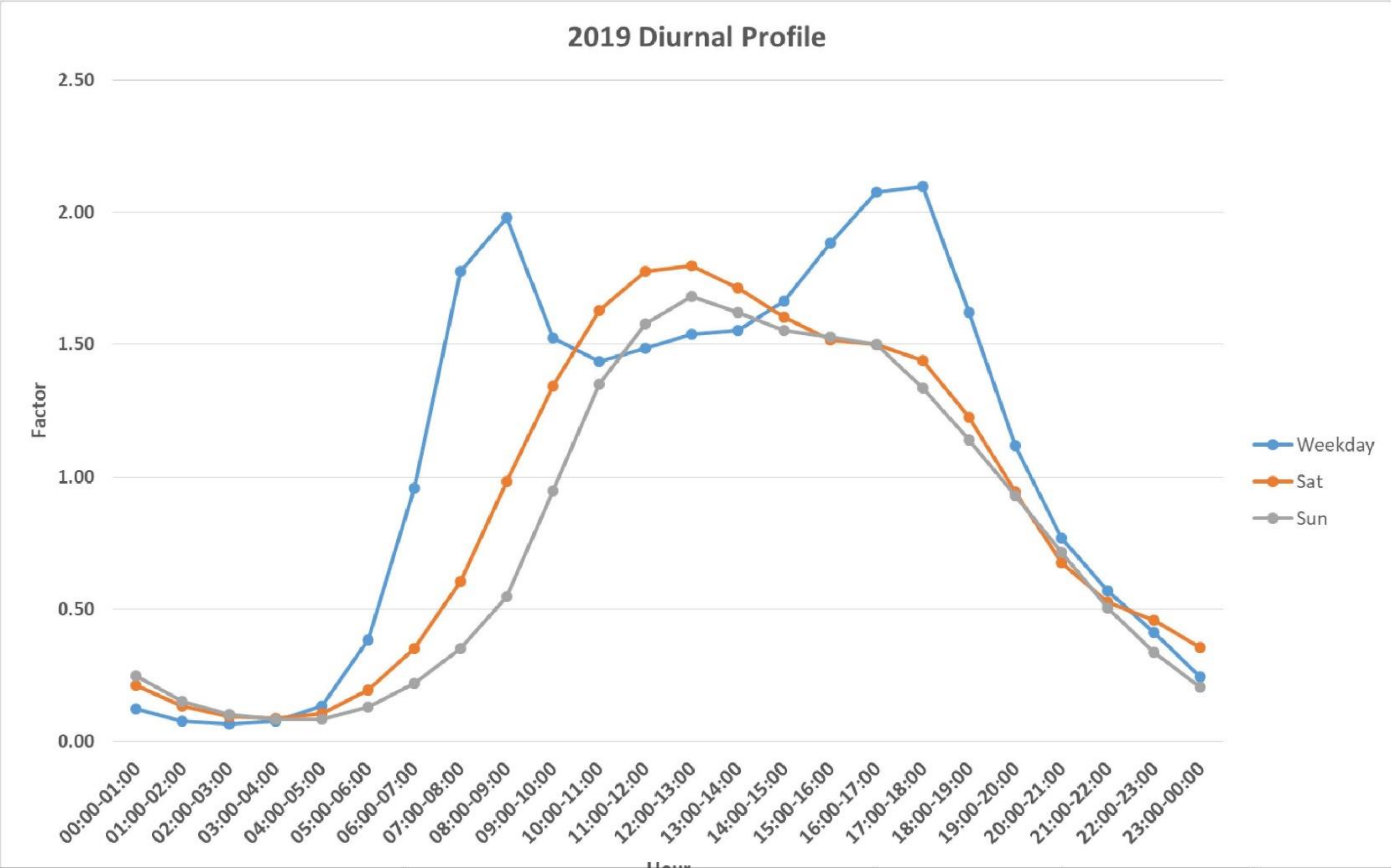


Project Title	Figure Title	Image Source	Map Scale	Author
Phase 3 Banbury	Location of Local Authority Monitoring and AQMAs in Relation to the Site	OSM Standard	1:10000	
Client	**Figure Reference**	**Date**	**Version No.**	**Approver**
Monte Blackburn Limited	Figure 3	13/07/2021	01	

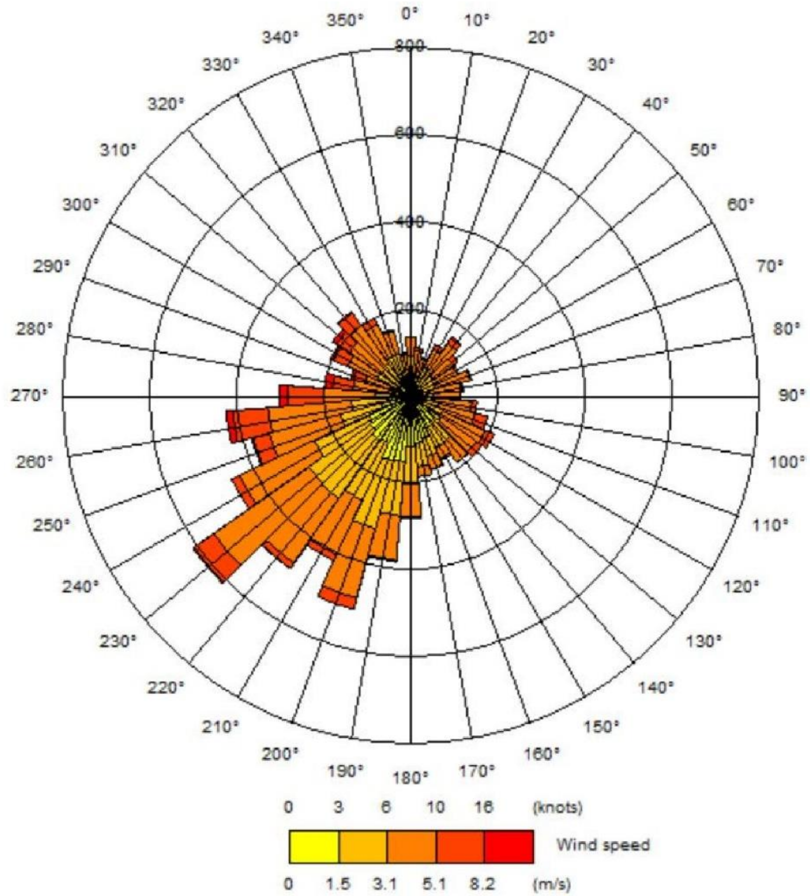


Project Title	Figure Title	Image Source	Map Scale	Author
Phase 3 Banbury	Construction and Earthworks Dust Buffers	Google Satellite	1:7500	
Client	Figure Reference	Date	Version No.	Approver
Monte Blackburn Limited	Figure 4	13/07/2021	01	

Project Title	Figure Title	Image Source	Map Scale	Author
Phase 3 Banbury	Modelled Roads and Receptors	OSM Standard	1:15000	
Client	**Figure Reference**	**Date**	**Version No.**	**Approver**
Monte Blackburn Limited	Figure 5	13/07/2021	01	



Project Title	Figure Title	Image Source	Map Scale	Author
Phase 3 Banbury	National Road Transport Diurnal Profile for 2019	N/A	N/A	
Client	**Figure Reference**	**Date**	**Version No.**	**Approver**
Monte Blackburn Limited	Figure 6	13/07/2021	01	



Project Title	Figure Title	Image Source	Map Scale	Author
Phase 3 Banbury	Church Lawford Meteorological Station 2019	N/A	N/A	
Client	**Figure Reference**	**Date**	**Version No.**	**Approver**
Monte Blackburn Limited	Figure 7	13/07/2021	01	

Appendix A: Construction Dust Assessment Tables

Table A1: Definition of Dust Emission Magnitude

Demolition		
Small	**Medium**	**Large**
• Total building volume <20,000m^3 • Construction material with low potential for dust release (e.g. Metal cladding or timber) • Demolition activities <10m above ground • Demolition during wetter months	• Total building volume 20,000 - 50,000m^3 • Potentially dusty construction material • Demolition activities 10 - 20m above ground level	• Total building volume >50,000m^3 • Potentially dusty construction material (e.g. Concrete) • On-site crushing and screening • Demolition activities >20m above ground level
Earthworks		
Small	**Medium**	**Large**
• Total site area <2,500m^2 • Soil type with large grain size (e.g. Sand) • <5 heavy earth moving vehicles active at any one time • Formation of bunds <4m in height • Total material moved <10,000 tonnes • Earthworks during wetter months	• Total site area 2,500m^2 - 10,000m^2 • Moderately dusty soil type (e.g. Silt) • 5 – 10 heavy earth moving vehicles active at any one time • Formation of bunds 4 - 8m in height • Total material moved 20,000 - 100,000 tonnes	• Total site area >10,000m^2 • Potentially dusty soil type (e.g. Clay, which will be prone to suspension when dry due to small particle size) • >10 heavy earth moving vehicles active at any one time • Formation of bunds >8m in height • Total material moved >100,000 tonnes
Construction		
Small	**Medium**	**Large**
• Total building volume <25,000 m^3 • Construction material with low potential for dust release (e.g. Metal cladding or timber)	• Total building volume 25,000 - 100,000m^3 • Potentially dusty construction material (e.g. Concrete) • On-site concrete batching	• Total building volume >100,000m^3 • On-site concrete batching • Sandblasting
Trackout		
Small	**Medium**	**Large**
• <10 HDV (>3.5t) outward movements in any one day • Surface material with low potential for dust release	• 10 – 50 HDV (>3.5t) outward movements in any one day	• >50 HDV (>3.5t) outward movements in any one day

• Unpaved road length <50m	• Moderately dusty surface material (e.g. High clay content) • Unpaved road length 50 – 100m	• Potentially dusty surface material (e.g. High clay content) • Unpaved road length >100m

Table A2: Examples of receptor sensitivities for various construction effects

Receptor sensitivity	Effects		
	Dust soiling	**Elevated PM_{10}**	**Ecological**
High	• Users can reasonably expect an enjoyment of a high level of amenity. • The appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. • Indicative examples include dwellings, museum and other culturally important collections, medium- and long-term car parks and car showrooms.	• Locations where members of the public are exposed over a period of time relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	• Locations with an international or national designation and the designated features may be affected by dust soiling; or • Location where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List for Great Britain • An indicative example is a Special Area of Conservation (SAC) designated for acid heathlands adjacent to the demolition of a large site containing concrete (alkali) buildings or for the presence of lichen.
Medium	• Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home • The appearance, aesthetics or value of their property could be diminished by soiling • The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	• Locations where the people exposed are workers, and exposure is over a period of time relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	• Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown • Locations with a national designation where the features may be affected by dust deposition. • Indicative examples include a site of special scientific interest (SSSI) with dust sensitive features.

Receptor sensitivity	Effects		
	Dust soiling	Elevated PM_{10}	Ecological
	• Indicative examples include parks and places of work.	• Indicative examples may include office and shop workers but will generally not include workers occupationally exposed to pm_{10}, as protection is covered by health and safety at work legislation.	
Low	• The enjoyment of amenity would not reasonably be expected • There is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling • There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. • Indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.	• Locations where human exposure is transient. • Indicative examples public footpaths, playing fields, parks and shopping streets.	• Locations with a local designation where the features may be affected by dust deposition. • Indicative example is a local nature reserve with dust sensitive features.

Table A3: Sensitivities of People to Dust Soiling Effects

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		< 20	< 50	< 100	< 350
High	> 100	High	High	Medium	Low
	10 – 100	High	Medium	Low	Low
	< 10	Medium	Low	Low	Low
Medium	> 1	Medium	Low	Low	Low
Low	> 1	Low	Low	Low	Low

Table A4: Sensitivities of People to the Health Effects of PM_{10}

Receptor sensitivity	Annual mean PM_{10} concentration	Number of receptors	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table A5: Sensitivity of the Area to ecological impacts

Receptor sensitivity	Distance from the source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Appendix B: Traffic Data

Location	2019 Observed AADT			2026 Without Development			2026 With Development		
	AADT	HGVs	%HGV	AADT	HGVs	%HGV	AADT	HGVs	%HGV
Mansion Hill	6,569	302	4.6	9,627	443	4.6	9,631	443	4.6
A422 East	4,968	229	4.6	6,980	321	4.6	7,015	326	4.7
Banbury Lane	4,166	192	4.6	4,701	216	4.6	4,704	217	4.6
Overthorpe	4,980	229	4.6	5,005	230	4.6	5,109	236	4.6
A422 West	16,188	745	4.6	22,259	1,024	4.6	24,972	1,162	4.7
A361 North of Site	8,278	472	5.7	7,052	402	5.7	7,157	418	5.8
A361 South of Site	8,278	472	5.7	7,052	402	5.7	10,391	905	8.7
A442 Hennef Way East	50,696	2,028	4.0	54,507	2,180	4.0	55,824	2,379	4.3
Wildmere Road	9,567	383	4.0	19,598	784	4.0	19,669	795	4.0
Ermont Way	9,598	384	4.0	10,630	425	4.0	10,639	426	4.0
A442 Hennef Way Central	47,449	1,898	4.0	49,166	1,967	4.0	50,404	2,154	4.3
A4260	21,170	812	3.8	24,095	924	3.8	24,805	1,030	4.2
A442 Hennef Way West	33,557	1,644	4.9	33,388	1,636	4.9	33,918	1,716	5.1
Southam Road N	23,622	984	4.2	23,683	986	4.2	24,061	1,045	4.3
Southam Road S	11,594	494	4.3	13,419	572	4.3	13,435	583	4.3
Ruscote Avenue	18,108	710	3.9	18,485	725	3.9	18,619	752	4.0
M40 North NB	45,806	5,634	12.3	52,304	6,433	12.3	52,346	6,440	12.3
M40 North SB	49,377	6,073	12.3	55,211	6,791	12.3	55,444	6,826	12.3

M40 North Slip Off	10,685	1,314	12.3	10,509	1,293	12.3	10,742	1,327	12.4
M40 North Slip On	8,948	1,101	12.3	9,947	1,224	12.3	9,989	1,230	12.3
M40 Central NB	36,870	4,535	12.3	42,357	5,210	12.3	42,357	5,210	12.3
M40 Central SB	39,625	4,874	12.3	45,415	5,586	12.3	45,415	5,586	12.3
M40 South NB	46,125	5,673	12.3	51,101	6,285	12.3	51,843	6,416	12.4
M40 South SB	46,920	5,771	12.3	53,415	6,570	12.3	53,645	6,612	12.3
M40 South Slip Off	14,501	1,784	12.3	15,552	1,913	12.3	16,294	2,024	12.4
M40 South Slip On	9,909	1,219	12.3	8,000	984	12.3	8,230	1,019	12.4
A422 Roundabout	18,059	831	4.6	24,334	1,119	4.6	24,384	1,127	4.6
M40 Roundabout	62,439	4,726	7.6	66,000	4,995	7.6	69,325	5,438	7.8
Ermont Way Roundabout	60,478	1,241	2.1	63,346	2,534	4.0	64,663	2,733	4.2
A4260 Roundabout	51,090	2,123	4.2	53,362	2,217	4.2	54,599	2,392	4.4
Southam Road Roundabout	43,041	1,765	4.1	43,973	1,803	4.1	44,501	1,897	4.3

Appendix C: Model Verification

Factor 1:

Table C1: Results of Model Verification

Diffusion Tube Site ID	Modelled Annual Mean Road NOx Contribution (µg/m³)	Monitored Annual Mean Road NOx Contribution (µg/m³)*	Annual Mean Background NOx (µg/m³)	Annual Mean Background NO_2 (µg/m³)	Monitored Annual Mean NO_2 (µg/m³)	Modelled Annual Mean NO_2 (µg/m³)**
Ermont Road 1	6.61	24.11	21.45	15.51	28.0	19.07
Stroud Close	8.93	15.13	21.45	15.51	23.5	20.29

*Diffusion tube using NO2 to NOx Calculator (https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc)

** Using NOx to NO2 Calculator (https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

Table C2: Results of Model Verification and Adjustment

Site ID	Modelled Annual Mean Road NOx Contribution (µg/m³)	Monitored Annual Mean Road NOx Contribution (µg/m³)*	Adjustment Factor	Adjusted Modelled Roads NOx Contribution (µg/m³)	Annual Mean Background NOx (µg/m³)	Annual Mean Background NO_2 (µg/m³)	Monitored Annual Mean NO_2 (µg/m³)	Modelled Annual Mean NO_2 (µg/m³)**	Modelled vs Monitored NO_2 Total % Difference
Ermont Road 1	6.61	24.11	3.6	15.8	21.45	15.51	28.0	23.8	-14.9
Stroud Close	8.93	15.13	1.7	21.3	21.45	15.51	23.5	26.6	13.2
			2.386	This is the regression correction factor (m) for the equation trend line Y=mX where					
				Y is monitored road contribution NOx and X is modelled road contribution NOx					

*Diffusion tube using NO2 to NOx Calculator (https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc)

** Using NOx to NO2 Calculator (https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

Factor 2

Table C1: Results of Model Verification

Diffusion Tube Site ID	Modelled Annual Mean Road NOx Contribution (µg/m^3)	Monitored Annual Mean Road NOx Contribution (µg/m^3)*	Annual Mean Background NOx (µg/m^3)	Annual Mean Background NO_2 (µg/m^3)	Monitored Annual Mean NO_2 (µg/m^3)	Modelled Annual Mean NO_2 (µg/m^3)**
Hennef Way	26.52	149.60	21.45	15.51	77.5	29.18

*Diffusion tube using NO2 to NOx Calculator (https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc)

** Using NOx to NO2 Calculator (https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

Table C2: Results of Model Verification and Adjustment

Site ID	Modelled Annual Mean Road NOx Contribution (µg/m^3)	Monitored Annual Mean Road NOx Contribution (µg/m^3)*	Adjustment Factor	Adjusted Modelled Roads NOx Contribution (µg/m^3)	Annual Mean Background NOx (µg/m^3)	Annual Mean Background NO_2 (µg/m^3)	Monitored Annual Mean NO_2 (µg/m^3)	Modelled Annual Mean NO_2 (µg/m^3)**	Modelled vs Monitored NO_2 Total % Difference
Hennef Way	26.52	149.60	5.6	149.60	21.45	15.51	77.5	77.5	0
			5.641	This is the regression correction factor (m) for the equation trend line Y=mX where					
				Y is monitored road contribution NOx and X is modelled road contribution NOx					

*Diffusion tube using NO2 to NOx Calculator (https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc)

** Using NOx to NO2 Calculator (https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

Appendix D: Damage Cost Assessment Screenshots

Damage Cost User Interface

Pollutant	NOx	Road Transport

Pollutant	PM2.5	Road Transport

Note: If you are assessing PM10 impacts, please convert these to PM2.5 using conversion factors found in the Assumptions sheet

NOx Road Transport

Year	2022	2023	2024	2025	2026
Reduction in emissions (tonnes)	3.856914016	3.39201	2.98675	2.63362	2.34641
Central Damage Costs (£)	10010	10210	10414	10622	10835
Central Benefit (£)	38606	34632	31104	27975	25423
Discounted Central Benefit (£)	38606	33461	29036	25232	22154
Central Present Value	£148,489				
Low Sensitivity Damage Costs (£)	902	920	938	957	976
Low Sensitivity Benefit (£)	3479	3121	2803	2521	2291
Discounted Low Sensitivity Benefit (£)	3479	3015	2617	2274	1996
Low Sensitivity Present Value	£13,381				
High Sensitivity Damage Costs (£)	38358	39125	39908	40706	41520
High Sensitivity Benefit (£)	147943	132713	119194	107204	97423
Discounted High Sensitivity Benefit (£)	147943	128225	111269	96692	84898
High Sensitivity Present Value	£569,027				

PM2.5 Road Transport

Year	2022	2023	2024	2025	2026
Reduction in emissions (tonnes)	0.3245	0.3190	0.3147	0.3113	0.3089
Central Damage Costs (£)	90002	91803	93639	95511	97422
Central Benefit (£)	29205	29285	29466	29735	30095
Discounted Central Benefit (£)	29205	28295	27506	26819	26226
Central Present Value	£138,051				
Low Sensitivity Damage Costs (£)	19395	19783	20179	20583	20994
Low Sensitivity Benefit (£)	6294	6311	6350	6408	6486
Discounted Low Sensitivity Benefit (£)	6294	6097	5928	5779	5652
Low Sensitivity Present Value	£29,750				
High Sensitivity Damage Costs (£)	278996	284576	290267	296072	301994
High Sensitivity Benefit (£)	90532	90779	91339	92173	93292
Discounted High Sensitivity Benefit (£)	90532	87710	85266	83135	81298
High Sensitivity Present Value	£427,941				