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Environmental Statement Appendices: Chapter 9: Air Quality

Land at J10, M40

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Experts in air quality management & assessment

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9.1 Legislation and Policy Context

9.1.1 All European legislation referred to in this report is written into UK law and remains in place.

Air Quality Strategy 2007

9.1.2 The Air Quality Strategy (Defra, 2007) published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations, provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Air Quality Strategy 2023

9.1.3 The Air Quality Strategy: Framework for Local Authority Delivery 2023 (Defra, 2023a) sets out the strategic air quality framework for local authorities and other Air Quality Partners in England. It sets out their powers and responsibilities, and actions the government expects them to take. It does not replace other air quality guidance documents relevant to local authorities.

Clean Air Strategy 2019

9.1.4 The Clean Air Strategy (Defra, 2019) sets out a wide range of actions by which the UK Government will seek to reduce pollutant emissions and improve air quality. Actions are targeted at four main sources of emissions: Transport, Domestic, Farming and Industry. At this stage, there is no straightforward way to take account of the expected future benefits to air quality within this assessment.

Reducing Emissions from Road Transport: Road to Zero Strategy

9.1.5 The Office for Low Emission Vehicles (OLEV) and Department for Transport (DfT) published a Policy Paper (DfT, 2018) in July 2018 outlining how the government will support the transition to zero tailpipe emission road transport and reduce tailpipe emissions from conventional vehicles during the transition. This paper affirms the Government's pledge to end the sale of new conventional petrol and diesel cars and vans by 2040, and states that the Government expects the majority of new cars and vans sold to be 100% zero tailpipe emission and all new cars and vans to have significant zero tailpipe emission capability by this year, and that by 2050 almost every car and van should have zero tailpipe emissions. It states that the Government wants to see at least 50%, and as many as 70%, of new car sales, and up to 40% of new van sales, being ultra-low emission by 2030.

9.1.6 The paper sets out a number of measures by which Government will support this transition, but is clear that Government expects this transition to be industry and consumer led. The Government has since announced that the phase-out date for the sale of new petrol and diesel cars and vans will be brought forward to 2030 and that all new cars and vans must be fully zero emission at the tailpipe from 2035. If these ambitions are realised then road traffic-related NOx emissions can be expected to reduce significantly over the coming decades, likely beyond the scale of reductions forecast in the tools utilised in carrying out this air quality assessment.

Environment Act 2021

9.1.7 The UK's new legal framework for protection of the natural environment, the Environment Act (2021) passed into UK law in November 2021. The Act gives the Government the power to set long-term, legally binding environmental targets. It also establishes an Office for Environmental Protection (OEP), responsible for holding the government to account and ensuring compliance with these targets.

9.1.8 The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 (SI 2023 No. 96) sets two new targets for future concentrations of $PM_{2.5}$.

Environmental Improvement Plan 2023

9.1.9 Defra published its 25 Year Environment Plan in 2018 (Defra, 2018a). The Environment Act (2021) requires Defra to review this Plan at least every five years. The Environmental Improvement Plan 2023 (Defra, 2023b) is the first revision. This outlines the progress made since 2018 and adds detail to the goals defined in the 2018 Plan, including that of achieving clean air.

9.1.10 The Environmental Improvement Plan 2023 sets out the new air quality targets which have been set for concentrations of $PM_{2.5}$. These targetsinclude the long-term targets in the Statutory Instrument described in Paragraph 9.1.8, and interim targets to be achieved by 2028.

9.1.11 The 2023 Plan outlines the role of local authorities in helping it meet both its targets and existing commitments. It also outlines the respective roles of industry, agricultural sectors, and the Department for Transport in providing the coordinated action required to meet both its new, and pre-existing targets and commitments.

Planning Policy

National Policies

9.1.12 The National Planning Policy Framework (NPPF) (2023) sets out planning policy for England. It states that the purpose of the planning system is to contribute to the achievement of sustainable development, and that the planning system has three overarching objectives, one of which (Paragraph 8c) is an environmental objective:

"to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy".

9.1.13 To prevent unacceptable risks from air pollution, Paragraph 180 of the NPPF states that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by…preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air quality".

9.1.14 Paragraph 191 states:

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

9.1.15 More specifically on air quality, Paragraph 192 makes clear that:

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

9.1.16 The NPPF is supported by Planning Practice Guidance (PPG) (Ministry of Housing, Communities & Local Government, 2019), which includes guiding principles on how planning can take account of the impacts of new development on air quality. The PPG states that:

"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with Limit Values. It is important that the potential impact of new development on air quality is taken into account where the national assessment indicates that relevant limits have been exceeded or are near the limit, or where the need for emissions reductions has been identified".

9.1.17 Regarding plan-making, the PPG states:

"It is important to take into account air quality management areas, Clean Air Zones and other areas including sensitive habitats or designated sites of importance for biodiversity where there could be specific requirements or limitations on new development because of air quality".

9.1.18 The role of the local authorities through the LAQM regime is covered, with the PPG stating that a local authority Air Quality Action Plan "*identifies measures that will be introduced in pursuit of the objectives and can have implications for planning*". In addition, the PPG makes clear that *"Odour and dust can also be a planning concern, for example, because of the effect on local amenity"*.

9.1.19 Regarding the need for an air quality assessment, the PPG states that:

"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity".

9.1.20 The PPG sets out the information that may be required in an air quality assessment, making clear that:

"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific".

9.1.21 The PPG also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that:

"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact. It is important that local planning authorities work with applicants to consider appropriate mitigation so as to ensure new development is appropriate for its location and unacceptable risks are prevented".

Local Policies

9.1.22 The Cherwell Local Plan 2011 – 2031 (Cherwell District Council, 2015) sets out planning policy within Cherwell District. Within this plan, Policy ESD10 'Protection and Enhancement of Biodiversity and the Natural Environment' concerns air quality and states the following:

"Protection and enhancement of biodiversity and the natural environment will be achieved by the following…

If significant harm resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or as a last resort, compensated for, then development will not be permitted…

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."

9.1.23 In addition, a number of Saved Policies from the Cherwell Adopted Local Plan 1996 (Cherwell District Council, 1996) remain relevant to planning decisions. Policy ENV1 concerns pollution control, and states the following:

"Development which is likely to cause materially detrimental levels of noise, vibration, smell, smoke, fumes or other type of environmental pollution will not normally be permitted."

9.1.24 Cherwell District Council (CDC) published a consultation draft (Regulation 18) of the Local Plan Review 2040 in September 2023 (Cherwell District Council, 2023). Within this Core Policy 16: Air Quality states:

"Development proposals that are likely to have an impact on local air quality, including those in, or within relative proximity to, existing or potential Air Quality Management Areas (AQMAs) will need to provide design mitigation measures to minimise any impacts associated with air quality. Where development is proposed in areas of existing poor air quality and/ or where significant development is proposed, an air quality assessment will normally be required. The Council will require applicants to demonstrate that the development will minimise the impact on air quality, both during the construction process and lifetime of the completed development.

Mitigation measures will need to demonstrate how the proposal would make a positive contribution towards the aims of the Council's Air Quality Action Plan. Mitigation measures will be secured either through a negotiation on a scheme, or via the use of a planning condition and/or planning obligation depending on the scale and nature of the development and its associated impacts on air quality."

Air Quality Action Plans

National Air Quality Plan

9.1.25 Defra has produced an Air Quality Plan to tackle roadside nitrogen dioxide concentrations in the UK (Defra, 2017); a supplement to the 2017 Plan (Defra, 2018b) was published in October 2018 and sets out the steps Government is taking in relation to a further 33 local authorities where shorter-term exceedances of the limit value were identified. Alongside a package of national measures, the 2017 Plan and the 2018 Supplement require those identified English Local Authorities (or the GLA in the case of London Authorities) to produce local action plans and/or feasibility studies. These plans and feasibility studies must have regard to measures to achieve the statutory limit values within the shortest possible time, which may include the implementation of a Clean Air Zone (CAZ). There is currently no straightforward way to take account of the effects of the 2017 Plan or 2018 Supplement in the modelling undertaken for this assessment; however, consideration has been given to whether there is currently, or is likely to be in the future, a limit value exceedance in the vicinity of the proposed development. This assessment has principally been carried out in relation to the air quality objectives, rather than the limit values that are the focus of the Air Quality Plan.

Local Air Quality Action Plan

9.1.26 Cherwell District Council's Air Quality Action Plan (Cherwell District Council, 2017) sets out a series of measures by which they will seek to achieve the air quality objectives in their AQMAs. The Plan includes a number of general measures across the district which will seek to improve air quality, none of which specially relate to this development or its location.

9.1.27 The Plan also contains a number of others measures relevant to the individual AQMAs which are no relevant to the assessment.

9.2 Construction Dust Assessment Procedure

9.2.1 The criteria developed by IAQM (2024) divide the activities on construction sites into four types to reflect their different potential impacts. These are:

- demolition;
- earthworks;
- construction; and
- trackout.

9.2.2 The assessment procedure includes the four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

9.2.3 An assessment is required where there is a human receptor within 250 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the site entrance(s), or where there is an ecological receptor within 50 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the site entrance(s).

9.2.4 Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is *negligible* and that any effects will be 'not significant'. No mitigation measures beyond those required by legislation will be required.

STEP 2: Assess the Risk of Dust Impacts

9.2.5 A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude (Step 2A); and
- the sensitivity of the area to dust effects (Step 2B).

9.2.6 These two factors are combined in Step 2C, which is to determine the risk of dust impacts with no mitigation applied. The risk categories assigned to the site may be different for each of the four potential sources of dust (demolition, earthworks, construction and trackout).

Step 2A – Define the Potential Dust Emission Magnitude

9.2.7 Dust emission magnitude is defined as either 'Small', 'Medium', or 'Large'. The IAQM guidance explains that this classification should be based on professional judgement, but provides the examples in Table 9.2.1.

Table 9.2.1: Examples of How the Dust Emission Magnitude Class May be Defined

Class	Examples
Demolition	
Large	Total building volume >75,000 m^3, potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities >12 m above ground level
Medium	Total building volume 12,000 m^3 – 75,000 m^3, potentially dusty construction material, demolition activities 6-12 m above ground level
Small	Total building volume <12,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <6 m above ground, demolition during wetter months
Earthworks	
Large	Total site area >110,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >6 m in height
Medium	Total site area 18,000 m^2 – 110,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 3 m – 6 m in height
Small	Total site area <18,000 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <3 m in height
Construction	
Large	Total building volume >75,000 m^3, on site concrete batching; sandblasting
Medium	Total building volume 12,000 m^3 – 75,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching
Small	Total building volume <12,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout [a]	
Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m
Medium	20-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m
Small	<20 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m

[a] These numbers are for vehicles that leave the site after moving over unpaved ground.

Step 2B – Define the Sensitivity of the Area

9.2.8 The sensitivity of the area is defined taking account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether there are natural shelters to reduce the risk of wind-blown dust.

9.2.9 The first requirement is to determine the specific sensitivities of local receptors. The IAQM guidance recommends that this should be based on professional judgment, taking account of the principles in

Table 9.2.2. These receptor sensitivities are then used in the matrices set out in Table 9.2.3, Table 9.2.4 and Table 9.2.5 to determine the sensitivity of the area. Finally, the sensitivity of the area is considered in relation to any other site-specific factors, such as the presence of natural shelters etc., and any required adjustments to the defined sensitivities are made.

Step 2C – Define the Risk of Impacts

9.2.10 The dust emission magnitude determined at Step 2A is combined with the sensitivity of the area determined at Step 2B to determine the *risk* of impacts with no mitigation applied. The IAQM guidance provides the matrix in Table 9.2.6 as a method of assigning the level of risk for each activity.

STEP 3: Determine Site-specific Mitigation Requirements

9.2.11 The IAQM guidance provides a suite of recommended and desirable mitigation measures which are organised according to whether the outcome of Step 2 indicates a low, medium, or high risk. The list provided in the IAQM guidance has been used as the basis for the requirements set out in Appendix 9.5.

STEP 4: Determine Significant Effects

9.2.12 The IAQM guidance does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be ‘not significant’.

9.2.13 The IAQM guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will be ‘not significant’.

Table 9.2.2: Principles to be Used When Defining Receptor Sensitivities

Class	Principles	Examples
Sensitivities of People to Dust Soiling Effects		
High	users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land	dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms
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; or the appearance, aesthetics or value of their property could be diminished by soiling; or 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	parks and places of work
Low	the enjoyment of amenity would not reasonably be expected; or there is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or 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	playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads
Sensitivities of People to the Health Effects of PM_{10}		
High	locations where members of the public may be exposed for eight hours or more in a day	residential properties, hospitals, schools and residential care homes
Medium	locations where the people exposed are workers, and where individuals may be exposed for eight hours or more in a day.	may include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}
Low	locations where human exposure is transient	public footpaths, playing fields, parks and shopping streets
Sensitivities of Receptors to Ecological Effects		
High	locations with an international or national designation and the designated features may be affected by dust soiling; or locations where there is a community of a particularly dust sensitive species	Special Areas of Conservation with dust sensitive features
Medium	locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or locations with a national designation where the features may be affected by dust deposition	Sites of Special Scientific Interest with dust sensitive features
Low	locations with a local designation where the features may be affected by dust deposition	Local Nature Reserves with dust sensitive features

Table 9.2.3: Sensitivity of the Area to Dust Soiling Effects on People and Property [1]

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<250
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

1 For demolition, earthworks and construction, distances are taken either from the dust source or from the boundary of the site. For trackout, distances are measured from the sides of roads used by construction traffic. Without mitigation, trackout may occur from roads up to 500 m from sites with a *large* dust emission magnitude for trackout, 200 m from sites with a *medium* dust emission magnitude and 50 m from sites with a *small* dust emission magnitude, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table 9.2.4: Sensitivity of the Area to Human Health Effects [1]

Receptor Sensitivity	Annual Mean PM_{10}	Number of Receptors	Distance from the Source (m)			
			<20	<50	<100	<250
High	>32 µg/m³	>100	High	High	High	Medium
		10-100	High	High	Medium	Low
		1-10	High	Medium	Low	Low
	28-32 µg/m³	>100	High	High	Medium	Low
		10-100	High	Medium	Low	Low
		1-10	High	Medium	Low	Low
	24-28 µg/m³	>100	High	Medium	Low	Low
		10-100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	<24 µg/m³	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	>32 µg/m³	>10	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	28-32 µg/m³	>10	Medium	Low	Low	Low
		1-10	Low	Low	Low	Low
	24-28 µg/m³	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
	<24 µg/m³	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low

Table 9.2.5: Sensitivity of the Area to Ecological Effects [1]

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table 9.2.6: Defining the Risk of Dust Impacts

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Negligible
Low	Low Risk	Low Risk	Negligible

9.3 EPUK & IAQM Planning for Air Quality Guidance

9.3.1 The guidance issued by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air Quality as a Material Consideration

"Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning application decision, in addition to the policies in the local plan, will depend on such factors as:

- *the severity of the impacts on air quality;*
- *the air quality in the area surrounding the proposed development;*
- *the likely use of the development, i.e. the length of time people are likely to be exposed at that location; and*
- *the positive benefits provided through other material considerations".*

Recommended Best Practice

9.3.2 The guidance goes into detail on how all development proposals can and should adopt good design principles that reduce emissions and contribute to better air quality management. It states:

"The basic concept is that good practice to reduce emissions and exposure is incorporated into all developments at the outset, at a scale commensurate with the emissions".

9.3.3 The guidance sets out a number of good practice principles that should be applied to all developments that:

- include 10 or more dwellings;
- where the number of dwellings is not known, residential development is carried out on a site of more than 0.5 ha;
- provide more than 1,000 m^2 of commercial floorspace;
- are carried out on land of 1 ha or more.

9.3.4 The good practice principles are that:

- New developments should not contravene the Council's Air Quality Action Plan, or render any of the measures unworkable;
- Wherever possible, new developments should not create a new "street canyon", as this inhibits pollution dispersion;

- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;
- The provision of at least 1 Electric Vehicle (EV) "rapid charge" point per 10 residential dwellings and/or 1000 m^2 of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNOx/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
    - Spark ignition engine: 250 mgNOx/Nm^3;
    - Compression ignition engine: 400 mgNOx/Nm^3;
    - Gas turbine: 50 mgNOx/Nm^3.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNOx/Nm^3 and 25 mgPM/Nm^3.

9.3.5 The guidance also outlines that offsetting emissions might be used as a mitigation measure for a proposed development. However, it states that:

"It is important that obligations to include offsetting are proportional to the nature and scale of development proposed and the level of concern about air quality; such offsetting can be based on a quantification of the emissions associated with the development. These emissions can be assigned a value, based on the "damage cost approach" used by Defra, and then applied as an indicator of the level of offsetting required, or as a financial obligation on the developer. Unless some form of benchmarking is applied, it is impractical to include building emissions in this approach, but if the boiler and CHP emissions are consistent with the standards as described above then this is not essential".

9.3.6 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to offset emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

- Support and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;
- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructures.

Screening

Impacts of the Local Area on the Development

"There may be a requirement to carry out an air quality assessment for the impacts of the local area's emissions on the proposed development itself, to assess the exposure that residents or users might experience. This will need to be a matter of judgement and should take into account:

- *the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- *the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- *the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and*
- *the presence of a source of odour and/or dust that may affect amenity for future occupants of the development".*

Impacts of the Development on the Local Area

9.3.7 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the following apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use; and/or
- more than 1,000 m^2 of floor space for all other uses or a site area greater than 1 ha.

9.3.8 Coupled with any of the following:

- the development has more than 10 parking spaces; and/or
- the development will have a centralised energy facility or other centralised combustion process.

9.3.9 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, which sets out indicative criteria for requiring an air quality assessment. The stage 2 criteria relating to vehicle emissions are set out below:

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of 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;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights or roundabouts;
- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere; and
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor.

9.3.10 The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria are likely to be more appropriate.

9.3.11 On combustion processes (including standby emergency generators and shipping) where there is a risk of impacts at relevant receptors, the guidance states that:

"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. 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/Nm^3.

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.

Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable".

9.3.12 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area, provided that professional judgement is applied; the guidance importantly states the following:

"The criteria provided are precautionary and should be treated as indicative. They are intended to function as a sensitive 'trigger' for initiating an assessment in cases where there is a possibility of significant effects arising on local air quality. This possibility will, self-evidently, not be realised in many cases. The criteria should not be applied rigidly; in some instances, it may be appropriate to amend them on the basis of professional judgement, bearing in mind that the objective is to identify situations where there is a possibility of a significant effect on local air quality".

9.3.13 Even if a development cannot be screened out, the guidance is clear that a detailed assessment is not necessarily required:

"The use of a Simple Assessment may be appropriate, where it will clearly suffice for the purposes of reaching a conclusion on the significance of effects on local air quality. The principle underlying this guidance is that any assessment should provide enough evidence that will lead to a sound conclusion on the presence, or otherwise, of a significant effect on local air quality. A Simple Assessment will be appropriate, if it can provide this evidence. Similarly, it may be possible to conduct a quantitative assessment that does not require the use of a dispersion model run on a computer".

9.3.14 The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this chapter.

Assessment of Significance

9.3.15 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. This approach involves a two stage process:

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

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

- the existing and future air quality in the absence of the development;

- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts and, in such circumstances, several impacts that are described as '*slight*' individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a '*moderate*' or '*substantial*' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

9.3.17 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

9.3.18 A judgement of the significance should be made by a competent professional who is suitably qualified.

9.4 Modelling Methodology

Model Inputs

9.4.1 Predictions have been carried out using the ADMS-Roads dispersion model (v5). The model requires the user to provide various input data, including emissions from each section of road and the road characteristics, including road width. Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 11.0) published by Defra (2023c). Model input parameters are summarised in Table 9.4.1 and, where considered necessary, discussed further below.

Table 9.4.1: Summary of Model Inputs

Model Parameter	Value Used
Terrain Effects Modelled?	No
Variable Surface Roughness File Used?	Yes – 12km x 12km Cartesian grid at 50m resolution
Urban Canopy Flow Used?	No
Advanced Street Canyons Modelled?	No
Meteorological Monitoring Site	Brize Norton
Meteorological Data Year	2022
Dispersion Site Surface Roughness Length (m)	N/A (variable surface roughness file used)
Dispersion Site Minimum MO Length (m)	10
Met Site Surface Roughness Length (m)	0.3
Met Site Minimum MO Length (m)	10
Gradients?	No

9.4.2 AADT flows, diurnal flow profiles, speeds, and vehicle fleet composition data have been provided by David Tucker Associates, who have undertaken the transport assessment work for the proposed development. Traffic speeds have been estimated based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. The traffic data used in this assessment are summarised in Table 9.4.2 and Table 9.4.3. Diurnal and monthly flow profiles for the traffic have been derived from the national profiles published by DfT (2024).

Table 9.4.2: Summary of Baseline Traffic Data used in the Assessment (AADT Flows) [a]

Road Link	2022 Baseline		2026 Baseline [b]	
	AADT	%HDV	AADT	%HDV
1 – B4100	6,125	3	6,871	5
2 – B4100	6,125	3	6,871	5
3 – B4100	12,995	3	19,560	10
4 – B4100	12,995	3	18,375	10
5 – B4100	12,940	4	15,168	4
6 – A4095	15,711	4	17,394	4
7 – A4095	12,568	2	14,160	2
8 – A43	36,328	15	41,129	15
9 – B430	8,255	5	12,156	5
10 – M40 South of Junction 10	108,440	16	113,810	16
11 – M40 North of Junction 10	88,674	19	93,705	19
12 – A43	37,315	16	42,505	16
13 – M40 North Onslip	5,180	15	6,243	14
14 – M40 North Offslip	6,650	13	7,768	13
15 – M40 South Onslip	16,700	20	17,993	20
16 – M40 South Offslip	17,308	17	18,624	17
17 – M40 Overbridges	30,498	13	35,052	13
18 – A43 Padbury-Cherwell Link	47,027	15	52,525	15
19 – A43 North of Barleymow Roundabout	35,049	16	39,077	16
20 – A421 East	10,666	9	11,979	10

[a] Dual carriageways are modelled as separate roads with traffic data split 50% in each direction.

[b] Includes all development traffic from nearby cumulative schemes (Tritax, Great Wolf, Firthorn, Heyford Park and Axis J9)

Table 9.4.3: Summary of 'With Development' Traffic Data used in the Assessment (AADT Flows) [a, b]

Road Link	2026 Eastern Parcel		2026 Western Parcel		2026 Completed Development	
	AADT	%HDV	AADT	%HDV	AADT	%HDV
1 – B4100	7,061	5	7,439	6	7,628	7
2 – B4100	7,061	5	10,088	12	10,277	12
3 – B4100	21,116	11	20,430	10	21,986	12
4 – B4100	18,922	10	19,245	11	19,792	11
5 – B4100	15,630	4	15,887	4	16,349	4
6 – A4095	17,583	4	17,734	4	17,924	4
7 – A4095	14,266	2	14,312	2	14,417	2
8 – A43	41,780	15	42,377	15	43,029	16
9 – B430	12,282	5	12,458	5	12,584	4
10 – M40 South of Junction 10	114,146	16	114,415	16	114,752	16
11 – M40 North of Junction 10	93,895	19	94,046	19	94,235	19
12 – A43	43,199	16	43,640	16	44,334	17
13 – M40 North Onslip	6,338	15	6,413	15	6,508	15
14 – M40 North Offslip	7,862	13	7,938	13	8,032	13
15 – M40 South Onslip	18,161	20	18,296	20	18,464	20
16 – M40 South Offslip	18,792	17	18,926	17	19,094	17
17 – M40 Overbridges	35,441	13	35,827	13	36,216	13
18 – A43 Padbury-Cherwell Link	53,082	16	53,603	16	54,160	16
19 – A43 North of Barleymow Roundabout	39,555	16	39,860	16	40,338	16
20 – A421 East	12,194	10	12,331	10	12,546	11
21 – Baynards Green Roundabout [c]	42,925	17	45,027	17	45,910	17
E – Site Access Albion East	2,102	28	0	0	2,102	28
W – Site Access Albion West	0	0	3,784	28	3,784	28

[a] Dual carriageways are modelled as separate roads with traffic data split 50% in each direction.

[b] Includes all development traffic from nearby cumulative schemes (Tritax, Great Wolf, Firthorn, Heyford Park and Axis J9)

[c] A worst-case traffic flow for the Baynards Green Roundabout, which combines the highest baseline flow of any input and the highest development flow.

9.4.3 Figure 9.4.1, shows the road network included within the model, along with the speed at which each link was modelled.

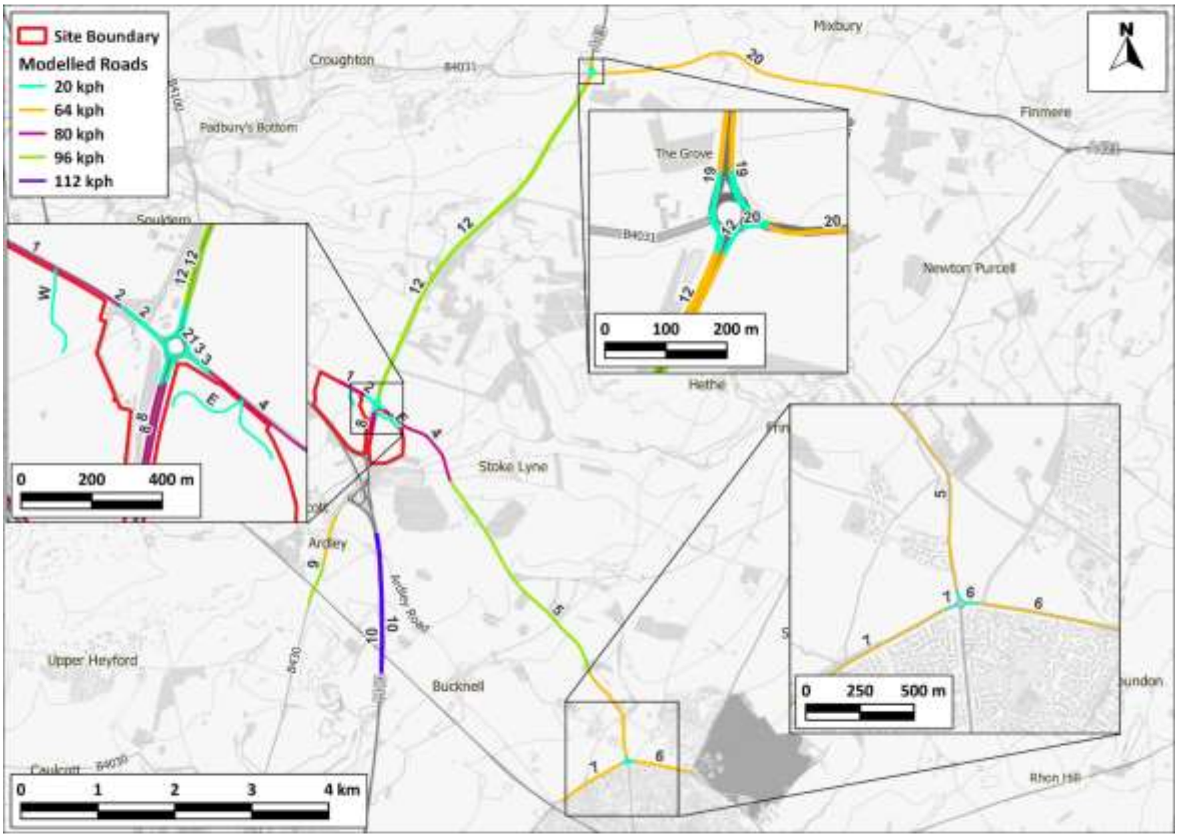

Figure 9.4.1: Modelled Road Network & Speed

9.4.4 Hourly sequential meteorological data in sectors of 10 degrees from Brize Norton for 2022 have been used in the model. This meteorological monitoring station is located at RAF Brize Norton, approximately 34 km to the southwest of the proposed development. It is deemed to be an appropriate monitoring station with sufficient data representative of meteorological conditions in the vicinity of the proposed development; it is located in an inland area of central England with relatively flat topography. A wind rose for the site for the year 2022 is provided in Figure 9.4.2. The station is operated by the UK Met Office. Raw data were provided and quality assured by the Met Office.

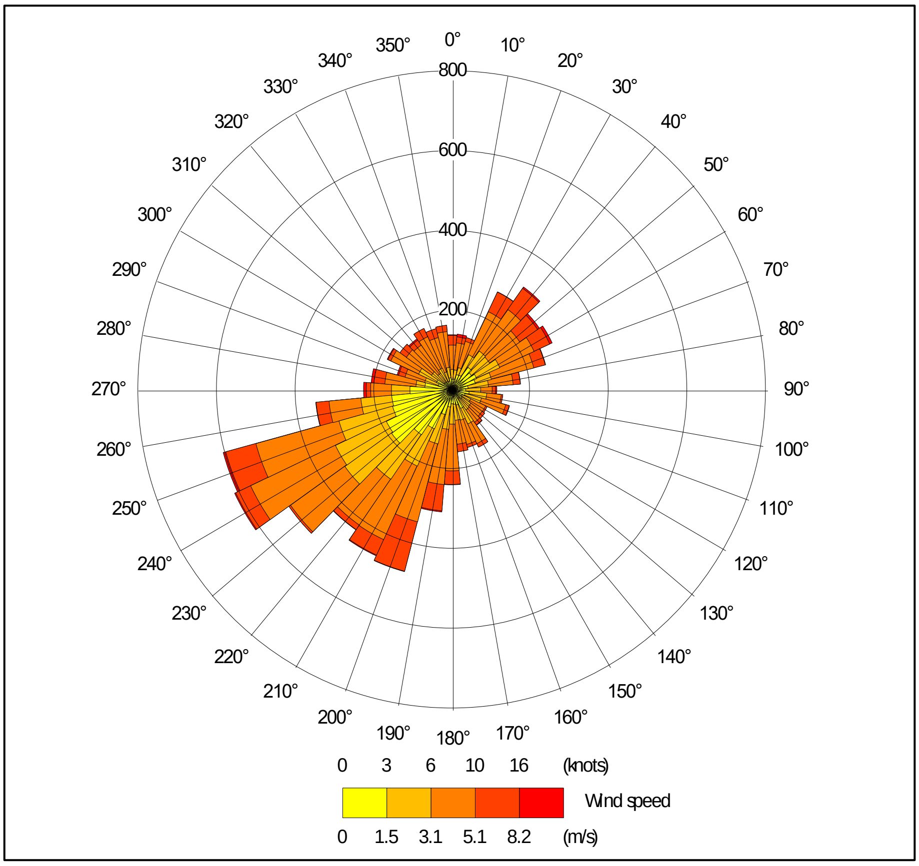

Figure 9.4.2: 2022 Wind Rose from Brize Norton

Model Verification

9.4.5 Evidence collected over many years has shown that, in most urban areas, dispersion modelling relying upon Defra's EFT has tended to systematically under-predict roadside nitrogen dioxide concentrations. To account for this, it is necessary to adjust the model against local measurements. The model has been run to predict annual mean nitrogen dioxide concentrations during 2022 at the DT20 (formerly DT47) diffusion tube monitoring site in Ardley. This site has been selected because it is located at a roadside location within the modelled study area. Only one site was used for model verification; the latest 2023 ASR contains a number of inconsistencies in Site IDs and coordinates which meant other sites could not be reliably included. Former site DT18 was not included in the verification as there were no data for 2022.

Nitrogen Dioxide

9.4.6 Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). The model has been run to predict the annual mean NOx concentrations during 2022 at diffusion tube monitoring site DT20. Concentrations have been modelled at 2 m, the height of the monitor.

9.4.7 The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentration and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 8.1) available on the Defra LAQM Support website (Defra, 2023c).

9.4.8 An adjustment factor has been determined as the ratio of the 'measured' road contribution and the model derived road contribution. This factor has then been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations. The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator (Defra, 2023c).

9.4.9 The data used to calculate the adjustment factor are provided below:

- Measured NO_2 : 18.0 µg/m^3
- Background NO_2 : 13.7 µg/m^3
- 'Measured' road-NOx (using NOx from NO_2 calculator): 8.1 µg/m^3
- Modelled road-NOx = 3.8 µg/m^3
- Road-NOx adjustment factor: 8.1/3.8 = **2.142**[2]

9.4.10 The factor implies that the unadjusted model is under-predicting the road-NOx contribution. This is a common experience with this and most other road traffic emissions dispersion models.

PM_{10} and $PM_{2.5}$

9.4.11 The approach described above for NOx and nitrogen dioxide determines the road increment of concentrations by subtracting the predicted local background from the roadside measurements. This works well for NOx because the differences between roadside and background concentrations typically represent a large proportion of the total measured value. The same is not true for PM_{10} and $PM_{2.5}$ concentrations, which are dominated by non-road emissions, even at the roadside. In practice, the influence of a local road on concentrations can often be smaller than the uncertainty in the mapped background concentration. As an example of this, 31% of all roadside and kerbside sites in London which measured $PM_{2.5}$ in 2019 with >75% data capture, recorded an annual mean concentration lower than the equivalent Defra mapped background value. Using measured background concentrations does not provide any significant benefit, owing largely to the spatial resolution of available measurements, but also because of measurement uncertainty. For example, hourly-mean $PM_{2.5}$ concentrations measured at roadside sites are often lower than those measured at nearby urban

2 Based on un-rounded values.

background sites, while concentrations at urban background sites are often lower than those measured at rural sites.

9.4.12 For these reasons, it is not appropriate to calculate the annual mean road-increment to PM_{10} and $PM_{2.5}$ concentrations by subtracting either the mapped background or a local measured background concentration. This, in turn, means that the approach to model adjustment which is described for NOx and NO_2 is not appropriate for PM_{10} and $PM_{2.5}$. Historically, many studies have derived a model adjustment factor for NOx and applied this to PM_{10} and $PM_{2.5}$. This is also not appropriate, since there is no reason to expect the same bias in emissions of NOx, PM_{10} and $PM_{2.5}$.

9.4.13 While there is very strong evidence that EFT-based models have consistently under-predicted road-NOx concentrations in urban areas, there is no equivalent evidence for PM_{10} and $PM_{2.5}$. There is currently no strong basis for applying any adjustment to the model outputs. Predicted concentrations of PM_{10} and $PM_{2.5}$ have thus not been adjusted.

Post-Processing

9.4.14 The model predicts road-NOx concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background NO_2, has been processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2023e). The traffic mix within the calculator has been set to “All UK traffic”, which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2.

Model Uncertainty

9.4.15 There are many components that contribute to the uncertainty of modelling predictions. The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms.

9.4.16 An important stage in the process is model verification, which involves comparing the model output with measured concentrations. Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of base year (2022) concentrations.

9.4.17 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations and vehicle emissions. Historic versions of Defra’s EFT tended to over-state emissions reductions into the future. However, analyses of the more recent versions of Defra’s EFT carried out by AQC (2020a; 2020b) suggest that, on balance, these versions are unlikely to over-state the rate at which NOx emissions decline in the future at an ‘average’ site in the UK. In practice, the balance of evidence suggests that NOx concentrations are most likely to decline more quickly in the future, on average, than predicted by previous versions of the EFT, especially against a base year of 2016 or later. Whilst such an analysis has not been undertaken by AQC for EFT v12.0, it is considered that using EFT v12.0 for future-year forecasts in this report provides a robust assessment, given that the model has been verified against measurements made in 2022.

9.4.18 Forecasts of future-year concentrations are usually based on measurements made during a recent year. They then take account of projected changes over time to factors such as the composition of the vehicle fleet and the uptake of other new technologies, as well as population increases etc. In early 2020, activity in the UK was disrupted by the Covid-19 pandemic. As a result, concentrations of traffic-related air pollutants fell appreciably (Defra Air Quality Expert Group, 2020). While the pandemic may cause long-lasting changes to travel activity patterns, it is reasonable to expect a return to more typical activity levels in the future. Thus, 2020 is likely to present as an atypically low pollution year for roadside pollutant concentrations, as is 2021.

9.4.19 It is not currently possible to make robust predictions of the rate at which travel activity patterns will return to historically-normal levels; or the extent of any long-lasting changes to travel behaviour. The most robust approach to making future-year projections is thus to use activity forecasts made before the impact of the pandemic was understood, which is the approach that has been taken in this assessment. The model has been verified in 2022 and thus, the impact of the covid-19 pandemic is not considered to affect model results.

9.5 Construction Mitigation

9.5.1 Table 9.5.1 sets out a list of best-practice measures from the IAQM guidance (IAQM, 2024) that should be incorporated into the specification for the works. These measures should ideally be written into a Dust Management Plan. Some of the measures may only be necessary during specific phases of work, or during activities with a high potential to produce dust, and the list should be refined and expanded upon in liaison with the construction contractor when producing the Dust Management Plan.

Table 9.5.1: Best-Practice Mitigation Measures Recommended for the Works

Measure	Desirable	Highly Recommended
Communications		
Develop and implement a stakeholder communications plan that includes community engagement before and during work on site		✓
Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site manager		✓
Display the head or regional office contact information		✓
Dust Management Plan		
Develop and implement a Dust Management Plan (DMP) approved by the Local Authority which documents the mitigation measures to be applied, and the procedures for their implementation and management		✓
Site Management		
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken		✓
Make the complaints log available to the local authority when asked		✓
Record any exceptional incidents that cause dust and/or air emissions, either on- or off- site, and the action taken to resolve the situation in the log book		✓
Monitoring		
Undertake daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust. Record inspection results, and make the log available to the Local Authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary, with cleaning to be provided if necessary	✓	
Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the Local Authority when asked		✓
Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions		✓
Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Further guidance is		✓

provided by IAQM on monitoring during demolition, earthworks and construction **(IAQM, 2018)**		
Preparing and Maintaining the Site		
Plan the site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible		✓
Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site		✓
Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period		✓
Avoid site runoff of water or mud		✓
Keep site fencing, barriers and scaffolding clean using wet methods		✓
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below		✓
Cover, seed, or fence stockpiles to prevent wind whipping		✓
Operating Vehicle/Machinery and Sustainable Travel		
Ensure all vehicles switch off their engines when stationary – no idling vehicles		✓
Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery-powered equipment where practicable		✓
Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate)	✓	
Implement a Travel Plan that supports and encourages sustainable staff travel (public transport, cycling, walking, and car-sharing)	✓	
Operations		
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems		✓
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate		✓
Use enclosed chutes, conveyors and covered skips		✓
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate		✓
Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods		✓
Waste Management		
Avoid bonfires and burning of waste materials		✓

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

9.6 Cumulative Modelling Results

Table 9.6.1: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2026 (µg/m^3) [a]

Receptor	Without Development or Tritax	With Development and Tritax	% Change [b]	Impact Descriptor
1	11.2	12.6	3	Negligible
2	13.9	15.5	4	Negligible
3	14.3	15.7	4	Negligible
4	14.1	14.6	1	Negligible
5	14.9	15.6	2	Negligible
6	22.6	22.8	0	Negligible
7	**40.7**	**41.1**	1	Moderate Adverse
8	12.4	13.3	2	Negligible
9	8.2	8.5	1	Negligible
10	9.0	9.3	1	Negligible
11	12.1	13.1	2	Negligible
12	8.8	9.1	1	Negligible
13	10.7	11.2	1	Negligible
14	10.7	11.2	1	Negligible
15	10.8	11.2	1	Negligible
16	10.4	10.6	0	Negligible
17	10.9	11.1	1	Negligible
18	10.2	10.3	0	Negligible
19	10.1	10.2	0	Negligible
20	13.4	14.2	2	Negligible
21	13.1	13.8	2	Negligible
22	15.5	16.3	2	Negligible
23	15.2	16.0	2	Negligible
24	11.2	11.6	1	Negligible
25	9.0	9.3	1	Negligible
Objective	**40**		**-**	**-**

[a] Exceedances of the objective are shown in bold.

[b] % changes are relative to the objective and have been rounded to the nearest whole number.

Table 9.6.2: Predicted Impacts on Annual Mean PM_{10} Concentrations in 2026 (µg/m[3])

Receptor	Without Development or Tritax	With Development and Tritax	% Change [a]	Impact Descriptor
1	15.9	16.2	1	Negligible
2	16.2	16.5	1	Negligible
3	16.3	16.5	1	Negligible
4	15.6	15.7	0	Negligible
5	15.8	15.9	0	Negligible
6	17.3	17.3	0	Negligible
7	19.5	19.6	0	Negligible
8	14.6	14.7	1	Negligible
9	14.0	14.0	0	Negligible
10	14.1	14.2	0	Negligible
11	14.7	14.9	1	Negligible
12	14.1	14.1	0	Negligible
13	14.6	14.7	0	Negligible
14	14.6	14.7	0	Negligible
15	14.6	14.7	0	Negligible
16	14.6	14.6	0	Negligible
17	14.6	14.6	0	Negligible
18	14.8	14.8	0	Negligible
19	14.8	14.8	0	Negligible
20	16.4	16.6	1	Negligible
21	16.9	17.1	1	Negligible
22	17.1	17.3	1	Negligible
23	14.8	15.0	1	Negligible
24	15.9	15.9	0	Negligible
25	14.7	14.7	0	Negligible
Objective	40		-	-

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

Table 9.6.3: Predicted Impacts on Annual Mean $PM_{2.5}$ Concentrations in 2026 (µg/m[3])

Receptor	Without Development or Tritax	With Development and Tritax	% Change [a]	Impact Descriptor
1	9.4	9.5	1	Negligible
2	9.6	9.7	1	Negligible
3	9.6	9.7	1	Negligible
4	9.5	9.6	0	Negligible
5	9.6	9.7	0	Negligible

6	10.4	10.4	0	Negligible
7	11.7	11.8	0	Negligible
8	8.8	8.9	1	Negligible
9	8.6	8.6	0	Negligible
10	8.7	8.7	0	Negligible
11	9.0	9.1	1	Negligible
12	8.6	8.7	0	Negligible
13	9.7	9.7	0	Negligible
14	9.7	9.7	0	Negligible
15	9.7	9.7	0	Negligible
16	9.6	9.7	0	Negligible
17	9.7	9.7	0	Negligible
18	9.2	9.2	0	Negligible
19	9.2	9.2	0	Negligible
20	9.7	9.8	0	Negligible
21	9.7	9.7	0	Negligible
22	10.0	10.1	1	Negligible
23	9.2	9.3	1	Negligible
24	9.2	9.3	0	Negligible
25	8.7	8.8	0	Negligible
Objective	**40**		**-**	**-**

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

9.7 Glossary and References

Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
AQAL	Air Quality Assessment Level
AQC	Air Quality Consultants
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
CDC	Cherwell District Council
CEMP	Construction Environmental Management Plan
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMP	Dust Management Plan
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
EU	European Union
EV	Electric Vehicle
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HMSO	Her Majesty's Stationery Office
IAQM	Institute of Air Quality Management
JAQU	Joint Air Quality Unit
kph	Kilometres Per hour
LAQM	Local Air Quality Management
LDV	Light Duty Vehicles (<3.5 tonnes)
$\mu g/m^3$	Microgrammes per cubic metre
NO	Nitric oxide

NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
OLEV	Office for Low Emission Vehicles
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
PPG	Planning Practice Guidance
RDE	Real Driving Emissions
SPD	Supplementary Planning Document
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEMPro	Trip End Model Presentation Program

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9.8 Air Quality Ecological Impact Assessment

Air Quality CONSULTANTS

Biodiversity Air Quality Modelling Assessment: Baynards Green, Cherwell

March 2024

Experts in air quality management & assessment

Document Control

Client	Albion Land Ltd	Principal Contact	Lewis Jenkins (Quod)

Job Number	J/10/12215C

Report Prepared By:	Isabel Stanley and Adam Dawson

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Contents

1 Introduction

1.1 This report presents the potential changes to air quality at designated nature conservation sites near to a proposed 280,000 m^2 B8-use logistics development at land at Junction 10 of the M40. It has been produced to complement the Air Quality assessment within chapter 9 of the Environmental Statement submitted for the scheme. The current report sets out the predicted air quality concentrations and deposition fluxes at nearby designated sites to allow Tyler Grange, the project ecologist, to assess the potential for significant effects.

1.2 The impacts have been considered within the Ardley Cutting and Quarry Site of Special Scientific Interest (SSSI), the Stoke Little Wood Ancient Woodland (AW) and the Twelveacre Copse AW. These sites have been scoped in as they all have been confirmed as having features sensitive to air pollution within 200 m of a road where the Development will lead to an increase in traffic. The location of the Development and the assessed designated ecological sites are shown in Figure 1.

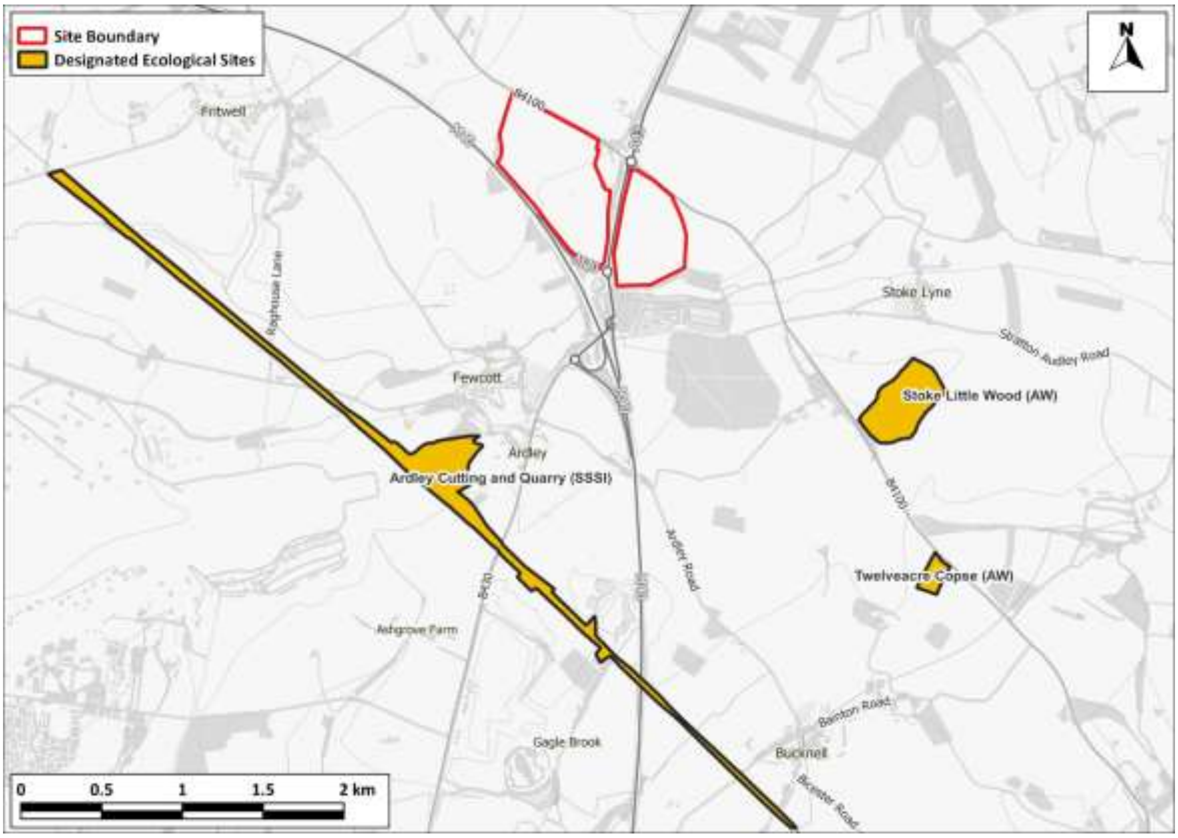

Figure 1: Proposed Development Setting

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1.3 Road traffic can emit nitrogen oxides (NOx) and ammonia, and some sensitive vegetation may be affected by elevated concentrations of these pollutants. Furthermore, the deposition of both NOx and ammonia can alter the nutrient and acidity balance of some ecosystems, causing changes to their composition and health. This assessment has quantified the changes to NOx and ammonia concentrations that would be caused by the Development, as well as the changes to nitrogen and acid deposition fluxes.

1.4 This report describes existing local air quality conditions, and the predicted air quality in the future assuming the Development (in-isolation) and nearby planned developments (in-combination) proceed. The assessment of traffic-related impacts focuses on 2026, which represents the earliest opening year of the Development.

1.5 While an impact assessment on the sections of Ardley Cutting and Quarry SSSI adjacent to the M40 has been undertaken for completeness, guidance from the Joint Nature Conservation Committee (JNCC) is that "*the effects of an individual development proposal on traffic related emissions on the existing road network, strategic 'trunk roads' should be excluded from the scope of the assessment"*[1]. The JNCC guidance explains that "*Trunk roads are central to long distance travel and connectivity across the UK and traffic patterns on trunk roads are a consequence of predicted growth across the UK generally"*[1]. The M40 would be expected to carry additional traffic from new development in the region irrespective of its precise location and any effects of this traffic growth are appropriately considered as part of strategic planning involving National Highways. An assessment is not required as part of individual planning applications, but has nevertheless been included here for information.

1.6 This report has been prepared taking into account all relevant local and national guidance and regulations. The professional experience of the consultants involved in the assessment is summarised in Appendix A1.

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[1] Chapman and Kite (2021) Guidance on Decision-Making Thresholds for Air Pollution, Available: JNCC Report No., JNCC, Peterborough, ISSN 0963-9091

2 Policy Context

2.1 Protection of nature conservation sites is provided by an array of different national, and international policies. This effectively provides different levels of protection to different types of sites, as outlined below.

Sites of National and Local Importance

2.2 Sites of national importance are designated as Sites of Special Scientific Interest (SSSIs). Originally notified under the National Parks and Access to the Countryside Act[2], SSSIs have been re-notified under the Wildlife and Countryside Act[3]. Improved provisions for the protection and management of SSSIs (in England and Wales) were introduced by the Countryside and Rights of Way Act[4] (the "CROW" act). If a development is "*likely to damage*" a SSSI, the CROW act requires that a relevant conservation body (in this case Natural England) is consulted.

2.3 The CROW act also provides protection to local nature conservation sites, which can be particularly important in providing 'stepping stones' or 'buffers' to SSSIs. A broad range of site designations are included under the umbrella term of 'sites of local importance'. They are largely non-statutory designations, with sites identified by the local authority, the Wildlife Trusts, or other local groups. An ancient woodland inventory is provided by Natural England to identify the locations of the main historic woodlands. It is important to note, however, that local site designations, including ancient woodlands, are frequently updated and that there is no single published database which includes all sites. It is thus necessary to apply professional judgement in determining the key locations where a proposed project might have air quality effects, noting that sites which are both highly sensitive and highly valuable would be expected to be designated as being of national or international importance.

Planning Policy

National Policies

2.4 The National Planning Policy Framework (NPPF)[5] sets out planning policy for England. It states that the purpose of the planning system is to contribute to the achievement of sustainable development, and that the planning system has three overarching objectives, one of which (Paragraph 8c) is an environmental objective:

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2 National Parks and Access to the Countryside Act (1949)

3 Wildlife and Countryside Act (1981)

4 Countryside and Rights of Way Act 2000 (2000)

5 Ministry of Housing, Communities & Local Government (2023) National Planning Policy Framework, Available: https://assets.publishing.service.gov.uk/media/65a11af7e8f5ec000f1f8c46/NPPF_December_2023.pdf

"to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy".

2.5 With respect to protecting biodiversity, the NPPF places a heavy reliance on the designation status of sites (for example if they are designated as a SSSI), explaining that planning policies and decisions should contribute to and enhance the natural environment by:

"protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan)" (Para 180).

Furthermore, *"Plans should: distinguish between the hierarchy of international, national and locally designated sites"* (Para 185).

2.6 The NPPF provides specific guidance on determining planning applications with respect to protecting habitats and biodiversity, explaining that local planning authorities should apply the following principles:

a) *"if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;*

b) *development on land within or outside a Site of Special Scientific Interest, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of Sites of Special Scientific Interest;*

c) *development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists; and*

d) *development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to improve biodiversity in and around developments should be integrated as part of their design, especially where this can secure measurable net gains for biodiversity or enhance public access to nature where this is appropriate"* (Para 180).

2.7 The NPPF is supported by Planning Practice Guidance (PPG)[6], which includes guiding principles on how planning can take account of the impacts of new development on air quality. Within the section on air quality, the PPG states that:

"Air quality considerations may … be relevant to obligations and policies relating to the conservation of nationally and internationally important habitats and species".

"Where air quality is a relevant consideration the local planning authority may need to establish:

…whether the proposed development could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity)".

2.8 The PPG sets out the information that may be required in an air quality assessment, making clear that:

"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific".

Local Policies

2.9 The Cherwell Local Plan was adopted in 2015[7]. Within this Policy ESD10: Protection and Enhancement of Biodiversity and the Natural Environment states:

"Development which would result in damage to or loss of a site of biodiversity or geological value of regional or local importance including habitats of species of principal importance for biodiversity will not be permitted unless the benefits of the development clearly outweigh the harm it would cause to the site, and the loss can be mitigated to achieve a net gain in biodiversity/geodiversity.

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."

2.10 This is also reflected in Core Policy 11 of the Cherwell Local Plan Review 2040[8], which states:

"ii Development which is likely to have a significant adverse impact on nationally important sites, namely Sites of Special Scientific Interest (SSSI) and National Nature reserves (NNRs), will not be permitted unless the benefits of the development clearly outweigh the harm it would cause to the site and the wider national network of SSSIs and NNRs and the loss can be mitigated to achieve a net gain in biodiversity/geodiversity, and

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6 Ministry of Housing, Communities & Local Government (2019) Planning Practice Guidance

7 Cherwell District Council (2015) Cherwell Local Plan 2011-2031

8 Cherwell District Council (2023) Cherwell Local Plan Review 2040

iii Development which would result in damage to or loss of a site of biodiversity or geological value of regional or local importance, in addition to irreplaceable habits such as ancient woodland, and aged or veteran trees, will not be permitted unless the benefits of the development clearly outweigh the harm it would cause to the site."

3 Critical Levels and Critical Loads

3.1 EU Directive 2008/50/EC[9] sets a limit value for annual mean concentrations of nitrogen oxides and for annual and winter mean concentrations of sulphur dioxide. The same values have been set as domestic objectives within the Air Quality (England) Regulations[10] and the Air Quality (England) (Amendment) Regulations[11]. The limit values and objectives only apply a) more than 20 km from an agglomeration (about 250,000 people), and b) more than 5 km from Part A industrial sources, motorways and built-up areas of more than 5,000 people.

3.2 Critical levels (CLes) and critical loads (CLos) are the ambient concentrations and deposition fluxes below which significant harmful effects to sensitive ecosystems are unlikely to occur. Some of the CLes are set at the same concentrations as the objectives but do not have the same spatial constraints on where they apply. Exceedances of the CLes and CLos are considered in the context of preventing harm to sites which are protected under the various designation frameworks outlined in Section 2. The CLes relevant to this assessment are set out in Table 1.

3.3 The CLos are specific to different habitat types, and those which are most relevant to this assessment are provided in Table 1. A standard CLo of 10 kgN/ha/yr for nutrient deposition is to be used for ancient woodlands, based on guidance published by the Woodland Trust[12,13].

3.4 The more stringent CLe of 1 µg/m^3 for annual mean ammonia only applies where lichens or bryophytes are present or form a key part of the ecosystem integrity; as a worst-case it has been assumed that this is the case for all assessed AWs. For the Ardley Cutting and Quarry SSSI, APIS states the ammonia critical level is either 1 µg/m^3 or 3 µg/m^3, depending on the presence of lichens and bryophytes. APIS also states that lichens or bryophytes are not relevant, therefore, the less stringent ammonia critical level of 3 µg/m^3 has been used.

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9 The European Parliament and the Council of the European Union (2008) Directive 2008/50/EC of the European Parliament and of the Council

10 HMSO (2000) The Air Quality (England) Regulations 2000 Statutory Instrument 928

11 HMSO (2002) The Air Quality (England) (Amendment) Regulations 2002, Statutory Instrument 3043

12 Woodland Trust (2019) Assessing air pollution impacts on ancient woodland – ammonia.

13 The Woodland Trust guidance predates a revision of the empirical critical loads used in England, but 10 kgN/ha/yr remains the lower-bound critical load for all types of deciduous woodland, and the use of this value remains worst-case.

Table 1: Vegetation and Ecosystem CLes [a] and CLos

Pollutant	Time Period	Ardley Cutting and Quarry SSSI	Ancient Woodlands
Nitrogen Oxides (expressed as NO_2)	Annual Mean [a,b]	30 µg/m^3	30 µg/m^3
	24-Hour Mean [a,c]	75 (200[d]) µg/m^3	75 (200[d]) µg/m^3
Ammonia	Annual Mean	3 µg/m^3 [e]	1 µg/m^3
Nutrient Deposition	Annual Mean	10 kgN/ha/yr [f]	10 kgN/ha/yr [g]
Acid Deposition	Annual Mean	4.856 keq/ha/yr	n/a

[a] The CLes are defined by the World Health Organisation[14].

[b] Away from major sources (see Paragraph 3.1), this CLe is set as an objective[15] and a limit value[16].

[c] This CLe is not an objective and thus does not have the same legal standing.

[d] The CLe is 75 µg/m^3 but Natural England and IAQM both recommend that a value of 200 µg/m^3 is usually more appropriate for current UK conditions. The current assessment considers the value of 75 µg/m^3.

[e] The more stringent CLe of 1 µg/m^3 only applies where lichens or bryophytes are present or form a key part of the ecosystem integrity, which is not the case at this designated site.

[f] Based on the designated habitat of Bromus Erectus - Brachypodium Pinnatum Lowland Calcareous Grassland.

[g] Based on the habitat being unmanaged woodlands.

3.5 There are no site-specific CLos for acid deposition at the AW sites; nutrient nitrogen is considered to be the principal issue at such sites, thus acid deposition has not been assessed.

[14] WHO (2000) Air Quality Guidelines for Europe; 2nd Edition. http://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf

[15] Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

[16] The European Parliament and the Council of the European Union (2008) The European Parliament and the Council of the European Union (2008) Directive 2008/50/EC of the European Parliament and of the Council

4 Relevant Guidance

4.1 Different organisations have issued assessment guidance and screening criteria for different types of emissions source and different site designations. This has resulted in different levels of protection being provided with respect to effects of the same pollutants on the same sites. There is no single official guidance document which fully covers the impacts assessed in this report and so it is helpful to consider the protection provided with respect to different development types.

Environment Agency

4.2 The Environment Agency has published criteria which allow impacts from developments requiring environmental permits to be rapidly screened out as insignificant[17,18]. These are applied to the impacts from developments in isolation (i.e. not in combination with other plans or projects). Exceeding these criteria does not mean that there is a Likely Significant Effect (LSE), it simply means that further consideration is required of the potential changes to air quality or deposition. No further assessment is required if the changes caused by the proposed development (termed the Process Contributions 'PC' by the Environment Agency) are all less than the relevant criteria in Table 2.

Table 2: Environment Agency Screening Criteria (% of CLe or CLo)

Site Type	Averaging Period [a]	Impacts of Ammonia Emissions from Intensive Pig and Poultry Farms	Impacts from Other Emissions
Natura 2000 Sites	LT	4% to 20% [b]	1%
	ST	- [c]	10%
SSSIs	LT	20% to 50% [b]	1%
	ST	- [c]	10%
NNRs, LNRs, LWS, and AW	LT or ST	100%	100%

[a] LT = Long Term (annual mean or 1-week mean), ST = Short-term (15-minute, 1-hour and 24-hour).

[b] The upper thresholds apply in where there are no other intensive farms which might affect the same receptors. Internally, the Environment Agency has begun requiring detailed modelling wherever the PC exceeds 4% of a CLe or CLo and the 20% criterion is not supported, but is still recommended in the Environment Agency's published guidance.

[c] There is no short-term CLes for ammonia and no short-term CLos .

4.3 The Environment Agency[17] also notes that there is no need for further consideration of changes to concentrations or deposition fluxes if:

- the annual mean concentration or flux is less than 70% of the CLe or CLo; and

[17] Environment Agency (2021) Air emissions risk assessment for your environmental permit

[18] Environment Agency (2021) Intensive farming risk assessment for your environmental permit

- the short-term Process Contribution is less than 20% of the short-term CLe minus twice the long-term background concentration.

4.4 These criteria have been widely applied to the results from detailed dispersion modelling but are principally intended by the Environment Agency to guide a decision as to whether detailed modelling is required, with changes below the criteria not requiring such modelling.

National Highways

4.5 National Highways (then Highways England) issued guidance on the assessment of air quality impacts caused by Highways England road schemes as part of its Design Manual for Roads and Bridges (DMRB). The current version of this guidance is LA 105[19]. This states that the air quality impacts of each individual project should be scoped out from any further assessment where the changes caused by the project in isolation (i.e. not in combination with other plans or projects) do not meet any of the following criteria within 200 m of a designated site:

- annual average daily traffic (AADT) >=1,000; or
- heavy duty vehicle (HDV) AADT >=200; or
- a change in speed band; or
- a change in carriageway alignment by >=5m.

4.6 As with the Environment Agency criteria, National Highways uses these values to define when a more detailed consideration of air quality impacts is required and not to define an LSE.

4.7 Where detailed air quality modelling has been carried out, guidance from National Highways is that there will be no significant effect wherever:

- the total nitrogen deposition is less than the relevant CLo; OR
- the change to nitrogen deposition caused by the proposed development (alone) is <1% of the CLo.

4.8 Changes with respect to a CLe are also considered to be not significant where one of the above criteria is met.

4.9 Where the potential for an LSE cannot be discounted using the above criteria, National Highways refers to Table 21 of Natural England Report 210[20], which is reproduced in Appendix A3 of this report. This table estimates the increase to nitrogen deposition which would reduce species richness by one species. National Highways states that the effects will be not significant (i.e. no LSE) if the increases

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[19] Highways England (2019) Design Manual for Roads and Bridges LA 105 Air Quality Revision 0

[20] Caporn et al. (2016) Assessing the effects of small increments of atmospheric nitrogen deposition (above the critical load) on semi-natural habitats of conservation importance

to nitrogen deposition caused by the project alone (i.e. not in combination with other projects or plans) are smaller than those in Appendix A3. This approach is described here in order to add context to the more robust approach which has been followed in the current assessment.

Natural England

4.10 Natural England's guidance on advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations[21] recommends the use of the DMRB criteria (see Paragraph 4.5) for changes to traffic caused by all types of plans or projects, and not just for highways schemes. In the same way, irrespective of their original derivation, Natural England[21] adopts the 1% change criterion from the Environment Agency (Table 2) as a basis for screening out the need for more detailed assessment. It explains:

"the AADT thresholds and 1% of critical load/level are considered by Natural England's air quality specialists … to be suitably precautionary, as any emissions below this level are … considered to be imperceptible". It goes on: *"There can therefore be a high degree of confidence in* [the use of these criteria] *to screen for risks of an effect".*

4.11 Natural England[21] further explains that the AADT criteria have "*been adopted here to simply help trigger when to look further where traffic projection data is the sole means of assessment* – [triggering the criteria] *does not immediately mean there will be an effect*".

4.12 A key difference between how these criteria are applied by Natural England[21] when compared with both National Highways and the Environment Agency is that Natural England suggests that they should be applied first to the change caused by each individual project and then to the changes caused by relevant plans and projects in combination with one another.

4.13 Natural England provides guidance on which plans and projects should be considered within an in-combination assessment for Natura 2000 sites. It explains that this "*is restricted to plans and projects which are 'live' at the same time as the assessment being undertaken. These can potentially include:*

- *The incomplete or non-implemented parts of plans or projects that have already commenced;*
- *Plans or projects given consent or given effect but not yet started;*
- *Plans or projects currently subject to an application for consent or proposed to be given effect;*
- *Projects that are the subject of an outstanding appeal;*

[21] Natural England (2018) Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations (NEA001), Available: http://publications.naturalengland.org.uk/publication/4720542048845824

- *Ongoing plans or projects that are the subject of regular review and renewal;*
- *Any draft plans being prepared by any public body;*
- *Any proposed plans or projects that are reasonably foreseeable and/or published for consultation prior to application."*

4.14 Natural England also explains that an exhaustive search for live plans or projects which could potentially fall within the scope of an 'in-combination' assessment is not necessary:

"it is Natural England's view that staff in a competent authority can apply their professional judgment when considering this. It might be that a pragmatic approach to identifying the most pertinent ones may be required from the competent authority. It might be reasonable to initially limit a search to those plans and projects which are of most direct relevance to the subject plan or project under HRA (i.e. the likelihood of that plan or project's effects impacting upon the same site in-combination with the proposed plan or project). This may be those which are simply the closest to the site or within a certain distance from it, or the most influential in nature."

4.15 Natural England also stresses that, at the screening stage, the competent authority must "*remember that the subject plan or project remains the focus of any in-combination assessment. Therefore, it is Natural England's view that care should be taken to avoid unnecessarily combining the insignificant effects of the subject plan or project with the effects of other plans or projects which can be considered significant in their own right… it is only the appreciable effects of those other plans and projects that are not themselves significant alone which are added into an in-combination assessment with the subject proposal.*"

IAQM

4.16 IAQM issued a guide to the assessment of air quality impacts on designated nature conservation sites in 2019, which was then amended in 2020[22]. This summarises the other guidance referred to above, but does not definitively recommend any one complete assessment approach. The limited areas where the IAQM guidance adds to, or unambiguously supports, that contained within other guidance documents are:

- on traffic screening criteria:
  - if the DMRB criteria (Paragraph 4.5) are used, they should be applied to changes in traffic caused by the development alone as well as in combination with other projects and plans;
- on the Environment Agency screening criteria:

22 Holman et al (2020) A guide to the assessment of air quality impacts on designated nature conservation sites. IAQM. Version 1.1, Available: https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf

  - the Environment Agency criteria (Paragraph 4.2) are suitable for screening the need for further assessment from all types of emissions sources where detailed air quality modelling has been carried out and not just those requiring environmental permits. The criteria should, though, "*be used in the context of an in-combination assessment*". The guidance also hints that the 100% criterion used by the Environment Agency for local site designations should not be used and that the 1% criterion should be used instead. The 100% criterion is not used in this assessment.
  - the 1% criterion should not be used rigidly, or with more precision than the modelling can justify (for example emphasising the difference between 0.9% and 1.1%);
  - that exceeding the 1% criterion is simply an indication that further investigation is needed and does not necessarily indicate an LSE;
- on defining in combination projects:
  - projects and plans to be considered include those that may have been approved but are, as yet, incomplete, the subject of an outstanding appeal, or ongoing review;
- on receptor siting:
  - it is recommended that the predictions are not made closer than 2 m from the edge of the road; and
- on designation types:
  - the IAQM document covers all site designation types and thus suggests that the same overall assessment method should be applied regardless of the designation.

CIEEM

4.17 The Chartered Institute of Ecology and Environmental Management (CIEEM) has published advice on the Ecological Assessment of Air Quality Impacts[23], which is intended for use by both ecologists and air quality specialists. This provides six steps to exploring potential effects:

1) identifying the baseline ecological features and air quality;

2) assessing confounding factors, background pollution trends, the relative importance of each sector, and the sensitivity of the receptor;

3) determining if the CLes or CLos are exceeded;

[23] CIEEM (2021) Advice on Ecological Assessment of Air Quality Impacts. Chartered Institute of Ecology and Environmental Management. Winchester, UK.

4) applying the CLes and CLos with expert judgement;

5) considering the project duration and seasonal effects; and

6) considering the relative importance of ambient concentrations versus deposition fluxes.

JNCC

4.18 The Joint Nature Conservation Committee (JNCC) has published Decision-Making Thresholds (DMTs) and Site-Relevant Thresholds (SRTs) for air pollution[24], which were developed for JNCC by AQC[25]. The thresholds define changes caused by individual projects (i.e. not in combination with other projects and plans) which can be discounted as not significant without additional work. Where the appropriate thresholds are exceeded, then further assessment will be needed. The SRTs are for emissions from industry and agriculture and take account of the overall development pressure in an area. The DMT for road traffic takes account of the scale of each development within the context of overall traffic growth but is ultimately expressed as a proportion of the baseline traffic flow. The thresholds are set out in Table 3, with additional guidance on defining development density given in Table 4.

4.19 The JNCC guidance makes clear that an air quality assessment is only necessary if the effects of a project have not already been assessed. This is particularly relevant with respect to development sites which are allocated in strategic development plans which have themselves been considered through an HRA. For example, there is no need to consider impacts on a Natura 2000 site from a development site which is allocated within a Local Plan if those impacts have already been considered when developing that Plan. The guidance also makes clear that the study area for the assessment of impacts from road traffic should not extend more than 10 km from a plan boundary, and that impacts alongside the Strategic Road Network (SRN)[26] only require consideration for road infrastructure schemes.

4.20 Where the DMT for road traffic in Table 3 is exceeded, a "road-relevant" approach may be taken based on the distance between the affected road and the nearest boundary of a designated site. The JNCC guidance recommends that professional judgement is used, taking account of the predicted reduction with distance away from the road, and a view as to whether other plans and projects are likely to cause a combined exceedance of the 1% criterion described in paragraph 4.10[24].

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24 Chapman and Kite (2021) Guidance on Decision-Making Thresholds for Air Pollution, Available: JNCC Report No., JNCC, Peterborough, ISSN 0963-9091

25 AQC (2021) Decision-Making Thresholds for Air Pollution Technical Report, Available: JNCC Report No., JNCC, Peterborough, ISSN 0963-9091

26 Our roads - Highways England, Official list of trunk roads (transport.gov.scot), Welsh Government strategic road network map | Traffic Wales, Link Corridors and Trunk Roads brochure | Department for Infrastructure (infrastructure-ni.gov.uk).

4.21 There are specific exceptions where the JNCC criteria should not be used. These are summarised as:

- 'clean' or 'pristine' sites (i.e. those with very low existing levels of air pollution) where there is reason to doubt the improving background trend;
- sites with sensitive epiphytic or epilithic components that are, or form an important part of, a qualifying feature of the site and which are at or just below their CLo or CLe;
- sites with a highly localised and sensitive qualifying feature(s) that may coincide spatially with maxima of nitrogen deposition / ammonia concentrations from clusters of emission sources; and
- situations where it may be inappropriate to rely on DMTs because the assumptions which underpin them do not reflect the particular circumstances which apply[24].

4.22 The development of these criteria included widespread consultation with ecology specialists and UK nature conservation agencies, as well as extensive legal review. The criteria are thus considered appropriate for use in this assessment.

Table 3: Site-Relevant and Decision-Making Thresholds for Application to Individual Plans and Projects[25]

Development Density	Very Low	Low	Medium	High
Site-Relevant Thresholds for On-site Emissions				
Annual Mean NH_3 (lichens/bryophytes) (μg/m^3)	0.0075	0.0034	0.0020	0.00079
Annual Mean NH_3 (higher plants) (μg/m^3)	0.022	0.010	0.0060	0.0024
Annual Mean NOx (μg/m^3)	0.087	0.046	0.030	0.014
Annual Mean N dep (woodland (kg-N/ha/yr)	0.13	0.057	0.034	0.013
Annual Mean N dep (grassland) (kg-N/ha/yr)	0.088	0.040	0.024	0.0093
Decision-Making Threshold for Road Traffic				
Increase in Traffic Flow	0.15% of AADT in the year that the assessment is carried out			

Table 4: Guidance on Defining Development Density for On-site Emissions[25]

Development Density	Very Low	Low	Medium	High
Description [a]	Remote area which sees very little development	Area which sees small amounts of development	Typical agriculture / industrial area	Area experiencing intensive growth (e.g. Powys or Immingham docks)
Example Number of additional new projects below the thresholds within 5 km of proposed development over 13 yrs [a]	1	5	10	30

[a] These might be either industrial or agricultural projects, or both.

5 Assessment Approach

5.1 Consideration has been given to potential effects on the Ardley Cutting and Quarry SSSI, the Stoke Little Wood AW and the Twelveacre Copse AW, which are 1.8 km to the southwest and 1.5 km and 2.4 km southeast of the Development, respectively. These areas are within 10 km of the Development and within 200 m of roads on which development traffic flows have been predicted by the project Transport Consultants (DTA) to increase above the Decision-Making Threshold[27]. All other identified designated habitats have either been screened out of the assessment based on the above criteria or have been ruled out due to confirmation from the project ecologist that they contain no air pollution sensitive habitat features.

Receptors

5.2 Impacts have been predicted at selected receptors within several transects, which represent the locations within the designated sites perpendicular to the road, distances of 2 m, 3 m, 5 m, 9 m, 17 m, 33 m, 65 m, 129 m and 200 m from the road. Following guidance from the IAQM (Paragraph 4.16), impacts have not been predicted within 2 m of roads[28]. These transects are shown in Figure 2 and their origins are described in Table 5.

5.3 It is conventional to calculate deposition from concentrations predicted at a height of 1.5 m above ground. This is because the deposition velocities used are ultimately derived from a range of studies centred on this height and because this is the height used in the national deposition maps which underpin this, and most other, assessments (see Paragraph 5.4, below). However, in practice it makes very little difference whether a height of 1.5 m or 0 m is used for receptors in the dispersion model; the results are largely unchanged. In the current assessment, all receptors and transects have been modelled at a height of 0 m to be consistent with modelling undertaken for the nearby Tritax Scheme.

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27 Contained within the JNCC published Guidance on Decision-Making Thresholds for Air Pollution document.

28 For Twelveacre Copse and Stoke Little Wood, the designated site is located more than 2 m from the road edge. In both cases the '2 m' receptor has been located at the closest point of the designated site to the modelled road.

Table 5: Description of Roadside[a] Receptor Locations for Designated Conservation Sites

Receptor		Designated Site	X coordinate	Y coordinate
T1	Northwest of B430	Ardley Cutting and Quarry (SSS)	454091.6	226736.6
T2	Southeast of B430		454098.0	226730.1
T3	Northwest of M40		454953.8	225914.3
T4	Southeast of M40		454987.8	225882.0
T5	Northeast of B4100	Stoke Little Wood (AW)	456318.9	227487.0
T6	Southwest of B4100	Twelve Acre Copse (AW)	456798.2	226707.7

[a] Only the location of the receptor at the start of each transect is given. Each transect extends 200 m from the affected road or to the furthest point from the road within the ecological site.

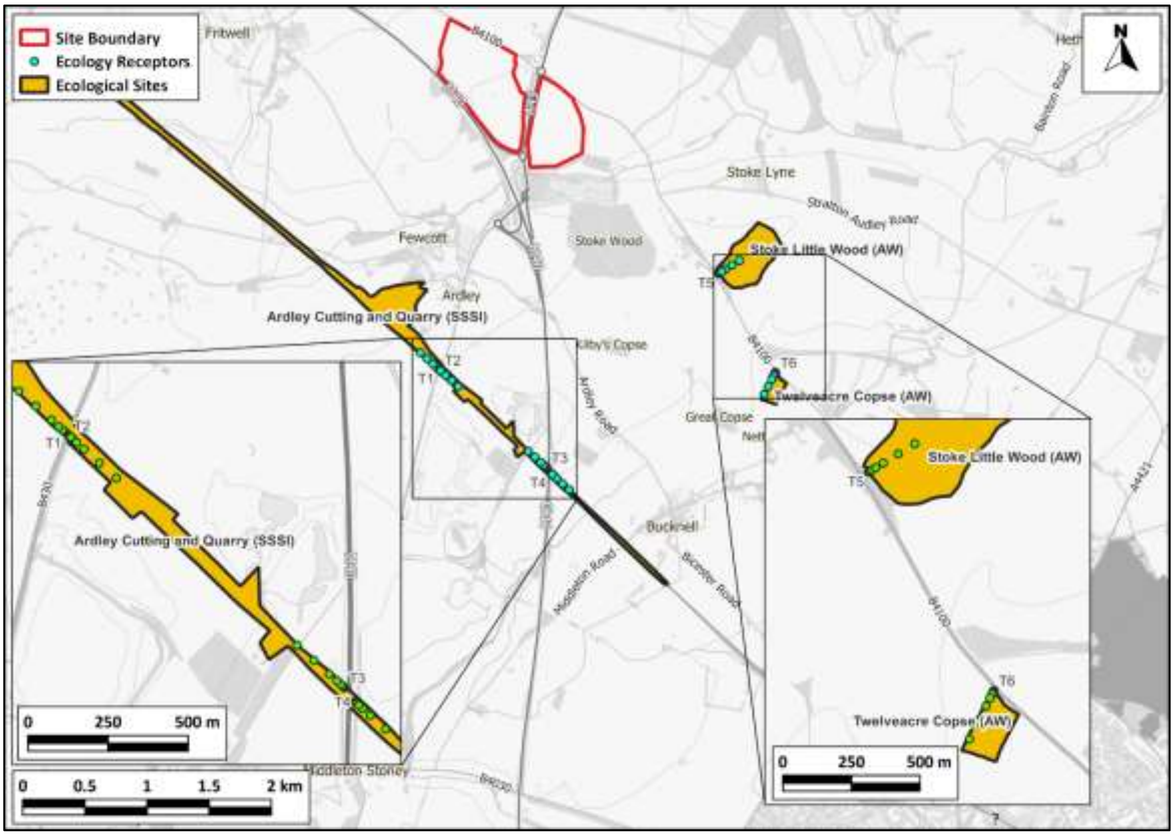

Figure 2: Transect and Receptor Locations

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Background Concentrations and Fluxes

5.4 Background concentrations of ammonia, and nitrogen and acid deposition fluxes, have been taken from the Air Pollution Information System (APIS) website[29]. These concentrations represent 1 km x 1 km averages. APIS currently presents 3-year mean values centred on the calendar year of 2020. Nitrogen and acid deposition fluxes are expected to reduce in the near future and JNCC has provided an approach to predict the rate of this reduction. However, to ensure an approach consistent with the modelling undertaken for the Tritax Scheme, backgrounds concentrations for ammonia and fluxes for nitrogen deposition have been based on 2020 values; these backgrounds have been used within the 2026 scenarios, and assume no change in concentrations in future years.

5.5 Again, to ensure an approach consistent with the modelling undertaken for the Tritax Scheme, NOx background concentrations have been taken from Defra's 2018 1 x 1 km background maps[30], which contain projections forward to 2026.

Assessment Scenarios

5.6 NOx and ammonia concentrations, and nitrogen and acid deposition fluxes, have been predicted for the following scenarios:

A) 2026 future base year without the Development;

B) 2026 future base year, with the Development; and

C) 2026 future base year, with the Development and five nearby cumulative schemes (including the nearby Tritax scheme).

5.7 The three 2026 scenarios have been compared to derive the impacts of the proposed Development alone and in-combination with other projects and plans:

- the difference between scenarios A and B represents the change caused by the proposed Development which, for consistency with other regimes, is termed the Process Contribution ('PC');
- the difference between scenarios A and C represents the In-Combination Change ('ICC').

Modelling Methodology

5.8 Concentrations have been predicted using the ADMS-Roads dispersion model, with emissions of NOx derived using Defra's Emission Factor Toolkit (EFT) (v11.0)[30], and emissions of ammonia

29 APIS (2023) Available: http://www.apis.ac.uk/

30 Defra (2024) Local Air Quality Management (LAQM) Support Website [online]. Available: https://laqm.defra.gov.uk/

derived using AQC's Calculator for Road Emissions of Ammonia (CREAM) (v1A) model[31]. Traffic flows have been provided by DTA Transport Planning Consultants. The modelled NOx results have been verified using the calibration factor calculated within the human health assessment. Details of the model inputs and the model verification are provided in Appendix A4. Deposition fluxes have been calculated from the predicted concentrations of nitrogen dioxide and ammonia. Details on the method for calculating the deposition are provided in Appendix A4.

Uncertainty

5.9 The uncertainties with the traffic modelling are outlined within the Chapter 9: Air Quality, however there are additional uncertainties in relation to modelling undertaken to consider ecological impacts, outlined here.

5.10 Road-NOx emissions have been verified as outlined within Appendix 9.4 of the Chapter 9: Air Quality. There are however no suitable roadside ammonia monitoring sites in the area which can be used to verify the modelled ammonia concentrations. Development of the CREAM model[31], which has been used in this assessment, included verifying the emissions model, combined with the ADMS-Roads dispersion model, against measurements from the most dense roadside ammonia monitoring network in Europe. The modelling has thus been verified as far as is possible.

5.11 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. Historically, less attention has been given to calculating emissions of ammonia from road traffic than to calculating emissions of NOx. Future forecasts of traffic-related ammonia are thus quite uncertain. However, the CREAM model takes a deliberately conservative approach regarding these future uncertainties and can thus be considered robust.

[31] AQC (2020) Calculator for Road Emissions of Ammonia (CREAM) [online]. Available: https://www.aqconsultants.co.uk/resources/calculator-for-road-emissions-of-ammonia

6 Background Information and Context

Relevant Designated Conservation Sites

6.1 The designated sites which are relevant to this assessment are the Ardley Cutting and Quarry SSSI, the Stoke Little Wood AW and the Twelveacre Copse AW, as shown in Figure 1.

Background Concentrations and Fluxes

6.2 Estimated background concentrations of NOx and ammonia are set out in Table 6. The background concentrations of NOx are predicted to be well below the CLe at both sites. Predicted background concentrations of ammonia are also below the applicable CLe of 3 µg/m^3 for the Ardley Cutting and Quarry SSSI, but exceed the applicable CLe of 1 µg/m^3 at the Stoke Little Wood and Twelveacre Copse AWs.

Table 6: Estimated Annual Mean Background Pollutant Concentrations (µg/m^3)

Pollutant	Site	CLe
Ardley Cutting and Quarry SSSI		
NOx	9.8 – 15.3	**30**
NH_3	1.8 - 2	**3**
Stoke Little Wood and Twelveacre Copse AWs		
NOx	8.9	**30**
NH_3	1.8 – 1.9	**1**

6.3 Background nitrogen deposition fluxes are presented in Table 7. Predicted background nutrient nitrogen deposition rates exceeded the CLo at both sites. Predicted acid deposition rates are below the CLo for the Ardley Cutting and Quarry SSSI.

Table 7: Estimated Annual Mean Background Deposition Fluxes (µg/m^3)

Deposition	Site	CLo
Ardley Cutting and Quarry SSSI		
Nutrient Deposition	16.9 – 17.2	**10**
Acid Deposition	1.2	**4.856**
Stoke Little Wood and Twelveacre Copse AWs		
Nutrient Deposition	29.4 – 29.5	**10**

Modelled Baseline Conditions

6.4 Modelled baseline concentrations and fluxes at the location of maximum concentration or flux within each transect are shown in Table 8. The modelled baseline is a combination of the background concentration or flux and the contribution from baseline traffic from adjacent roads.

6.5 The annual mean NOx CLe is exceeded in the sections of Ardley Cutting and Quarry SSSI adjacent to the M40, whilst the 24-hour mean NOx CLe is only exceeded to the southeast of the M40. The ammonia CLe is exceeded at both ancient woodland sites, as well as the sections of the Ardley Cutting and Quarry SSSI adjacent to the M40. The nitrogen deposition CLo is exceeded at all sites, whilst the acid deposition CLo is not exceeded at all.

Table 8: Air Quality Baseline Conditions at Worst-case Locations [a]

Pollutant/Averaging Period	Annual Mean NH_3 ($\mu g/m^3$)	Annual Mean NOx ($\mu g/m^3$)	24-Hour Mean NOx ($\mu g/m^3$)	Nitrogen Deposition (kg-N/ha/yr)	Acid Deposition (kg-N/ha/yr)
Transect 1 – Ardley Cutting and Quarry SSSI	2.4	24.1	32.4	**21.0**	1.5
Transect 2 – Ardley Cutting and Quarry SSSI	2.6	26.8	33.7	**21.9**	1.6
Transect 3 – Ardley Cutting and Quarry SSSI	**5.9**	**92.6**	66.5	**42.5**	3.0
Transect 4 – Ardley Cutting and Quarry SSSI	**8.6**	**141.3**	**89.2**	**58.6**	4.2
Transect 5 – Stoke Little Wood AW	**2.1**	16.9	21.6	**33.4**	N/A
Transect 6 – Twelveacre Copse AW	**2.2**	15.8	21.1	**33.2**	N/A
CLe/CLo	3 or 1 [b]	30	75	10	4.856 [c]

[a] Exceedances of the CLe/CLo are shown in bold.

[b] An ammonia critical level of 3 $\mu g/m^3$ has been used for the Ardley Cutting and Quarry SSSI, whereas for both AWs, the more stringent critical level of 1 $\mu g/m^3$ has been used (see Paragraph 3.4).

[c] There are no site-specific CLos for acid deposition at the AW sites (see Paragraph 3.5).

7 Impact Assessment

In-isolation

7.1 Results are provided in As shown in Table 6, there are a number of exceedances of the CLes/CLos due to the baseline. The development in-isolation does not directly lead to any new exceedances of the CLe/Clo within any designated site.

7.2 Table 9 for the in-isolation scenario at the location of maximum concentration or flux within each designated site.

7.3 Whilst the in-isolation impact of the Development leads to changes in annual mean NOx that are greater than 1% of the CLe at all designated sites, the CLe is not exceeded at either AW or the section of Ardley Cutting and Quarry SSSI adjacent to the B430. However, the CLe is exceeded in the sections of Ardley Cutting and Quarry adjacent to the M40, where there are higher levels of baseline traffic. The 24-hour mean NOx CLe is not exceeded at any designated site and the impacts are all <10% of the CLe.

7.4 For nitrogen deposition, the change in concentration is >1% and the CLo is exceeded at all sites within the worst-case locations. As shown in Table 7, the background nitrogen deposition flux is exceeded within all designated sites. The in-isolation impacts on acid deposition are <1% at the Ardley Cutting and Quarry SSSI.

7.5 The in-isolation changes to annual mean ammonia concentrations exceed 1% of the Cle in small sections of the Ardley Cutting and Quarry SSSI adjacent to the B430; however, the CLe is not exceeded at these locations. The in-isolation changes exceed 1% of the Cle, and the CLe is exceeded within the section of the Ardley Cutting and Quarry SSSI adjacent to the M40.

7.6 Within both the Stoke Little Wood and the Twelceacre Copse AWs, the in-isolation change is >1% of the CLe and the CLe of 1 $\mu g/m^3$ is exceeded. It should be noted that a worst-case CLe of 1 $\mu g/m^3$ for ammonia has been used for both AWs, which assumes that lichens and bryophytes are important to these sites.

7.7 As shown in Table 6, there are a number of exceedances of the CLes/CLos due to the baseline. The development in-isolation does not directly lead to any new exceedances of the CLe/Clo within any designated site.

Table 9: Air Quality Conditions at Worst-case Locations (In-Isolation) [a]

Pollutant/Averaging Period	Maximum PC	% of CLe/CLo	Distance where PC below 1%/10% (m) [b]	Maximum PEC	% of CLe/CLo	Distance where PEC below 100% (m)	CLe/ CLo
At Location of Maximum Concentration or Flux Transect 1 (Ardley Cutting and Quarry SSSI)							
Annual Mean NH_3 (µg/m³)	0.02	0.8	N/A	2.4	79.8	N/A	**3**
Annual Mean NOx (µg/m³)	0.48	1.6	17	24.6	82.0	N/A	**30**
24-Hr Mean NOx (µg/m³) [c]	0.22	0.3	N/A	-	-	-	**75**
Nitrogen Deposition (kg-N/ha/yr)	0.16	1.6	9	21.1	211.2	> 200	**10**
Acid Deposition (keq/ha/yr)	0.01	0.2	N/A	1.5	31.1	N/A	**4.856**
At Location of Maximum Concentration or Flux in Transect 2 (Ardley Cutting and Quarry SSSI)							
Annual Mean NH_3 (µg/m³)	0.03	1.1	3	2.7	88.9	N/A	**3**
Annual Mean NOx (µg/m³)	0.61	2.0	17	27.4	91.4	N/A	**30**
24-Hr Mean NOx (µg/m³) [c]	0.28	0.4	N/A	-	-	-	**75**
Nitrogen Deposition (kg-N/ha/yr)	0.21	2.1	17	22.1	221.3	> 200	**10**
Acid Deposition (keq/ha/yr)	0.01	0.3	N/A	1.6	32.5	N/A	**4.856**
At Location of Maximum Concentration or Flux in Transect 3 (Ardley Cutting and Quarry SSSI)							
Annual Mean NH_3 (µg/m³)	0.04	1.5	17	6.0	199.6	65	**3**
Annual Mean NOx (µg/m³)	0.63	2.1	33	93.3	310.9	129	**30**
24-Hr Mean NOx (µg/m³) [c]	0.29	0.4	N/A	-	-	-	**75**
Nitrogen Deposition (kg-N/ha/yr)	0.26	2.6	33	42.8	427.7	> 200	**10**
Acid Deposition (keq/ha/yr)	0.02	0.4	N/A	3.1	62.9	N/A	**4.856**
At Location of Maximum Concentration or Flux in Transect 4 (Ardley Cutting and Quarry SSSI)							
Annual Mean NH_3 (µg/m³)	0.07	2.4	33	8.6	287.6	**129**	**3**
Annual Mean NOx (µg/m³)	0.99	3.3	129	142.3	474.3	200	**30**
24-Hr Mean NOx (µg/m³) [c]	0.46	0.6	N/A	-	-	-	**75**
Nitrogen Deposition (kg-N/ha/yr)	0.42	4.2	129	59.0	590.0	> 200	**10**
Acid Deposition (keq/ha/yr)	0.03	0.6	N/A	4.2	86.8	N/A	**4.856**
At Location of Maximum Concentration or Flux in Transect 5 (Stoke Little Wood AW)							
Annual Mean NH_3 (µg/m³)	0.03	3.0	65	2.2	217.6	> 200	**1**
Annual Mean NOx (µg/m³)	0.59	2.0	65	17.5	58.2	N/A	**30**
24-Hr Mean NOx (µg/m³) [c]	0.27	0.4	N/A	-	-	-	**75**
Nitrogen Deposition (kg-N/ha/yr)	0.32	3.2	129	33.8	337.7	> 200	**10**

At Location of Maximum Concentration or Flux in Transect 6 (Twelveacre Copse AW)							
Annual Mean NH_3 (µg/m^3)	0.03	3.1	65	2.3	227.7	> 200	**1**
Annual Mean NOx (µg/m^3)	0.53	1.8	33	16.3	54.3	N/A	**30**
24-Hr Mean NOx (µg/m^3) [c]	0.25	0.3	N/A	-	-	-	**75**
Nitrogen Deposition (kg-N/ha/yr)	0.32	3.2	65	33.5	335.0	> 200	**10**

[a] Exceedances of the screening criteria are shown in red. N/A denotes no exceedance. – denotes no PC exceedance of screening criteria, so no PEC has been calculated.

[b] 1% is the screening criteria for all long term standards; whereas, 10% is a commonly applied screening thresholds for 24-hour standards.

[c] The 10 % criteria for 24-Hour Mean NOx is not exceeded at any location. It is therefore not required for the PEC to be calculated.

In-combination

7.8 Results are provided in Table 10 for the in-combination scenario at the location of maximum concentration or flux within each designated site.

7.9 Whilst the in-combination impacts of the developments lead to changes in annual mean NOx that are greater than 1% of the CLe at all designated sites, the CLe is not exceeded at either AW or the northern section of the Ardley Cutting and Quarry SSSI adjacent to the B430. However, the CLe is exceeded in sections of the Ardley Cutting and Quarry SSSI adjacent to the M40, where there are higher levels of baseline traffic. The 24-hour mean NOx CLe is not exceeded at any designated site, and the impacts are all <10% of the CLe.

7.10 For nitrogen deposition, the in-combination change in concentration is >1% and the CLo is exceeded at all sites within the worst-case locations. As shown in Table 7, the background nitrogen deposition flux is exceeded within all designated sites. The in-combination impacts on acid deposition are >1% at the Ardley Cutting and Quarry SSSI, with the exception of the section north of the B430.

7.11 The in-combination change to annual mean ammonia concentrations exceeds 1% of the CLe at all sites. The CLe is exceeded at all locations, with the exception of the sections of the Ardley Cutting and Quarry SSSI adjacent to the B430.

7.12 As shown in Table 6, there are a number of exceedances of the CLes/CLos due to the baseline. The in-combination impacts only lead to one new exceedance of a CLe/CLo, the annual mean NOx CLe within Transect 2 (the Ardley Cutting and Quarry SSSI next to the M40). It should be noted that this exceedance only extends to 5 m of the road edge, where the CLe is predicted to no longer be exceeded.

Table 10: Air Quality Conditions at Worst-case Locations (In-Combination) [a]

Pollutant/Averaging Period	Maximum PC	% of CLe/CLo	Distance where PC below 1%/10% (m) [b]	Maximum PEC	% of CLe/CLo	Distance where PEC below 100% (m)	CLe/ CLo
At Location of Maximum Concentration or Flux Transect 1 (Ardley Cutting and Quarry SSSI)							
Annual Mean NH_3 (µg/m^3)	0.26	8.8	65	2.6	87.8	N/A	**3**
Annual Mean NOx (µg/m^3)	4.48	14.9	200	28.6	95.4	N/A	**30**
24-Hr Mean NOx (µg/m^3) [c]	2.08	2.8	N/A	-	-	-	**75**
Nitrogen Deposition (kg-N/ha/yr)	1.71	17.1	129	22.7	226.6	> 200	**10**
Acid Deposition (keq/ha/yr)	0.12	2.5	17	1.6	33.3	N/A	**4.856**
At Location of Maximum Concentration or Flux in Transect 2 (Ardley Cutting and Quarry SSSI)							
Annual Mean NH_3 (µg/m^3)	0.34	11.4	129	3.0	99.2	N/A	**3**
Annual Mean NOx (µg/m^3)	5.71	19.0	200	32.5	108.4	5	**30**
24-Hr Mean NOx (µg/m^3) [c]	2.66	3.5	N/A	-	-	-	**75**
Nitrogen Deposition (kg-N/ha/yr)	2.19	21.9	200	24.1	241.1	> 200	**10**
Acid Deposition (keq/ha/yr)	0.16	3.2	333	1.7	35.5	N/A	**4.856**
At Location of Maximum Concentration or Flux in Transect 3 (Ardley Cutting and Quarry SSSI)							
Annual Mean NH_3 (µg/m^3)	0.10	3.4	65	6.0	201.5	65	**3**
Annual Mean NOx (µg/m^3)	1.54	5.1	129	94.2	314.0	129	**30**
24-Hr Mean NOx (µg/m^3) [c]	0.72	1.0	N/A	-	-	-	**75**
Nitrogen Deposition (kg-N/ha/yr)	0.61	6.1	129	43.1	431.2	> 200	**10**
Acid Deposition (keq/ha/yr)	0.04	0.9	N/A	3.1	63.4	N/A	**4.856**
At Location of Maximum Concentration or Flux in Transect 4 (Ardley Cutting and Quarry SSSI)							
Annual Mean NH_3 (µg/m^3)	0.16	5.5	129	8.7	290.7	129	**3**
Annual Mean NOx (µg/m^3)	2.43	8.1	200	143.7	479.1	200	**30**
24-Hr Mean NOx (µg/m^3) [c]	1.13	1.5	N/A	-	-	-	**75**
Nitrogen Deposition (keq/ha/yr)	0.97	9.7	200	59.6	595.5	> 200	**10**
Acid Deposition (keq/ha/yr)	0.07	1.4	17	4.3	87.6	N/A	**4.856**
At Location of Maximum Concentration or Flux in Transect 5 (Stoke Little Wood AW)							
Annual Mean NH_3 (µg/m^3)	0.08	7.9	200	2.2	222.5	> 200	**1**
Annual Mean NOx (µg/m^3)	1.57	5.2	> 200	18.5	61.5	N/A	**30**
24-Hr Mean NOx (µg/m^3) [c]	0.73	1.0	N/A	-	-	-	**75**
Nitrogen Deposition (kg-N/ha/yr)	0.86	8.6	> 200	34.3	343.0	> 200	**10**

At Location of Maximum Concentration or Flux in Transect 6 (Twelveacre Copse AW)							
Annual Mean NH_3 (µg/m^3)	0.08	8.1	129	2.3	232.7	> 200	**1**
Annual Mean NOx (µg/m^3)	1.42	4.7	129	17.2	57.2	N/A	**30**
24-Hr Mean NOx (µg/m^3) [c]	0.66	0.9	N/A	-	-	-	**75**
Nitrogen Deposition (kg-N/ha/yr)	0.85	8.5	200	34.0	340.2	> 200	**10**

[a] Exceedances of the screening criteria are shown in red. N/A denotes no exceedance. – denotes no PC exceedance of screening criteria, so no PEC has been calculated.

[b] 1% is the screening criteria for all long term standards; whereas, 10% is a commonly applied screening thresholds for 24-hour standards.

[c] The 10 % criteria for 24-Hour Mean NOx is not exceeded at any location. It is therefore not required for the PEC to be calculated.

8 Conclusions

8.1 An assessment has been provided for air quality impacts on pollutant concentrations within designated ecological sites associated with operation of the Development. The emissions which have been considered are emissions from road traffic generated by the completed and occupied Development. The increase to traffic associated with the Development will be greater than the Decision-Making Threshold for traffic defined by JNCC, meaning that a quantitative assessment is required.

8.2 The Development will increase concentrations of NOx and ammonia, and nitrogen deposition fluxes within the Ardley Cutting and Quarry SSSI, Stoke Little Wood AW and Twelveacre Copse AW. With the exception of 24-hour NOx concentrations, industry screening thresholds for all Cle and CLo are exceeded, either in-isolation or in-combination. Distances where the impacts are reduced to below the screening thresholds are typically below 100 m for in-isolation impacts and 200 m for in-combination impacts.

8.3 It should be noted that the development in-isolation does not lead to any exceedances of a Cle/CLo at any site where the baseline concentration/flux is not already exceeding. Similarly, the development in-combination with cumulative schemes only leads to a new exceedance within Transect 2 (the Ardley Cutting and Quarry SSSI next to the M40); however, in this case, the predicted exceedance is limited to within 5 m of the road edge.

8.4 There are not predicted to be any exceedances as a result of in-isolation or in-combination impacts of the:

- annual mean NOx CLe at either AW;
- the 24-hour NOx CLe at any ecological site;
- the ammonia CLe at the Ardley Cutting and Quarry SSSI adjacent to the B430; and
- the acid deposition CLo at the Ardley Cutting and Quarry SSSI.

8.5 While an impact assessment on the section of Ardley Cutting and Quarry SSSI alongside the M40 has been undertaken for completeness, JNCC guidance is that "*the effects of an individual development proposal on traffic related emissions on the existing road network, strategic 'trunk roads' should be excluded from the scope of the assessment*"[1]. It is considered the effect of traffic emissions on the Ardley Cutting and Quarry SSSI is therefore the responsibility of National Highways, and an assessment is not required as part of the planning application.

8.6 When excluding the Ardley Cutting and Quarry SSSI beside the M40, the ammonia Cle and nutrient nitrogen CLo will be exceeded at distances greater than 200 m from both AWs, both in-isolation and in-combination. This is due to the background levels exceeding the relevant CLe and CLo. Industry screening thresholds will also be exceeded at both AWs. This will occur at different distances, dependant on whether in-isolation or in-combination impacts are considered.

8.7 This assessment includes a number of worst-case elements, such as:

- The effect of the M40 on concentrations, and consequently deposition fluxes, is thought to have been significantly over-estimated (see Paragraph 9.7.19 of ES Chapter 9: Air Quality);
- the deposition of ammonia is not significantly inhibited[32] where ammonia concentrations are high. The deposition velocity for ammonia used in this assessment was developed by the AQTAG to be precautionary in most settings. Thus, close to emissions sources it is likely to have caused the deposition of ammonia to have been over-predicted.
- The ammonia emissions model (CREAM) is deliberately conservative;
- A conservative deposition velocity for ammonia has been used, meaning that all roadside deposition fluxes are likely to be overpredicted; and
- No improvement in background nitrogen deposition fluxes in the future has been assumed, contrary to current and emerging evidence.

8.8 The significance of these predicted changes is considered in ES Chapter 8: Ecology.

32 Cape et al (2008) Concentration-dependent deposition velocities for ammonia: moving from lab to field.

9 Glossary

AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
APIS	Air Pollution Information System
AQAL	Air Quality Assessment Level
AQC	Air Quality Consultants
AQMA	Air Quality Management Area
AW	Ancient Woodland
CLe	Critical Level - **"***concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge*"[29]
CLo	Critical Load – "*a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge*"[29]
CROW	Countryside and Rights of Way Act
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emission Factor Toolkit
EU	European Union
EUNIS	European Nature Information System
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HMSO	Her Majesty's Stationery Office
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LSE	Likely Significant Effect. An effect is 'likely' if it cannot be excluded on the basis of objective information. An effect is 'significant' if it undermines the conservation objectives.
$\mu g/m^3$	Microgrammes per cubic metre

NE	Natural England
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
OLEV	Office for Low Emission Vehicles
PC	Process Contribution
PEC	Predicted Environmental Concentration
PPG	Planning Practice Guidance
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
WHO	World Health Organisation

10 Appendices

A1 Professional Experience

Dr Ben Marner, BSc (Hons) PhD CSci MIEnvSc MIAQM

Dr Marner is the Director of Air Quality Modelling and Assessment at AQC and has over 20 years' relevant experience. He has been responsible for air quality and greenhouse gas assessments of road schemes, rail schemes, airports, power stations, waste incinerators, commercial developments and residential developments in the UK and abroad. He has acted as expert witness at public inquiries, where he has presented evidence on health-related air quality impacts, the impacts of air quality on sensitive ecosystems, and greenhouse gas impacts. He has developed a range of widely-used air quality models and contributed to the development of best practice. Dr Marner has provided support and advice to foreign governments, Highways England, Transport Scotland, Transport for London, Greater London Authority, the Joint Nature Conservation Committee, the Environment Agency, and numerous local authorities. He is a Member of the Institute of Air Quality Management and a Chartered Scientist. He currently advises the UK Government on air quality as part of its Air Quality Expert Group (AQEG), where his specific area of expertise relates to air quality assessment in the development control process.

Adam Dawson, BSc (Hons) MSc MIEnvSc MIAQM

Mr Dawson is a Principal Consultant with AQC with over ten years' experience in the field of air quality assessment. He undertakes air quality and odour assessments for AQC, covering residential and commercial developments, industrial installations, energy centres and waste facilities. He has experience using a range of dispersion models including ADMS-Roads, ADMS-5 and Breeze AERMOD to complete quantitative modelling assessments, for both planning and permitting purposes. He previously spent over two years as part of the Environment Agency's permitting team, so has extensive experience of the permitting process and industrial emissions. He is a Member of the Institute of Air Quality Management and a Member of the Institution of Environmental Sciences.

Isabel Stanley, MSci (Hons)

Miss Stanley is a Consultant with AQC, having joined the company in October 2019. Prior to joining AQC she completed an MSci degree in Geology at the University of Bristol, where her studies included modules focusing on GIS, dispersion modelling and environmental geochemistry. She has undertaken numerous air quality assessments, including road traffic and plant emissions modelling, as well as indoor air quality plans and construction dust risk assessments.

A2 Relevant Case Law

A2.1 Interpretation of the Habitats Regulations with respect to air quality impacts and effects has been shaped by judgements and opinions of European and UK courts. Published findings of the Planning Inspectorate for England and Wales, and the advice given to this Inspectorate by Natural England, has also proven seminal in defining how air quality impacts on Natura 2000 sites should be assessed. A brief summary of some key cases, in chronological order, is given below.

2004 - Waddenzee[33]

A2.2 This case in the Court of Justice of the European Union (CJEU) explained the extent to which the precautionary principal must be followed in HRA. In particular, the judgement (para 61) notes: *"the competent national authorities …. are to authorise such an activity only if they have made certain that it will not adversely affect the integrity of that site. That is the case where no reasonable scientific doubt remains as to the absence of such effects".*

2009 - Boggis[34]

A2.3 This judgement explained that a breach of Article 6.3 does not occur solely because of a hypothetical risk of harm to a designated site. There must be credible evidence that the risk is real for this to require consideration (para 37).

2011 Sweetman[35]

A2.4 This judgement from the CJEU also emphasised the need for the precautionary principal. In particularly, it highlighted that the word "Likely" in LSE is unique to the English language interpretation of the Habitats Directive and should not be seen as synonymous with 'probable'. The judgement explained that an AA "*cannot have lacunae and must contain complete, precise and definitive findings and conclusions capable of removing all reasonable scientific doubt as to the effects of the works proposed on the protected site concerned".*

2013 – Lough Corrib[36]

A2.5 This case in the CJEU explained that the entirety of each Natura 2000 site is protected by the Habitats Directive: if a "*plan or project will lead to the lasting and irreparable loss of the whole or part of a priority natural habitat type whose conservation was the objective that justified the designation*

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33 Case C-127/02. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:62002CJ0127:EN:PDF

34 [2009] EWCA Civ 1061. Boggis & Anor v Natural England & Anor [2009] EWCA Civ 1061 (20 October 2009) (bailii.org)

35 Case C-258/11 (Sweetman) Judgement para 44, 46 and 47

36 Case C-258/11. CURIA - Documents (europa.eu)

of the site concerned …, the view should be taken that such a plan or project will adversely affect the integrity of that site." (para 46).

2017 - Wealden 1[37]

A2.6 This case in the UK High Court concerned the approach to in-combination assessments pursuant to the Habitats Regulations. The principal issue was whether it was appropriate to apply a screening criterion published by Highways England (in which changes of less than 1,000 vehicles per day could be discounted as not significant) to consider the impacts of individual plans. The overall conclusion in this respect was that the criterion should have been applied to the aggregated change caused by two plans and not to each plan in isolation. This has changed the approach taken at the screening stage of HRA, which now routinely considers the effects of plans and projects in combination as well as on their own.

2018 People over Wind[38]

A2.7 The judgement of the CJEU was that it was more appropriate to consider the effects of mitigation at the AA stage rather than at the screening stage: "*it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project on that site"*. This is particularly challenging to reconcile with the concepts of 'better by design' and 'air quality positive' which expect consideration of air quality improvement to run throughout the design of a project. Since the People over Wind judgement, most assessments consider that on-site measures to reduce emissions which are not required solely to avoid an LSE can form part of the assessment considered at the screening stage.

2018 Dutch Nitrogen Cases[39]

A2.8 These two cases highlighted several interesting points. The most relevant in terms of air quality assessment in the UK are:

1) that an AA may not take into account the existence of 'autonomous' measures[40] (i.e. measures not part of that programme), if the expected benefits of those measures are not certain;

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37 Judgment in Wealden District Council v Secretary of State for Communities and Local Government, Lewes District Council and South Downs National Park Authority) [2017]

38 C-323/17 Judgement of the Court 12 April 2018, Request for a preliminary ruling under Article 247 TFEU from the High Court (Ireland), made by decision on 10 May 2017, received at the Court on 30 May 2017, in the proceedings of People Over Wind and Peter Sweetman v Coillte Teoranta, curia.europa.eu/juris/document/document.jsf?text=&docid=200970&pageIndex=0&doclang=en&mode=req&dir=&occ=first&part=1&cid=619449.

39 Coöperatie Mobilisation for the Environment UA and Vereniging Leefmilieu v College van gedeputeerde staten van Limburg and College van gedeputeerde staten van Gelderland. Requests for a preliminary ruling from the Raad van State Joined Cases C-293/17 and C-294/17

40 i.e. measures which are not being delivered as part of the plan, project, or programme being assessed.

2) that screening thresholds may only be used to discount an LSE from a project if there is no reasonable scientific doubt that that project will not affect the integrity of a designated site in combination with other plans and projects; and

3) that recurring activities such as grazing and fertilizer use may be classified as a 'project' in the context of the Habitats Directive.

2019 - Examination of the Submission Wealden Local Plan

A2.9 This does not relate to a court case, but the judgements expressed by NE and the planning inspectorate have had significant implications for the way in which air quality impacts on nature conservation sites are assessed in the UK. In particular, they form the basis of the approach which was taken to derive the DMTs and SRTs (see Paragraph 4.18). Furthermore, the political implications for Wealden District Council (WDC) of not following NE's advice on this matter have provided a clear signal to other local planning authorities regarding the treatment of autonomous measures in planning decisions.

A2.10 In the evidence supporting its 2018 Submission Local Plan, Wealden District Council showed the impact of its Submission Plan on air quality conditions within the Ashdown Forest SAC. It quantified the PC and ICC, and also showed the net effect of forecast changes to national and international emissions (i.e. autonomous measures). These emissions were forecast using three alternative approaches, each of which assumed a different level of efficacy of the autonomous measures.

A2.11 NE advised WDC that it should base its plan-making solely on the scenario that used AQC's CURED model[41], but instead the Council took account of all three emissions scenarios, including one in which autonomous measures were assumed to have no effect[42] .

A2.12 Under NE's preferred scenario[41], improvements caused by autonomous measures were predicted to be greater than the adverse effects of the Submission Local Plan, both alone and in-combination with other predicted traffic growth (i.e. the effect of autonomous measures was greater than both the PC and ICC). Detailed habitats surveys had identified the distribution of the protected feature, and at the worst relevant location, the PC was predicted to remove 53% of the autonomous improvements, while the ICC was predicted to remove 74% of the autonomous improvements[43].

41 This was termed 'Scenario B'. AQC's CURED model has since been withdrawn but the modelling presented in this report is consistent with the level of precaution which was inherent in this model scenario.

42 This was termed 'Scenario A'.

43 As documented in the executive summary of the air quality modelling report cited by Natural England[44] which shows the maximum deposition to heath predicted using the most detailed modelling would fall from 22.7 kgN/ha/yr in 2015 to: 19.3 kgN/ha/yr in 2028 without any 'in-combination' traffic; 20.8 kgN/ha/yr in 2028 without the Submission Plan, and 21.8 kgN/ha/yr with the Plan..

These predictions were used by NE to inform its supplementary conservation objectives for Ashdown Forest[44]. Making specific reference to the modelling published by WDC, NE stated:

"Assessment of improvements in vehicular technology and in particular Euro6/VI standards that all vehicles are currently being manufactured to, will outweigh impacts from new development. The improvements will be marginally retarded by additional development but future nitrogen deposition and concentration will continue to decline with the existing trend."[44].

A2.13 This statement relates to the entire SAC and thus takes account of the large area where the ICC was predicted to remove less than 74% of the autonomous improvements, as well as these worst-case impacts. NE also explained the importance of this net downward trend in its representations to the planning inspector[45,46]. The predicted improving trend related only to NOx and nitrogen deposition. The modelling published by WDC, to which NE referred, did not predict any reductions to ammonia concentrations, only adverse impacts. NE's advice took a holistic view of ambient concentrations in general in its advice relating to air quality.

A2.14 It is important to note that NE's position regarding the importance of autonomous emissions reductions at Ashdown Forest did not refer to specific habitat features, their sensitivity, or any other ecological context. The statement which is quoted in Paragraph A2.12, relates solely to air quality forecasts. A key disagreement between WDC and NE was whether the autonomous measures included in the air quality forecasts were sufficiently certain for decision making in the context of the Habitats Regulations[47]. The Submission Plan ultimately had to be withdrawn, partly because of WDC's failure to take account of NE's advice on the significance of the PC and ICC when viewed in the context of the benefits provided by autonomous measures[48].

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44 Natural England (2019) European Site Conservation Objectives: Supplementary advice on conserving and restoring site features Ashdown Forest Special Area of Conservation (SAC) Site Code: UK0030080

45 e.g. Paragraphs 19 to 25, and Paragraphs 37 to 46 of Annex 1 to Natural England Comments on Proposed Submission Document 05/08/18 – Natural England ref 255168 (available on request).

46 It is important to note that the examination in public followed shortly after the judgement from the Dutch Nitrogen Cases, which were discussed at length and thus fully accounted for in advice from both Natural England and the planning inspector.

47 In particular, WDC noted that measurements showed that traffic-related nitrogen deposition had, on average, been increasing for many years despite the same forecasts showing concurrent reductions.

48 Wealden District Council concluded that the PC and ICC were both potentially significant without mitigation, while for the reasons given in Paragraph A2.12, Natural England determined that mitigation was not required.

A3 Data from Caporn et al 2016 Cited by National Highways

Table A3.1: Values from Table 21 of Caporn et al[20] Relied on in National Highways' Assessment Method

Habitat	Nitrogen Deposition KgN/ha/yr						
	CLo	Background deposition					
		5	10	15	20	25	30
		Increase required to reduce measured species richness by 1					
Upland heath [a]	10-20	0.4	0.8	1.3	1.7	2.0	2.4
Upland heath [a]	10-20	1.7	2.0	2.5	3.3	5.0	20.0
Lowland heath	10-20	0.4	0.8	1.3	1.7	2.0	2.4
Bog	5-10	-	-	-	3.3	-	-
Sand dunes [a]	8-15	0.1	0.5	1.1	2.0	-	-
Sand dunes [a]	8-15	0.3	0.6	0.9	1.3	-	-
Sand dunes [a]	8-15	0.3	0.6	0.9	1.3	-	-
Acid grasslands	10-15	1.7	1.7	2.0	2.0	2.5	2.5

[a] Based on two separate studies using different quadrat sizes.

A4 Modelling Methodology

A4.1 The modelling methodology is the same as outlined in Appendix 9.4. Additional details relating to this assessment are as follows.

Traffic Data

A4.2 AADT flows, the proportions of HDVs and speed data have been provided by DTA Transportation Ltd, who have undertaken the transport assessment work for the Development. Traffic speeds have been based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. The traffic data used in this assessment are summarised in Table A4.1. Diurnal and monthly flow profiles for the traffic have been derived from the national profiles published by DfT[49].

Table A4.1: Summary of Traffic Data used in the Assessment

Road Link	2026		2026 With Development (in-isolation)		2026 With Development and Cumulative Schemes	
	AADT	%HDV	AADT	%HDV	AADT	%HDV
5 – B4100	13,223	4	14,405	4	16,349	4
9 – B430	8,436	5	8,865	4	12,584	4
10 – M40 [a]	112,463	16	113,405	16	114,752	16

[a] The M40 has been modelled as a dual carriageway with half of the M40 flow for each carriageway.

A4.3 Figure A4.1 shows the road network included within the model, along with the speed at which each link was modelled.

[49] DfT (2020), DfT Road traffic statistics (TRA03)

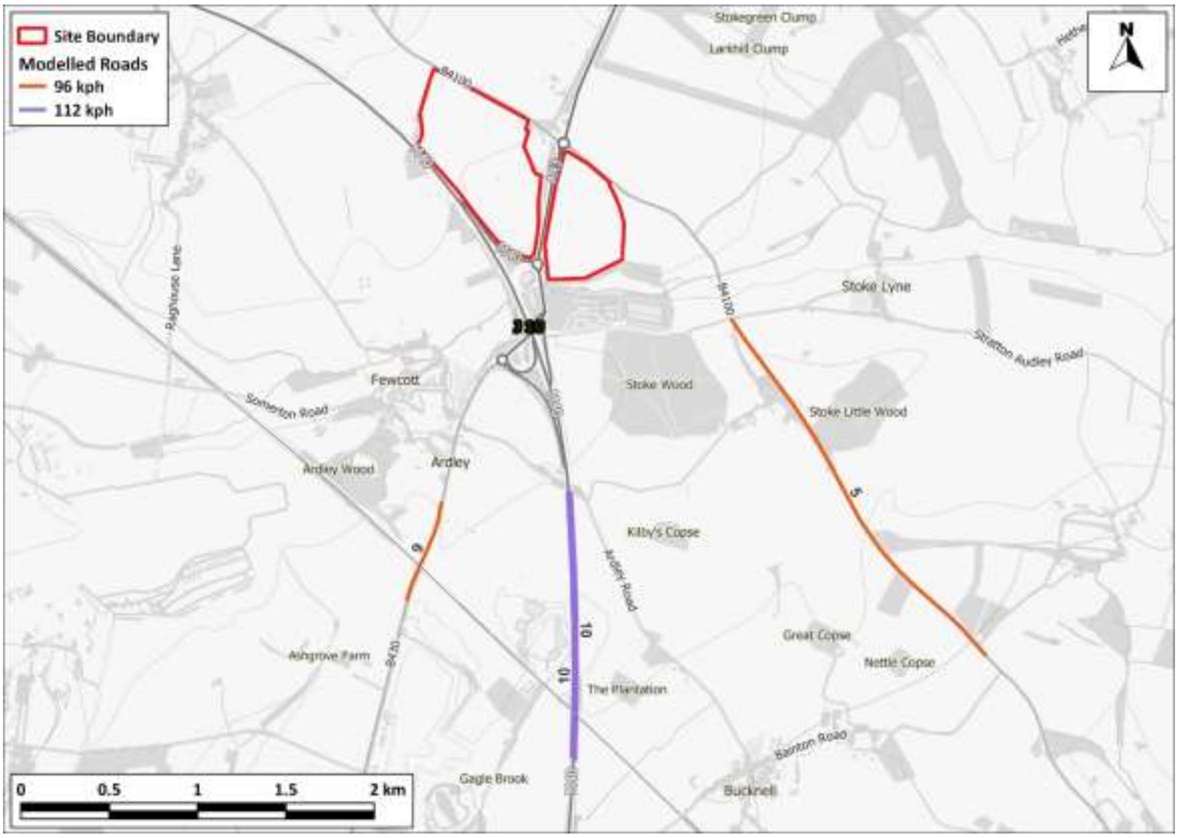

Figure A4.1: Modelled Road Network & Speed

Verification of NOx Concentrations

A4.4 The model results for traffic-related NOx concentrations have been verified based on a factor of 2.142, consistent with the NO_2 verification factor derived as part of the human health assessment. Full details on verification are provided in Appendix 9.4.

Verification of Ammonia Concentrations

A4.5 There are no local roadside ammonia monitoring sites which can be used to verify the model results for traffic-related ammonia emissions. Development of the CREAM emissions model[31] included verification of concentrations predicted using the ADMS-Roads dispersion model and measured traffic data against ambient measurements from the most detailed network of roadside monitoring sites which has ever been run in the UK. No further adjustment to the model predictions is considered appropriate.

Deposition Rates

A4.6 Dry deposition has been included within the dispersion model for ammonia, but not for nitrogen oxides; the principal depositing component of concern is nitrogen dioxide, and this is calculated from nitrogen oxides outside of the model. As such the depletion of ammonia concentrations with distance from the source has been accounted for within this assessment. Ammonia depletes more rapidly with distance from the source, as evidenced by the deposition velocities in Table A4.2, and it is thus most appropriate to include depletion in the model.

A4.7 Deposition has been calculated from the predicted ambient concentrations using the deposition velocities set out in Table A4.2. Deposition velocities refer to a height above ground, usually 1.5 m, although in practice the precise height makes little difference and here they have been applied to concentrations predicted at a height of 0 m above ground. The velocities are applied simply by multiplying a concentration (µg/m^3) by the velocity (m/s) to predict a deposition flux (µg/m^2/s) and then scaling by time and area to represent kg/ha/yr of the nitrogen component of the molecule.

Table A4.2: Deposition Velocities Used in This Assessment

Pollutant	Deposition Velocity (m/s)		Reference
	Forest	Grassland	
Nitrogen Dioxide	0.003	0.0015	AQTAG06[50]
Ammonia	0.03	0.02	AQTAG06[50]

A4.8 Wet deposition of the emitted pollutants close to the emission source will be restricted to wash-out, or below cloud scavenging. For this to occur, rain droplets must come into contact with the gas molecules before they hit the ground. Falling raindrops displace the air around them, effectively pushing gasses away. AQTAG06 guidance[50] is that the wet deposition of nitrogen dioxide and ammonia is not significant within a short range. It has thus not been included.

50 AQTAG (2011), AQTAG06 - Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air