CHAPTER 11: AIR QUALITY

11.1 INTRODUCTION

11.1.1 This chapter of the ES has been produced by Peter Brett Associates LLP (PBA) and considers the potential for air quality and odour impacts associated with the Proposed Development.

11.1.2 The assessment covers two potential air quality issues:

- The impact of the Proposed Development on the surrounding area, during both the construction and operational phases; and
- The impact of existing local pollution sources, in particular local road traffic emissions and odour, on the Project Site itself.

11.1.3 Existing local air quality, the likely future air quality in the absence of the Proposed Development and the likely future air quality if the Proposed Development goes ahead, have all been defined and the potential impacts associated with this air quality assessed. In addition, a further scenario has been included as a sensitivity test, which includes a primary school. The main air pollutants of concern related to construction are dust and fine particulate matter (PM_{10}), and for road traffic they are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$).

11.2 ASSESSMENT CRITERIA & METHODOLOGY

Previous Assessment

11.2.1 No previous air quality assessment has been carried out for this Project Site.

Scoping Opinion

11.2.2 South Gloucestershire District Council (SGC) have provided the following scoping opinion:

"The EIA Scoping Report submitted by Savills, dated April 2018, states that potential for air quality and odour impacts will be considered within a specific chapter of the ES. The scoping report appears to address the relevant potential air quality and odour issues. However, the assessment of operational impacts should also include sensitivity testing in light of the uncertainty around emission factors for nitrogen dioxide to provide a worst-case assessment. If the proposal includes any centralised energy facility or other central combustion process, such as CHP, the impacts of this should also be considered.

As regards the mitigation envisaged (Section 11.5), the following good practice principles identified in the 'Land-Use Planning & Development Control: Planning for Air Quality' guidance produced by Environmental Protection UK (EPUK) / Institute of Air Quality Management (IAQM)

(January 2017) should be applied to all development to reduce emissions and contribute to better air quality management:

• The provision of at least 1 Electric Vehicle (EV) "rapid charge" point per 10 residential dwellings and/or 1000m^2 of commercial floor space. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made.

• All gas fired boilers to meet a minimum standard of <40mgNOx/kWh.

It is recommended that the Environmental Protection Team is contacted to agree the detailed methodology, including a suitable approach to sensitivity testing and to obtain the latest available data."

11.2.3 Consideration has been given to the Scoping Opinion provided by SGC and the following response is provided:

- Discussion regarding the uncertainty around emissions factors has been included in **Appendix 11.5**;
- No centralised energy facility is proposed;
- The need for mitigation has been identified within the assessment, and the suggested mitigation measures have been taken into account. A number of the identified mitigation measures would form part of detailed proposals within any future reserved matter application;
- As noted below at Section 11.3, details of the assessment approach have been discussed with SGC.

Legislative Context

The Air Quality Strategy

11.2.4 The Air Quality Strategy (2007) establishes the policy framework for ambient air quality management and assessment in the UK (DETR, 2007). The primary objective is to ensure that everyone can enjoy a level of ambient air quality which poses no significant risk to health or quality of life. The Strategy sets out the National Air Quality Objectives (NAQOs) and Government policy on achieving these objectives.

11.2.5 Part IV of the Environment Act 1995 (Environment Act, 1995) introduced a system of Local Air Quality Management (LAQM). This requires local authorities to regularly and systematically review and assess air quality within their boundary, and appraise development and transport plans against these assessments. The relevant NAQOs for LAQM are prescribed in the Air

Quality (England) Regulations 2000 (Statutory Instrument, 2000) and the Air Quality (Amendment) (England) Regulations 2002 (Statutory Instrument, 2002).

11.2.6 Where an objective is unlikely to be met, the local authority must designate an Air Quality Management Area (AQMA) and draw up an Air Quality Action Plan (AQAP) setting out the measures it intends to introduce in pursuit of the objectives within its AQMA.

11.2.7 The Local Air Quality Management Technical Guidance 2016 (LAQM.TG(16); Defra, 2016), issued by the Department for Environment, Food and Rural Affairs (Defra) for Local Authorities provides advice as to where the NAQOs apply. These include outdoor locations where members of the public are likely to be regularly present for the averaging period of the objective (which vary from 15 minutes to a year). Thus, for example, annual mean objectives apply at the façades of residential properties, whilst the 24-hour objective (for PM_{10}) would also apply within the garden. They do not apply to occupational, indoor or in-vehicle exposure.

EU Limit Values

11.2.8 The Air Quality Standards Regulations 2010 (Statutory Instrument, 2010) implements the European Union's Directive on ambient air quality and cleaner air for Europe (2008/50/EC), and includes limit values for NO_2. These limit values are numerically the same as the NAQO values but differ in terms of compliance dates, locations where they apply and the legal responsibility for ensuring that they are complied with. The compliance date for the NO_2 EU Limit Value was 1 January 2010, five years later than the date for the NAQO.

11.2.9 Directive 2008/50/EC consolidated the previous framework directive on ambient air quality assessment and management and its first three daughter directives. The limit values remained unchanged, but it now allows Member States a time extension for compliance, subject to European Commission (EC) approval.

11.2.10 The Directive limit values are applicable at all locations except:

- Where members of the public do not have access and there is no fixed habitation;
- On factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and
- On the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access.

Habitats

11.2.11 European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive) requires member states to introduce a range of

measures for the protection of habitats and species. The Conservation of Habitats and Species Regulations (2017) (Stationery Office, 2017), transposes the Directive into law in England and Wales. Sites as Special Areas of Conservation (SACs) are designated under these regulations, as are Special Protection Areas (SPAs); with these classified under the Council Directive 2009/147/EC on the Conservation of Wild Birds. These Sites form a network termed "Natura 2000."

11.2.12 The Regulations primarily provide measures for the protection of European Sites and European Protected Species, but also require local planning authorities to encourage the management of other features that are of major importance for wild flora and fauna.

11.2.13 Sites as Special Areas of Conservation (SACs) are designated under these regulations, as are Special Protection Areas (SPAs); with these classified under the Council Directive 2009/147/EC on the Conservation of Wild Birds.

11.2.14 The Habitats Directive (as implemented by the Regulations) requires the competent authority, which in this case will be the planning authority, to firstly evaluate whether the development is likely to give rise to a significant effect on the European site. Where this is the case, it has to carry out an 'appropriate assessment' in order to determine whether the development will adversely affect the integrity of the site.

11.2.15 Sites of national importance may be designated as Sites of Special Scientific Interest (SSSIs). Originally notified under the National Parks and Access to the Countryside Act 1949, SSSIs have been re-notified under the Wildlife and Countryside Act 1981. Improved provisions for the protection and management of SSSIs (in England and Wales) were introduced by the Countryside and Rights of Way (CROW) Act 2000. If a development is "likely to damage" a SSSI, the CROW act requires that a relevant conservation body (i.e. Natural England) is consulted. The CROW act also provides protection to local nature conservation sites, which can be particularly important in providing 'stepping stones' or 'buffers' to SSSIs and European sites. In addition, the Environment Act (1995) and the Natural Environment and Rural Communities Act (2006) both require the conservation of biodiversity.

Air Quality Objectives

Human Health

11.2.16 The NAQOs for NO_2 and PM_{10} set out in the Air Quality Regulations (England) 2000 and the Air Quality (England) (Amendment) Regulations 2002, are shown in **Table 11.1**.

Table 11.1 NO_2 and PM_{10} Objectives

Pollutant	Time Period	Objective
Nitrogen Dioxide (NO_2)	1-hour mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual mean	40 µg/m^3
Particulate Matter (PM_{10})	24-hour mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual mean	40 µg/m^3

11.2.17 The objectives for NO_2 and PM_{10} were to have been achieved by 2005 and 2004, respectively, but also continue to apply in all future years thereafter. Analysis of long-term monitoring data suggests that if the annual mean NO_2 concentration is less than 60 µg/m^3 then the one-hour mean NO_2 objective is unlikely to be exceeded where road transport is the main source of pollution. Therefore, in this assessment this concentration has been used to screen whether the one-hour mean objective is likely to be achieved (Defra 2009).

11.2.18 The Air Quality Strategy 2007 (DETR, 2007) includes an exposure reduction target for smaller particles known as $PM_{2.5}$. These are an annual mean target of 25 µg/m^3 by 2020 and an average urban background exposure reduction target of 15% between 2010 and 2020.

11.2.19 The Ambient Air Quality and Cleaner Air for Europe directive (2008/50/EC) was adopted in May 2008, and includes a national exposure reduction target, a target value and a limit value for $PM_{2.5}$, shown in Table **11.2.** The UK Government transposed this new directive into national legislation in June 2010.

Table 11.2 $PM_{2.5}$ Objectives

	Time Period	Objective	To be Achieved by
UK Objectives	Annual mean	25 µg/m^3	2020
	3 year running annual mean	15% reduction in concentrations measured at urban background sites	Between 2010 and 2020
European Obligations	Annual mean	Target value of 25 µg/m^3	2010
	Annual mean	Limit value of 25 µg/m^3	2015
	Annual mean	Stage 2 indicative Limit value of 20 µg/m^3	2020
	3 year Average Exposure Indicator (AEI)	Exposure concentration obligation of 20 µg/m^3	2015

Note: (a) The 3 year annual or AEI is calculated from the $PM_{2.5}$ concentration averaged across all urban background monitoring locations in the UK e.g. the AEI for 2010 is the mean concentration measured over 2008, 2009 and 2010.

Ecological Sites

11.2.20 Objectives for the protection of vegetation and ecosystems have been set by the UK Government and were to have been achieved by 2000. They are summarised in **Table 11.3**

and are the same as the EU limit values. The objectives only strictly 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. However, Natural England has adopted a more precautionary approach and applies the objective to all internationally designated conservation Sites and SSSIs. For the assessment of road schemes, the Highways Agency follows this approach and requires an assessment of the impacts of roads traffic emissions on nature conservation Sites (Designated Sites) within 200 m of a road with significant traffic (considered to be >10,000 AADT). When pollutant concentrations exceed a critical level it is considered that there is a risk of harmful effects.

Table 11.2 Vegetation and Ecosystem Objectives (Critical Levels)

Pollutant	Time Period	Objective
Nitrogen Oxides (expressed as NO_2)	Annual mean	30 µg/m^3

Critical Loads

11.2.21 Critical loads for nitrogen deposition onto sensitive ecosystems have been specified by United Nations Economic Commission for Europe (UNECE). They are defined as the amount of pollutant deposited to a given area over a year, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Exceedance of a critical load is used as an indication of the potential for harmful effects to occur.

Planning Policy and Guidance

National Planning Policy

National Planning Policy Framework

11.2.22 The National Planning Policy Framework (NPPF, 2018) sets out the Government's planning policies for England and how they are expected to be applied. In relation to achieving sustainable development, paragraph 8 states that:

"Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

…

*c) **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."

11.2.23 So that sustainable development is pursued in a positive way, at the heart of the Framework is a presumption in favour of sustainable development. Paragraph 11 states that plans and decisions should apply a presumption in favour of sustainable development, which for decision-taking means:

"… d) where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date, granting permission unless:

…

ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole."

11.2.24 Paragraph 54 on planning conditions and obligations states:

"Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition."

11.2.25 Paragraph 102 on promoting sustainable transport states:

"Transport issues should be considered from the earliest stages of plan-making and development proposals, so that:

…

d) the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account – including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains; …"

11.2.26 Paragraph 103 continues to state:

"Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health."

11.2.27 Paragraph 170 on conserving and enhancing the natural environment states:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) 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 stability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans, and…"

11.2.28 Paragraph 180 within ground conditions and pollution 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."

11.2.29 Paragraph 181, also states that:

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

Planning Practice Guidance

11.2.30 Planning Practice Guidance (PPG) (Planning Practice Guidance, 2014) was first published in March 2014 to support the National Planning Policy Framework. Paragraph 001, Reference 32-007-20140306 (revision date 06.03.2014) of the PPG provides a summary as to why air quality is a consideration for planning:

"… Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values. It is important that the potential impact of new development on air quality is taken into account in planning where the national assessment indicates that relevant limits have been exceeded or are near the limit… The local air quality management (LAQM) regime requires every district and unitary authority to regularly review and assess air quality in their area. These reviews identify whether national objectives have been, or will be, achieved at relevant locations, by an applicable date… If national objectives are not met, or at risk of not being met, the local authority concerned must declare an air quality management area and prepare an air quality action plan… Air quality can also

affect biodiversity and may therefore impact on our international obligations under the Habitats Directive… Odour and dust can also be a planning concern, for example, because of the effect on local amenity."

11.2.31 Paragraph 002, Reference 32-002-20140306 (revision date 06.03.2014), of the PPG concerns the role of Local Plans with regard to air quality;

"… Drawing on the review of air quality carried out for the local air quality management regime, the Local Plan may need to consider;

- *the potential cumulative impact of a number of smaller developments on air quality as well as the effect of more substantial developments;*
- *the impact of point sources of air pollution…; and*
- *ways in which new development would be appropriate in locations where air quality is or likely to be a concern and not give rise to unacceptable risks from pollution. This could be through, for example, identifying measures for offsetting the impact on air quality arising from new development including supporting measures in an air quality action plan or low emissions strategy where applicable."*

11.2.32 Paragraph 005, Reference 32-005-20140306 (revision date 06.03.2014), of the PPG identifies when air quality could be relevant for a planning decision;

"… When deciding whether air quality is relevant to a planning application, considerations could include whether the development would;

- *Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more;*
- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Areas;*

- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality;*

- *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations; and*

- *Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites."*

11.2.33 Paragraph 007, Reference 32-007-20140306 (revision date 06.03.2014), of the PPG provides guidance on how detailed an assessment needs to be;

"Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific."

11.2.34 Paragraph 008, Reference 32-008-20140306 (revision date 06.03.2014), of the PPG provides guidance on how an impact on air quality can be mitigated;

"Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact… Examples of mitigation include;

- *the design and layout of development to increase separation distances from sources of air pollution;*

- *using green infrastructure, in particular trees, to absorb dust and other pollutants;*

- *means of ventilation;*

- *promoting infrastructure to promote modes of transport with low impact on air quality;*

- *controlling dust and emissions from construction, operation and demolition; and*

- *contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development."*

11.2.35 Paragraph 009, Reference 32-009-20140306 (revision date 06.03.2014), of the PPG provides guidance on how considerations about air quality fit into the development management process by means of a flowchart. The final two stages in the process deal with the results of the assessment;

"Will the proposed development (including mitigation) lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or national objectives for pollutants or fail to comply with the requirements of the Habitats Regulations." If Yes:

"Consider how the proposal could be amended to make it acceptable or, where not practicable, consider whether planning permission should be refused."

Local Planning Policy

Current Planning Policy

11.2.36 The South Gloucestershire Core Strategy, adopted in December 2013, sets out the vision for the area based on evidence, community objectives and the detailed spatial strategy for future development in South Gloucestershire to 2027. The Core Strategy Key Issue 7 - Managing the Environment and Heritage and key Issue 8 - Improving Health and Wellbeing identify traffic related pollution, and poor air quality as an issue in some urban areas of South Gloucestershire.

11.2.37 Policy CS9 – 'Managing the Environment and Heritage' considers the air quality objectives within the District:

"The natural and historic environment is a finite and irreplaceable resource. In order to protect and manage South Gloucestershire's environment and its resources in a sustainable way, new development will be expected to:

11. … protect land, air and aqueous environments, buildings and people from pollution…"

11.2.38 SGC has also adopted a Policies, Sites and Places Plan (2017) which includes policy PSP21 – Environmental Pollution and Impacts, which states that:

"Development proposals will be acceptable where they clearly demonstrate that development is sited and designed to prevent unacceptable risks and avoid unacceptable levels of pollution adversely impacting, by way of; fumes, dust, noise, vibration, odour, light or other forms of air, land, water pollution, exposure to contaminated land or land instability, directly or cumulatively, on:

- *environmental amenity; and*
- *the health, safety and amenity of users of the site or the surrounding area."*

Emerging Planning Policy

11.2.39 The emerging West of England Joint Spatial Plan does not include any policies relating to air quality.

11.2.40 SGC have published a consultation document relating to a revised Local Plan. This raises the issue of poor air quality in a number or sections, however, it is not listed as one of the areas needing a revised approach and therefore it is likely that a similar approach will be taken in the revised Local Plan to that in the currently adopted local plan.

Air Quality Action Plan

11.2.41 The South Gloucestershire Air Quality Action Plan (AQAP) adopted in March 2012 sets out local measures aimed at improving air quality within the Authority, especially within the declared AQMAs. It describes the actions that SGC will take to pursue improvements in air quality including; encouraging sustainable travel, reduce car usage, improve access by bicycle and restricting traffic where necessary.

Guidance/ Best Practice

11.2.42 The Institute of Air Quality Management (IAQM) have issued guidance on the assessment of dust from demolition and construction (2014) this guidance has been used to carry out the assessment. Full details of the construction dust assessment methodology is set out in the methodology section, below.

11.2.43 The IAQM, along with Environmental Protection UK (EPUK) have also issued guidance (2017) on how to assess the significance of air quality impacts for new developments. This guidance has been used in order to carry out the air quality assessment. Further information is provided below.

11.2.44 The IAQM has also issued guidance on the assessment of the impacts of odour for planning (2014). This guidance will be used in order to carry out the assessment of odour impacts.

Baseline Data Collection

11.2.45 Existing local air quality has been defined within the study area drawing upon monitoring carried out by SGC with the information provided within their Air Quality Review and Assessment reports and discussion with the environmental health officer. Additional background information has been gained from the published Defra background maps.

11.2.46 The odour baseline has been established based on discussion with SGC and information held by them regarding historic responses from the public in the area.

Assessment Methodology

Sensitive Receptors

11.2.47 Air quality impacts have been assessed at a range of worst-case receptors. For construction activities, these are existing properties closest to the Project Site, and onsite receptors

(proposed residential properties). For traffic-related impacts, the suitable receptor locations have been identified based upon detailed mapping and photography, and informed by professional judgement and screening criteria set out by IAQM. The IAQM guidance (2017) sets out screening criteria which identify areas where detailed assessment is required. In relation to the Proposed Development, this would include receptors on roads where there is predicted to be an increase of more than 500 Annual Average Daily Traffic (AADT)

11.2.48 In identifying relevant sensitive receptors, consideration is given to places where members of the public might be expected to be regularly present over the averaging period of the objectives. For the annual mean and daily mean objectives that are the focus of this assessment, sensitive receptors will generally be residential properties, schools, nursing homes, etc. When identifying these receptors, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested, and where there is a combined effect of several road links.

11.2.49 In terms of ecological impacts, the DMRB screening criteria (Highways Agency 2007) has been used to identify receptors; this requires the consideration of impacts of road traffic emissions on designations within 200m of a road on which daily traffic flows will change by 1,000 AADT or more.

11.2.50 In terms of odour impacts, residential areas within the Project Site are considered most sensitive, however, recreational areas have also been considered. The proposed uses of the Project Site are not odorous and therefore only the impact of existing odour sources on the site have been considered.

11.2.51 The impact of cumulative schemes, as identified in Chapter 5, have been considered in relation to the potential for interacting construction activities, and by the incorporation of traffic data from the schemes in this assessment in accordance with Transport Assessment (see Chapter 9).

Construction Impacts

11.2.52 The Institute of Air Quality Management (IAQM) has issued revised guidance on the assessment of dust from demolition and construction (Holman et al, 2014). Within the IAQM guidance, an 'impact' is described as a change in pollutant concentrations or dust deposition and an 'effect' is described as the consequence of an impact.

11.2.53 During construction the main potential effects are dust annoyance and locally elevated concentrations of PM_{10}.The suspension of particles in the air is dependent on surface characteristics, weather conditions and on-site activities. Impacts have the potential to occur when dust generating activities coincide with dry, windy conditions, and where sensitive receptors are located downwind of the dust source.

11.2.54 Separation distance is also an important factor. Large dust particles (greater than 30 μm), responsible for most dust annoyance, will largely deposit within 100 m of sources. Intermediate particles (10-30 μm) can travel 200-500 m. Consequently, significant dust annoyance is usually limited to within a few hundred metres of its source. Smaller particles (less than 10μm) are deposited slowly and may travel up to 1 km; however, the impact on the short-term concentrations of PM_{10} occurs over a shorter distance. This is due to the rapid decrease in concentrations with distance from the source due to dispersion.

11.2.55 The IAQM guidance recommends that the risk of dust generation is combined with the sensitivity of the area surrounding the site to determine the risk of dust impacts from construction and demolition activities. Depending on the level of risk (high, medium, low or negligible) for each activity, appropriate mitigation is selected.

11.2.56 In accordance with the IAQM, the dust emission magnitude is defined as either large, medium or small (**Table 11.4**) taking into account the general activity descriptors on site and professional judgement.

11.2.57 The sensitivity of the study area to construction dust impacts is defined based on the examples provided within the IAQM 2014 guidance (**Table 11.5**), taking into account professional judgement.

Table 11.3 Criteria for Dust Emission Magnitude

Dust Emission Magnitude	Activity
Large	**Demolition** >50,000 m3 building demolished, dusty material (e.g. concrete), on-site crushing/screening, demolition >20 m above ground level
	Earthworks >10,000 m^2 site area, dusty soil type (e.g. clay), >10 earth moving vehicles active simultaneously, >8 m high bunds formed, >100,000 tonnes material moved
	Construction >100,000 m^3 building volume, on site concrete batching, sandblasting
	Trackout >50 HDVs out / day, dusty soil type (e.g. clay), >100 m unpaved roads
Medium	**Demolition** 20,000 - 50,000 m^3 building demolished, dusty material (e.g. concrete) 10-20 m above ground level
	Earthworks 2,500 - 10,000 m^2 site area, moderately dusty soil (e.g. silt), 5-10 earth moving vehicles active simultaneously, 4 m – 8 m high bunds, 20,000 -100,000 tonnes material moved
	Construction 25,000 - 100,000 m^3 building volume, on site concrete batching
	Trackout 10 - 50 HDVs out / day, moderately dusty surface material, 50 -100 m unpaved roads

Dust Emission Magnitude	Activity
Small	**Demolition** <20,000 m^3 building demolished, non-dusty material, <10 m above ground level, work in winter
	Earthworks <2,500 m^2 site area, non-dusty soil, <5 earth moving vehicles active simultaneously, <4 m high bunds, <20,000 tonnes material moved
	Construction <25,000 m^3, non-dusty material
	Trackout <10 HDVs out / day, non-dusty soil, < 50 m unpaved roads

Table 11.4 Area Sensitivity Definitions

Area Sensitivity	People and Property Receptors	Ecological Receptors
High	>100 dwellings, hospitals, schools, care homes within 50 m 10 – 100 dwellings within 20 m Museums, car parks, car showrooms within 50 m PM_{10} concentrations approach or are above the daily mean objective	National or Internationally designated site within 20 m with dust sensitive features / species present
Medium	>100 dwellings, hospitals, schools, care homes within 100 m 10 – 100 dwellings within 50 m < 10 dwellings within 20 m Offices/shops/parks within 20 m PM_{10} concentrations below the daily mean objective.	National or Internationally designated site within 50 m with dust sensitive features / species present Nationally designated site or particularly important plant species within 20 m
Low	>100 dwellings, hospitals, schools, care homes 100 - 350m away 10 – 100 dwellings within 50 – 350 m < 10 dwellings within 20 – 350 m Playing fields, parks, farmland, footpaths, short term car parks, roads, shopping streets PM_{10} concentrations well below the daily mean objective.	Nationally designated site or particularly important plant species 20 – 50 m Locally designated site with dust sensitive features within 50 m

11.2.58 Based on the dust emission magnitude and the area sensitivity, the risk of dust impacts is then determined (**Table 11.6**), taking into account professional judgement.

Table 11.5 Risk of Dust Impacts

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low

Low	Low	Low	Negligible

11.2.59 Based on the risk of dust impacts, appropriate mitigation is selected from the IAQM guidance using professional judgement.

Significance Criteria

11.2.60 The construction impact significance criteria are based on the IAQM guidance. The guidance recommends that no assessment of the significance of effects is made without mitigation in place, as mitigation is assumed to be secured by planning conditions, legal requirements or required by regulations.

Operational Impacts

Receptors

11.2.61 The identified existing receptors have been modelled at a height of 1.5 m representing ground floor exposure, and in regard to proposed receptors, modelled at a height of 1.5m representing residential exposure at ground floor level. The change in predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at these receptors has been modelled.

11.2.62 Concentrations have also been predicted at one diffusion tube monitor located at High Street, Thornbury in order to verify the modelled results (see **Appendix 11.2** for further details on the verification method).

11.2.63 In respect to ecological designations, concentrations of nitrogen oxides have been predicted, and deposition calculated, at a number of points, forming a transect at increasing distances from the adjacent road in order to indicate whether or not the critical level and critical loads are being exceeded in the habitat.

Impact Predictions

11.2.64 Predictions have been carried out using the ADMS-Roads dispersion model (v4.1.1). The model requires the user to provide various input data, including the AADT flow, the proportion of Heavy Duty Vehicles (HDVs), road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. It also requires meteorological data. The model has been run using 2016 meteorological data from the Bristol meteorological station, which are considered suitable for this area (see Technical **Appendix 11.3** for further details on the model inputs).

11.2.65 AADT flows and the proportions of HDVs, for roads within 250 m of the Proposed Development site, existing receptors and monitoring site have been provided by Peter Brett Associates. Traffic data used in this assessment are summarised in Technical **Appendix 11.4**.

11.2.66 Traffic emissions were calculated using the Emission Factor Toolkit (EFT) v8.0, which utilises NO_x emission factors taken from the European Environment Agency COPERT 5 emission tool. The traffic data were entered into the EFT, along with speed data to provide combined emission rates for each of the road links entered into the model.

11.2.67 The transport model has a forecast year of 2028. Future traffic data for the year 2028 has been combined with 2021 emission factors and background concentrations in order to provide a conservative assessment of the effects of the Proposed Development as road traffic emissions are predicted to decline with time.

Human Health Assessment Criteria

11.2.68 The relevant objectives for human health are set out in **paragraph 11.2.16**, above. There is no official guidance in the UK on how to assess the significance of air quality impacts of a new development. The approach developed by the IAQM and Environmental Protection UK (EPUK), which considers the change in air quality as a result of a Proposed Development on existing receptors, has therefore been used (Moorcroft and Barrowcliffe et al., 2017).

11.2.69 The guidance sets out three stages: determining the magnitude of change at each receptor, describing the impact, and assessing the overall significance. Impact magnitude relates to the change in pollutant concentration; the impact description relates this change to the air quality objective.

Table 11.7 Impact Descriptor for Changes in Concentration at a Receptor

Long term average Concentration at receptor in assessment year	% Change in Concentration with development in relation to Objective / Limit Value			
	1*	2-5	6-10	>10
>110% (a)	Moderate	Substantial	Substantial	Substantial
>102% - ≤ 110% (b)	Moderate	Moderate	Substantial	Substantial
>95% - ≤ 102% (c)	Slight	Moderate	Moderate	Substantial
>75% - ≤ 95% (d)	Negligible	Slight	Moderate	Moderate
≤75% (e)	Negligible	Negligible	Slight	Moderate

Where concentrations increase the impact is described as adverse, and where it decreases, as beneficial.
* % change rounded to nearest whole number. Where the % change is 0 (ie. Less than 0.5%) the impact will be Negligible.
(a) NO_2 or PM_{10}: > 44µg/m^3 annual mean; $PM_{2.5}$ >27.5µg/m^3 annual mean; PM_{10} >35.2µg/m^3 annual mean (days).
(b) NO_2 or PM_{10}: > 40.8 – ≤ 44µg/m^3 annual mean; $PM_{2.5}$ > 25.5 – ≤27.5µg/m^3 annual mean; PM_{10} >32.64 – ≤35.2 µg/m^3 annual mean (days).

(c) NO_2 or PM_{10}: > 38 – ≤40.8µg/m^3 annual mean; PM2.5 >23.75 – ≤25.5µg/m^3 of annual mean; PM_{10} >30.4 – ≤32.64µg/m^3 annual mean (days).
(d) NO_2 or PM_{10}: >30 - ≤38µg/m^3 annual mean; $PM_{2.5}$ >18.75 - ≤23.75µg/m^3 annual mean; or <24 - ≤ 30.4µg/m^3 annual mean (days).
(e) NO_2 or PM_{10}: ≤30 µg/m^3 annual mean; $PM_{2.5}$ ≤18.75 µg/m^3 annual mean; PM_{10} ≤24µg/m^3 annual mean (days).

11.2.70 The guidance states that the assessment of significance should be based on professional judgement, taking into account factors including:

- the number of properties affected by minor, moderate or substantial air quality impacts and a judgement on the overall balance;
- the descriptions of the impacts at the receptors based on **Table 11.7**;
- whether or not an exceedance of an objective or limit value is predicted to arise in the operational study area (where there are significant changes in traffic) where none existed before or an exceedance area is substantially increased;
- the uncertainty, comprising the extent to which worst-case assumptions have been made; and
- the extent to which an objective or limit value is exceeded.

11.2.71 Where impacts can be considered in isolation at an individual receptor, moderate or major impacts (i.e. per **Table 11.7**) may be considered to be a significant environmental effect, whereas negligible or minor impacts would not be considered significant. The overall effect however, needs to be considered in the round taking into account the changes at all of the modelled receptor locations, with a judgement made as to whether the overall air quality effect of the development is significant or not.

Ecological Sites Assessment Criteria

11.2.72 The site specific critical loads for the ecological receptors have been provided by APIS (2018) and are presented in **Table 11.8**, below.

Table 11.8 Deposition and Site Relevant Critical Loads

Habitat	Total Nitrogen Deposition (kgN/ha/yr)	Acid Deposition	
		Nitrogen (keqN/ha/yr)	Sulphur (keqS/ha/yr)
Critical Load/Level	10-20	2.647	2.51

11.2.73 Where critical loads are already exceeded, an increase of more than 1% of the critical load is an indication of potentially significant effects which would trigger the need for further, more detailed assessment. It should be noted that an increase in deposition of more than 1% is not,

per se, an indication that a significant effect exists, only the possibility of one. Depending on a more detailed assessment which would take account of the actual ecological conditions at the location under consideration, an increase of more than 1% may be acceptable.

11.2.74 The same approach applies for the NO_x critical level of 30 µg/m^3 shown in **Table 11.3**.

Odour

11.2.75 The effects of odour have been considered in relation to the Institute of Air Quality Management (IAQM) guidance (IAQM, 2014). Section 4 of the IAQM guidance provides an overview of available odour assessment tools and recommends an approach that combines such tools; i.e. modelling and empirical observations. Modelling can range from a simple qualitative representation of the Source-Pathway-Receptor (S-P-R) concept, through to quantitative dispersion models.

11.2.76 Appendix 1 of the IAQM guidance contains the framework for the predictive source-pathway-receptor odour assessment and this is shown in **Table 11.9** below.

Table 11.9 Predictive Odour Assessment Framework

Source Odour Potential	Pathway Effectiveness	Receptor
Factors affecting the source odour potential include: • the magnitude of the odour release (taking into account odour-control measures) • how inherently odorous the compounds are • the unpleasantness of the odour	Factors affecting the odour flux to the receptor are: • distance from source to receptor • the frequency (%) of winds from the source to receptor (or qualitatively, the direction of receptors from source with respect to prevailing wind) • the effectiveness of any mitigation/control in reducing flux to the receptor • topography and terrain	For the sensitivity of people to odour, the IAQM recommends that the air quality practitioner uses professional judgement to identify where on the spectrum between high and low sensitivity a receptor lies.

Odour Sources

11.2.77 For the source-pathway-receptor model, the risk of odour exposure (i.e. the impact) can be defined in accordance with the IAQM guidance as shown in **Table 11.10**.

Table 11.10 Risk of Odour Exposure (Impact)

Pathway		Odour Source Potential		
		Small	Medium	Large
Pathway Effectiveness	Highly effective	Low risk	Medium risk	High risk
	Moderately effective	Negligible risk	Low risk	Medium risk
	Ineffective	Negligible risk	Negligible risk	Low risk

Odour Significance

11.2.78 **Table 11.11** provides the likely magnitude of the odour effects taking into account the risk of odour exposure and receptor sensitivity.

Table 11.11 Likely Magnitude of the Odour Effects

Risk of Odour Exposure	Receptor Sensitivity		
	Low	Medium	High
High risk of exposure	Minor	Moderate	Major
Medium risk of exposure	Negligible	Minor	Moderate
Low risk of exposure	Negligible	Negligible	Minor
Negligible risk of exposure	Negligible	Negligible	Negligible

11.2.79 The guidance states that where the effect is greater than 'minor adverse', then in accordance with Environmental Impact Assessment (EIA) requirements, the effect would be regarded as significant. In addition, the guidance states:

"Concluding that an effect is significant should not mean, of itself, that a development proposal is unacceptable and the planning application should be refused; rather, it should mean that careful consideration needs to be given to the consequences, scope for securing further mitigation, and the balance with any wider environmental, social and economic benefits that the proposal would bring."

Geographical Scope

11.2.80 For construction phase impacts, the geographical scope is considered to be an area up to 350m from construction phase activities (including earthworks), up to 50m from roads used by construction vehicles, and up to 500 m from the site entrance. This includes proposed residential receptors which may be occupied prior to the completion of construction works on the remainder of the Project Site.

11.2.81 For operational road traffic impacts, the geographical scope is considered to be sensitive receptors close to roads where there is predicted to be a change in road traffic of more than 500 AADT based on the traffic data provided by the transport consultants.

11.2.82 Proposed residential receptors within the Project Site are considered to be within the scope in relation to road traffic and odour impacts.

Temporal Scope

11.2.83 The assessment of the construction dust impacts will focus on the anticipated duration of the construction works. The assessment of operational impacts will focus on the earliest year that the Project is operational (2021), whilst utilising traffic data for the completed development (2028) to provide a worse case assessment. This is the approach set out within the IAQM and EPUK guidance (2017).

Assumptions & Limitations

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

11.2.85 A disparity between national road transport emissions projections and measured annual mean concentrations of nitrogen oxides and NO_2 has been identified in recent years. Whilst projections suggest that both annual mean nitrogen oxides and NO_2 concentrations from road traffic emissions should have fallen significantly over the past few years, at many monitoring sites levels have remained relatively stable, or have shown a slight increase (Carslaw, 2011).

The complete development modelling has been based on 2021 emission factors and background concentrations, whilst utilising traffic flows for 2028. The model has been verified against 2016 monitoring data. This is considered to provide an appropriately conservative assessment taking into account the uncertainties regarding future vehicle emission factors.

11.3 CONSULTATION

11.3.1 In addition to the scoping response set out above, additional consultation has been sought with both SGC Environmental Protection Department and Wessex Water.

11.3.2 Discussion was held with Sally Radwell (Scientific Officer, Environmental Protection, SGC) via email on 26th April 2018 to 22nd May 2018 to agree the assessment approach and obtain data for use in verification. In addition, information was provided regarding odour complaints in the vicinity of the Wessex Water Sewage Treatment Works on Oldbury Lane.

11.3.3 Attempts were made to consult with Wessex Water in relation to the potential for odour relating to the Sewage Treatment Works on Oldbury Lane, however, no response has been provided to date.

11.4 BASELINE ENVIRONMENT

LAQM

11.4.1 SGC has investigated air quality within its area as part of its responsibilities under the LAQM regime. To date, three AQMAs have been declared due to exceedances of the annual mean NO_2 objective. The closest AQMA to the Project Site is 12 km south and will therefore not be affected by the Proposed Development.

Monitoring

Nitrogen Dioxide

11.4.2 SGC carries out monitoring at one automatic monitoring station, which is located over 10 km from the Proposed Development and therefore does not represent conditions within the study area. SGC also deploys NO_2 diffusion tubes at a number of locations including one on Thornbury High Street (Figure 11.1). The diffusion tubes for 2016 were prepared and analysed by Somerset County Council Scientific Services using a preparation of 20% triethanolamine (TEA) in Water and the national adjustment factor of 0.88 was used to bias adjust concentrations at these tubes. Results from monitoring at the Thornbury diffusion tube site are shown in **Table 11.12**, below.

Table 11.12 Measured NO_2 Concentrations

Site ID	Site Type	Within AQMA	Annual Mean (µg/m^3)				
			2012	2013	2014	2015	2016
11	Roadside	No	30.7	27.8	26.6	25.5	26.8
Objective			**40**				

11.4.3 Measured concentrations at the Thornbury diffusion tube site have been well below the relevant objective between 2012 and 2016. Due to its location, concentrations of NO_2 are expected to be higher at this location than within the Project Site. There is no clear trend in concentrations over time.

PM_{10} and $PM_{2.5}$

11.4.4 There is no PM_{10} or $PM_{2.5}$ monitoring undertaken in close proximity to the Project Site.

Background Concentrations

11.4.5 Estimated background concentrations for the site have been obtained from the national maps provided by Defra (Defra, 2018) (shown in **Table 11.13**). Background concentrations are well below the objective at all locations.

Table 11.13 Estimated Annual Mean Background Concentrations

Year	Location	Annual Mean (µg/m^3)			
		NO_x	NO_2	PM_{10}	$PM_{2.5}$
2016	362_192	10.1	7.7	12.3	8.0
	363_189	16.3	12.0	13.3	8.6
	363_190	26.3	18.2	14.1	9.3
	363_191	13.0	9.7	13.3	8.6
	364_191	14.2	10.6	12.9	8.6
	365_190	13.9	10.4	13.4	8.7
	365_191	12.5	9.4	13.0	8.5
	367_191	13.7	10.3	13.9	8.9
2021	362_192	8.4	6.5	11.9	7.6
	363_189	13.4	10.1	12.8	8.2
	363_190	22.0	15.6	13.7	8.9

Year	Location	Annual Mean (µg/m^3)			
		NO_x	NO_2	PM_{10}	$PM_{2.5}$
	363_191	10.8	8.2	12.9	8.3
	364_191	11.7	8.9	12.5	8.2
	365_190	11.4	8.7	13.0	8.3
	365_191	10.3	7.8	12.6	8.1
	367_191	10.9	8.3	13.5	8.5
Objective		**-**	**40**	**40**	**25**

Identifying Receptors

11.4.6 Based on the criteria discussed above at paragraph 11.2.47 – 11.2.48, 12 existing properties have been identified as receptors for this assessment. The locations of these existing receptors were chosen to represent locations where impacts from road traffic related to the Proposed Development are likely to be the greatest, i.e. as a result of development traffic at junctions. They therefore do not include all road links with an increase of more than 500 AADT as those with a smaller change or where receptors are further from the road are represented by these worst case receptors. These locations are described in **Table 11.14**, and shown in **Figure 11.1**. In addition, a worst case receptor location within the Proposed Development, at the boundary of the area identified for housing closest to the road, has been chosen in order to assess the suitability of the site for residential development (also shown in **Figure 11.1**). A new development is under construction at Park Farm to the east of the Project Site which will introduce additional sensitive receptors. Houses within this new development will be located further from the road than existing receptor R10 and therefore this receptor can be used to indicate worst case conditions.

Table 11.14 Receptor Location Description

Receptor	Location	Co-Ordinates
Existing Receptors		
R1	Pound Cottage	365488, 191333
R2	Joy Cottage	635414, 191332
R3	Jasmine House	365309, 191345
R4	Yew Tree Farm	365235, 191365
R5	24 Swallow Park	364489, 191268
R6	Butt Lane	364436, 191254
R7	50 High Street	363649, 189883
R8	2 Gloucester Rd	363760, 190169
R9	Oldbury Ln	363968, 191734

Receptor	Location	Co-Ordinates
R10	Oldbury Ln	363497, 191910
R11	Pool Farm	362615, 192249
R12	A38	367404, 191477
Proposed Receptor		
PR1	Proposed Site	363716, 191828

11.4.7 There are two relevant ecological sites: Bluebell Wood Ancient Woodlands, adjacent to Morton Way, and the Park Mill Covert, to the south-west of the Project Site. The Park Mill Covert is more than 200 m from the nearest road and can therefore be screened out following the DMRB screening criteria. Whilst Bluebell Wood Ancient Woodlands is over 2km from the Project Site, additional traffic is predicted on Morton Way due to the Proposed Development and therefore an assessment has been carried out. A transect of receptors has been included on this site in order to assess the impact across the site (see Figure 11.1).

11.4.8 ODOUR

11.4.9 The Thornbury Wastewater Treatment Works is located 250 m from the Project Site (300 m from proposed residential units) and can be considered to be a potential odour source. There are existing residential dwellings located within 40 – 70 m from the boundary of the works and the council have no recorded complaints of odour in the vicinity.

Baseline Deposition – Ecological Receptor

11.4.10 The three-year average (2013 – 2015) nitrogen and acid deposition rates for the Bluebell Wood Ancient Woodland is presented in **Table 11.15**; data have been taken from the APIS website. The APIS data does not include future year predictions and therefore on a conservative basis, the APIS baseline is assumed constant for the future year assessments.

Table 11.15 Baseline Deposition Rates

Habitat	Total Nitrogen Deposition (kgN/ha/yr)	Acid Deposition	
		Nitrogen (keqN/ha/yr)	Sulphur (keqS/ha/yr)
T1 Bluebell Wood Ancient Woodlands			
2016	**31.92**	2.28	0.19
Critical Load/Level	**10**	**2.647**	**2.51**

11.4.11 The nitrogen deposition critical load is predicted to be exceeded in the habitat, the acid deposition critical load is not predicted to be exceeded.

Predicted Baseline Concentrations

11.4.12 The ADMS-Roads model has been run to predict baseline NO_2, PM_{10} and $PM_{2.5}$ concentrations at each of the existing receptor locations identified in **Table 11.14**. The results for the baseline scenarios are presented in **Table 11.16** below.

Table 11.16 Predicted Annual Mean Baseline Concentrations (µg/m^3)

Receptor	NO_2		PM_{10}		$PM_{2.5}$	
	2016	2021	2016	2021	2016	2021
R1	13.1	11.5	13.4	13.2	8.8	8.5
R2	13.8	12.2	13.5	13.3	8.8	8.5
R3	12.8	11.2	13.4	13.1	8.8	8.4
R4	11.9	10.2	13.3	13.0	8.7	8.3
R5	14.9	13.3	13.4	13.2	8.9	8.6
R6	13.5	11.7	13.2	12.9	8.8	8.5
R7	23.2	19.5	14.9	14.6	9.5	9.2
R8	31.7	26.5	16.1	15.7	10.5	10.0
R9	14.0	11.5	13.8	13.4	8.9	8.6
R10	12.9	10.6	13.6	13.3	8.9	8.5
R11	10.6	8.7	12.6	12.3	8.2	7.8
R12	17.6	14.6	14.8	14.5	9.5	9.1
Objective	**40**		**40**		**25**	

Exceedances highlighted in bold

11.4.13 The predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ objectives are not predicted to be exceeded at any of the existing receptor locations in 2016 and 2021.

11.4.14 None of the predicted annual mean NO_2 concentrations exceed 60 µg/m^3 and therefore exceedance of the 1-hour mean NO_2 objective is unlikely.

11.4.15 None of the predicted annual mean PM_{10} concentrations exceed 32 µg/m^3 and therefore the 24-hour mean PM_{10} objective is not predicted to be exceeded.

11.4.16 Baseline concentrations are predicted to decrease between 2016 and 2021 as vehicle emission factors and background concentrations are assumed to improve, despite the traffic increase in the network.

11.4.17 Predicted concentrations and deposition rates for the baseline scenarios in relation to the ecological receptor are presented in **Table 11.17**.

Table 11.17 Predicted Baseline Concentrations and Deposition

Receptor and Distance from Road	2016 Baseline			2021 Without Development		
	Total NO_x ($\mu g/m^3$)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)	Total NOx ($\mu g/m^3$)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)
T1 15m	17.3	**32.5**	**2.698**	17.4	**32.9**	2.538
T1 20m	16.7	**32.4**	**2.691**	16.2	**32.7**	2.525
T1 30m	15.9	**32.2**	**2.682**	14.9	**32.5**	2.510
T1 40m	15.5	**32.2**	**2.678**	14.1	**32.4**	2.502
T1 50m	15.2	**32.1**	**2.675**	13.6	**32.3**	2.496
T1 70m	14.9	**32.1**	**2.671**	13.0	**32.2**	2.489
T1 100m	14.6	**32.0**	**2.668**	12.5	**32.1**	2.483
T1 125m	14.5	**32.0**	**2.666**	12.3	**32.1**	2.481
Objective	**30**	**10**	**2.647**	**30**	**10**	**2.647**

11.4.18 The NO_x critical level is not exceeded at any location in 2016 and 2021. The relevant critical load for nutrient nitrogen is exceeded at all locations in both 2016 and 2021 due to the high background levels.

11.4.19 The acid deposition critical load is exceeded at all locations in 2016 but not in 2021.

11.5 INHERENT DESIGN MITIGATION

11.5.1 The Proposed Development has been designed with buildings set away from significant roads. This will reduce the impact of emissions from vehicles on these roads on future occupants. The Project Site has been designed with pedestrian and cycle access in order to encourage the use of sustainable modes of transport for local trips. This will reduce the impact of the development on local air quality.

11.6 POTENTIAL ENVIRONMENTAL IMPACTS & EFFECTS

Construction Impacts and Effects

11.6.1 The main potential effects during construction are dust deposition and elevated PM_{10} concentrations. The following activities have the potential to cause emissions of dust:

- Site preparation including delivery of construction material, erection of fences and barriers;
- Earthworks including digging foundations and landscaping;
- Materials handling such as storage of material in stockpiles and spillage;
- Construction and fabrication of units; and
- Disposal of waste materials off-site.

11.6.2 Typically, the main cause of unmitigated dust generation on construction sites is from vehicles using unpaved haul roads, and off-site from the suspension of dust from mud deposited on local roads by construction traffic. The main determinants of unmitigated dust annoyance are the weather and the distance to the nearest receptor.

11.6.3 Based on the IAQM criteria (**Table 11.4**), the dust emissions magnitude is considered to be **Large**. Although there are currently very few sensitive receptors nearby, there are a number of individual residential properties along Oldbury Lane, and the land to the east of the Project Site has been granted planning consent for up to 500 residential dwellings, see 'Park Farm' development in Chapter 5, and is currently under construction. In addition, the Park Mill Covert is adjacent to the western boundary of the Project Site and is likely to be sensitive to dust impacts. The study area is therefore considered to be of high sensitivity as there are expected to be between 10 and 100 dwellings and an Ancient Woodland within 20 m of the site works (**Table 11.5**). Appropriate mitigation corresponding to a high risk site is therefore required during the construction phase (**Table 11.6**).

Occupation Impacts and Effects

Human Health Receptors

11.6.4 Predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at existing receptors in 2021, both without and with the Proposed Development in place are presented in **Table 11.18** below. In addition, the results of a sensitivity test to identify any changes to air quality should a primary school be incorporated into the proposed development are also included in the table.

Table 11.18 Predicted Annual Mean Concentrations (µg/m^3)

Receptor	2021 Without Development			2021 With Development			2021 Sensitivity Test		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	11.5	13.2	8.5	11.7	13.2	8.5	11.7	13.2	8.5
R2	12.2	13.3	8.5	12.5	13.3	8.5	12.5	13.3	8.5
R3	11.2	13.1	8.4	11.4	13.1	8.4	11.4	13.1	8.4

R4	10.2	13.0	8.3	10.4	13.0	8.4	10.4	13.0	8.4
R5	13.3	13.2	8.6	14.2	13.4	8.7	14.2	13.4	8.7
R6	11.7	12.9	8.5	12.5	13.1	8.5	12.5	13.1	8.5
R7	19.5	14.6	9.2	19.9	14.7	9.2	19.9	14.7	9.2
R8	26.5	15.7	10.0	27.4	15.9	10.1	27.4	15.9	10.1
R9	11.5	13.4	8.6	12.6	13.6	8.7	12.5	13.6	8.7
R10	10.6	13.3	8.5	11.4	13.4	8.6	11.4	13.4	8.6
R11	8.7	12.3	7.8	8.7	12.3	7.9	8.8	12.3	7.9
R12	14.6	14.5	9.1	14.9	14.5	9.1	14.9	14.5	9.1
Objective	**40**	**40**	**25**	**40**	**40**	**25**	**40**	**40**	**25**

11.6.5 The predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations in 2021 without and with the Proposed Development in place are below the relevant objectives at all existing receptor locations.

11.6.6 None of the predicted annual mean NO_2 concentrations exceed 60 µg/m^3 and therefore exceedance of the 1-hour mean NO_2 objective is unlikely.

11.6.7 None of the predicted annual mean PM_{10} concentrations exceed 32 µg/m^3 and therefore the 24-hour mean PM_{10} objective is not predicted to be exceeded.

11.6.8 The changes in annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ are presented in **Table 11.19** below.

Table 11.19 Change in Predicted Concentrations brought about by the Development (µg/m^3) and Impact Descriptors

Receptor	NO_2		PM_{10}		$PM_{2.5}$	
	Change	Impact	Change	Impact	Change	Impact
R1	0.47	Negligible	0.04	Negligible	0.02	Negligible
R2	0.56	Negligible	0.05	Negligible	0.03	Negligible
R3	0.43	Negligible	0.04	Negligible	0.02	Negligible
R4	0.32	Negligible	0.03	Negligible	0.02	Negligible
R5	1.62	Negligible	0.14	Negligible	0.08	Negligible
R6	1.44	Negligible	0.12	Negligible	0.07	Negligible
R7	0.82	Negligible	0.08	Negligible	0.05	Negligible

R8	1.99	Negligible	0.19	Negligible	0.11	Negligible
R9	2.08	Negligible	0.15	Negligible	0.09	Negligible
R10	1.49	Negligible	0.10	Negligible	0.06	Negligible
R11	0.06	Negligible	0.00	Negligible	0.00	Negligible
R12	0.52	Negligible	0.04	Negligible	0.02	Negligible

Based on unrounded numbers

11.6.9 Using the criteria set out in **Table 11.8**, the impact on annual mean NO_2 concentrations is described as **Negligible** at 10 receptor locations and **Slight Adverse** at R8 and R9. The impact on PM_{10} and $PM_{2.5}$ concentrations is described as **Negligible** at all locations, and the annual mean of 32µg/m^3 equating to 35 days above 50µg/m^3 for PM_{10} is described as **Negligible** at all receptor locations.

11.6.10 The changes in annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ comparing the future baseline against the sensitivity test are presented in **Table 11.20** below. Whilst this table shows that there are some slight differences in the sensitivity test scenario, the impact descriptors are unchanged.

Table 11.20 Change in Predicted Concentrations brought about by the Development sensitivity test (µg/m^3) and Impact Descriptors

Receptor	NO_2		PM_{10}		$PM_{2.5}$	
	Change (sensitivity test)	Impact	Change (sensitivity test)	Impact	Change (sensitivity test)	Impact
R1	0.47	Negligible	0.04	Negligible	0.02	Negligible
R2	0.56	Negligible	0.05	Negligible	0.03	Negligible
R3	0.43	Negligible	0.04	Negligible	0.02	Negligible
R4	0.32	Negligible	0.03	Negligible	0.02	Negligible
R5	1.54	Negligible	0.13	Negligible	0.08	Negligible
R6	1.36	Negligible	0.11	Negligible	0.06	Negligible
R7	0.82	Negligible	0.08	Negligible	0.05	Negligible
R8	2.00	Negligible	0.19	Negligible	0.11	Negligible
R9	1.98	Negligible	0.14	Negligible	0.08	Negligible
R10	1.42	Negligible	0.10	Negligible	0.06	Negligible
R11	0.06	Negligible	0.00	Negligible	0.00	Negligible

Receptor	NO_2		PM_{10}		$PM_{2.5}$	
	Change (sensitivity test)	Impact	Change (sensitivity test)	Impact	Change (sensitivity test)	Impact
R12	0.54	Negligible	0.04	Negligible	0.03	Negligible

Based on unrounded numbers

Ecological Receptors

11.6.11 Predicted concentrations and deposition rates for 2021 both with and without the Proposed Development in relation to Bluebell Wood are presented in **Table 11.21**.

Table 11.21 Predicted Concentrations and Deposition

Receptor and Distance from Road	2021 Without Development			2021 With Development		
	Total NO_x ($\mu g/m^3$)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)	Total NO_x ($\mu g/m^3$)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)
T1 15m	18.04	**33.0**	2.545	18.74	**33.1**	2.553
T1 20m	16.79	**32.8**	2.531	17.37	**32.9**	2.538
T1 30m	15.31	**32.5**	2.515	15.73	**32.6**	2.519
T1 40m	14.53	**32.4**	2.506	14.87	**32.5**	2.510
T1 50m	13.95	**32.3**	2.499	14.23	**32.4**	2.503
T1 70m	13.26	**32.2**	2.491	13.47	**32.3**	2.494
T1 100m	12.72	**32.1**	2.485	12.86	**32.2**	2.487
T1 125m	12.45	**32.1**	2.482	12.57	**32.1**	2.484
Objective	**30**	**10**	**2.647**	**30**	**10**	**2.647**

11.6.12 Within the Bluebell Wood Ancient Woodlands, the NO_x critical level is not exceeded either with or without the development in place. The increase in NO_x concentration is over 1% of the critical level across parts of the site, however, this is **Not Significant** given that the NO_x concentrations are below the critical load.

11.6.13 The nitrogen deposition critical load is exceeded within the habitat, with or without the development in place. This is due to high background nitrogen deposition. The increase in nitrogen deposition is potentially significant up to 20 m from the road. Given that the background nitrogen deposition is over 300% of the critical load, it is not likely that the habitat in this location will be sensitive to a potential change in nitrogen deposition of 1.1% of the critical load.

11.6.14 The acid deposition critical load is not exceeded in 2021 either with or without the development in place and the increase in acid deposition is **Not Significant**.

11.6.15 Overall, given the extent and location of any impacts, the development impact on the ecological site is deemed to be **Not Significant**.

11.6.16 The sensitivity test modelling resulted in no change to ecological impacts when compared to the development scenario presented here and therefore the impacts should a school be incorporated into the scheme are also deemed to be **Not Significant**.

Project Site Suitability

11.6.17 Predicted concentrations at the worst case modelled receptor location (PR1) are presented in Table 11.21.

Table 11.21 Predicted Annual Mean Concentrations within the Development (µg/m^3)

Receptor	NO_2	PM_{10}	$PM_{2.5}$
PR1	9.7	13.1	8.4
Objective	**40**	**40**	**25**

11.6.18 There are no predicted exceedances of any of the objectives at the worst case proposed receptor location. Air quality at the Project site will be suitable for the proposed uses.

11.6.19 These results and the conclusion are unchanged when the sensitivity test scenario is considered.

Odour

11.6.20 The Thornbury Wastewater Treatment Works is not a large treatment plant and is located approximately 300m west northwest of the Project Site. In terms of the IAQM guidance, the odour source potential is considered to be **Medium**, taking into account the scale of the site and the potential offensiveness of the odour.

11.6.21 Given the distance to the proposed residential units (approximately 300m) and that the proposed receptors will not be downwind of the prevailing south west wind direction (see Technical **Appendix 11.3**) the odour pathway effectiveness is considered to be **Moderately Effective**. As the separation distance into the Project Site increases, the pathway effectiveness would reduce further. The risk of odour exposure is therefore considered to be **Low Risk** (**Table**

11.10). Considering residential receptors of high sensitivity, the maximum effect is considered to be **Minor Adverse** (**Table 11.11**) and therefore **Not Significant.**

11.7 ADDITIONAL MITIGATION, COMPENSATION & ENHANCEMENT MEASURES

Construction

11.7.1 The following standard high risk mitigation measures from the IAQM 2014 guidance are recommended. These should be included within a Construction Environmental Management Plan and agreed with the Local Authority.

Communication

- Develop and implement a stakeholder communications plan.
- Display the name and contact details of persons accountable on the site boundary.
- Display the head or regional office information on the site boundary.

Management

- Develop and implement a dust management plan.
- Record all dust and air quality complaints, identify causes and take measures to reduce emissions.
- Record exceptional incidents and action taken to resolve the situation.
- Carry out regular site inspections to monitor compliance with the dust management plan and record results.
- Increase site inspection frequency during prolonged dry or windy conditions and when activities with high dust potential are being undertaken.
- Agree dust monitoring locations with the local authority and instigate monitoring 3 months in advance of works commencing in the area.
- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible.
- Erect solid screens or barriers around dusty activities or the site boundary at least as high as any stockpile 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 run off of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove potentially dusty materials from site as soon as possible.
- Cover, seed or fence stockpiles to prevent wind whipping.
- Ensure all vehicles switch off engines when stationary.
- Avoid the use of diesel or petrol powered generators where possible.
- Produce a Construction Logistics Plan to manage the delivery of goods and materials.
- Only use cutting, grinding and sawing equipment with dust suppression equipment.
- Ensure an adequate supply of water on site for dust suppressant.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use water sprays on such equipment where appropriate.
- Ensure equipment is readily available on site to clean up spillages of dry materials.
- No on-site bonfires and burning of waste materials on site.

Earthworks

- Re-vegetate earthworks and exposed areas /soil stockpiles to stabilise surfaces as soon as practicable.
- Only remove the cover in small areas during work and not all at once.

Construction

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless required for a particular process.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored silos with suitable emissions control systems.

Trackout

- Use water assisted dust sweepers on the site access and local roads.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving the site are covered to prevent escape of materials.
- Record inspection of on-site haul routes and any subsequent action, repairing as soon as reasonably practicable.
- Install hard surfaced haul routes which are regularly damped down.
- Install a wheel wash with a hard-surfaced road to the site exit where site layout permits.
- The site access gate to be located at least 10m from receptors where possible.

Operation

11.7.2 The effects of development traffic on local air quality are judged to be Not Significant especially regarding the conservative nature of the assessment. No additional traffic mitigation is therefore required to reduce the direct effects of the development on local air quality.

11.7.3 However, to further reduce the impacts of traffic associated with the development a Travel Plan has been developed, which seeks to reduce the number of vehicle movements associated with the development and subsequent emissions by encouraging sustainable transport. Several mitigation measures are included within the documents, together with management, implementation and monitoring of such measures.

11.8 RESIDUAL ENVIRONMENTAL IMPACTS & EFFECTS

Construction

11.8.1 With appropriate mitigation in place as set out above, the residual effect of construction is assessed as **Not Significant.**

Operation

11.8.2 The operational residual air quality effects of the Proposed Development are judged to be **Not Significant.**

11.9 CUMULATIVE EFFECTS

Construction

11.9.1 Potential cumulative construction effects could occur with nearby development sites should construction occur at the same time.

11.9.2 Significant cumulative effects are unlikely to occur as each development is anticipated to employ similar dust mitigation techniques, secured within respective CEMPs, such that the individual construction phase effect was not significant, alone or in combination.

Operation

11.9.3 The future year traffic data utilised within the assessment includes relevant cumulative schemes, see Chapter 9, and the assessment has therefore predicted the cumulative concentrations arising from the committed developments.

11.10 ASSESSMENT SUMMARY

11.10.1 To date SGC has declared three AQMAs due to exceedances of the annual mean NO_2 objective. The Project Site is not located within an AQMA, the closest AQMA is approximately 12 km from the site.

11.10.2 The construction works have the potential to create dust. During construction it is recommended that a package of mitigation measures is put in place to minimise the risk of elevated PM_{10} concentrations and dust nuisance in the surrounding area. With mitigation in place the construction impacts are judged as **Not Significant**.

11.10.3 In terms of the impact on ecological sites, impacts on the Park Mill Covert have been screened out of this assessment due to the distance of the site from the road. Impacts on Bluebell Wood Ancient woodlands have been assessed and are considered **Not Significant**.

11.10.4 There are no predicted exceedances of the NO_2, PM_{10} and $PM_{2.5}$ air quality strategy objectives at any of the existing receptor locations in close proximity to the site and no exceedance is expected at the Park Farm development currently under construction.

11.10.5 No long-term or short-term NO_2 objectives are predicted to be exceeded at the Project Site. Furthermore, the potential impact of odour from the nearby wastewater treatment site is considered to be **Not Significant**. The site is considered to be suitable for the proposed residential development.

11.10.6 Overall, it is concluded that there are no air quality constraints to the Proposed Development.

Table 11.22: Air Quality Assessment Summary

Environmental Effect	Sensitivity of Receptor	Nature of Effect	Effect Significance	Additional Mitigation	Residual Significance of Effect	Confidence Level
Construction Effects						
Construction Dust	N/A*	Temporary	N/A*	CEMP	Not Significant	High
Operation Effects						
Emissions from road traffic on pollutant concentrations for human health impacts	High	Permanent	Not significant	None required	Not significant	High
Emissions from road traffic on NO_x concentrations and nitrogen/acid deposition for ecological impacts	High	Permanent	Not significant	None required	Not significant	High
Odour from WWTW	High	Permanent	Not significant	None required	Not significant	High
Cumulative Effects						

Environmental Effect	Description	Mitigation	Effect Significance	Confidence Level
Construction Dust	Effects from simultaneous construction	Standard dust mitigation measures secured through respective CEMPs	Not significant	High
Emissions from road traffic	Traffic data includes cumulative development	None required	Not significant	High

* IAQM guidance assesses risk in order to identify mitigation. With mitigation in place, the residual effect is not significant.

Table 11.23: Mitigation Implementation

Mitigation Measure	Implementing Agent(s)	Legal Instrument	Compliance Target	Implementation Timescale
Dust mitigation measures through CEMP	Construction contractor	Planning condition	Agree mitigation prior to construction	Construction