University of Gloucester

# University of Gloucester, City Campus

## Air Quality Assessment

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ARUP

# Contents

# 1 Introduction

Ove Arup and Partners Limited (Arup) has been commissioned by the University of Gloucestershire (UoG) to undertake an air quality assessment for the proposed development known as University of Gloucestershire City Campus. It is located at the former Debenhams department store in Gloucester city centre, within the jurisdiction of Gloucester City Council (GCC).

## 1.1 Existing Site

The proposed development (hereafter referred as the 'Proposed Development' to describe the proposals, or the 'Site' to describe the site boundary) is located within the city centre of Gloucester (see Figure 1). It is currently a vacant building which consists of four-storeys and a basement.

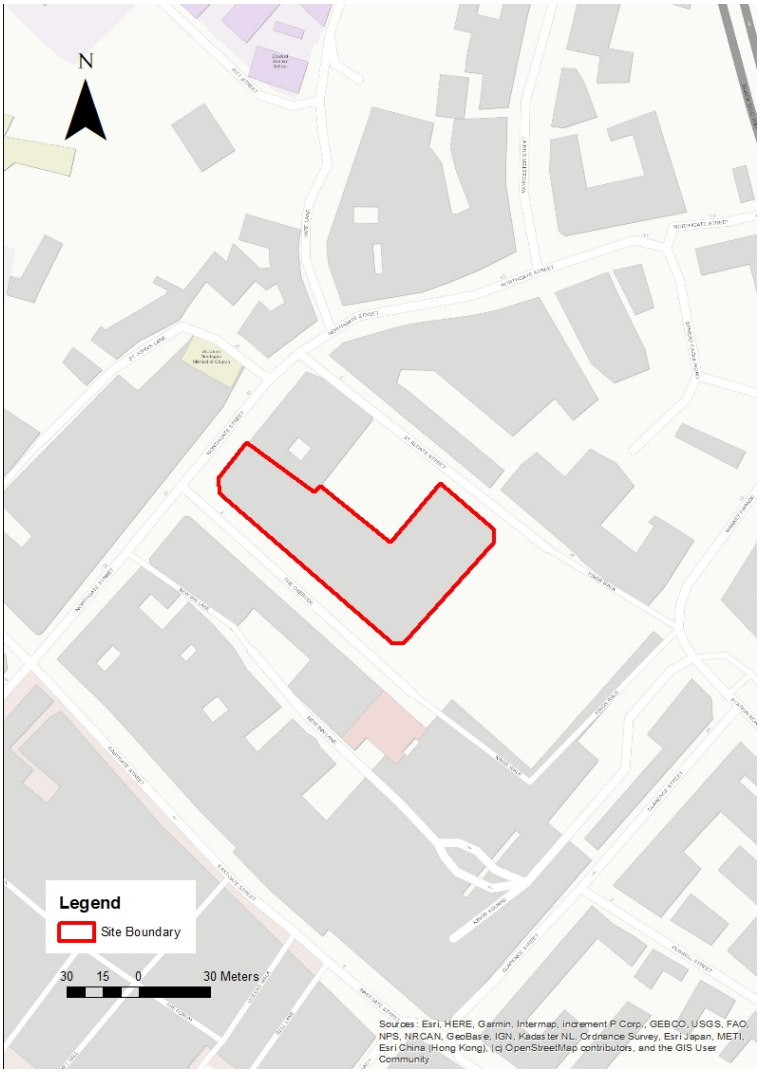
The Site is bounded by St. Aldate Street to the north, King's Square to the east, and shopping streets, Oxbode Lane and Northgate Street to the south and west, respectively. Access to the service yard and the 5-space car park is from St. Aldate Street to the north.

The Site is well-served by public transport; Gloucester train station is approximately 300m east of the Site, with direct services to Cheltenham, London and Cardiff. Furthermore, buses to Cheltenham depart for Market Parade approximately 150m northeast of the Site.

The Proposed Development is not located within an Air Quality Management Area (AQMA). The nearest AQMAs are Priory Road and Barton Street, approximately 380m and 650m from the Site, respectively.

There are no designated ecological sites of national or international importance within 1km of the Proposed Development, and therefore, ecological sites are not considered any further in this assessment.

Figure 1: Site Location




## 1.2 Scope of Assessment

Air quality studies are concerned with the presence of airborne pollutants in the atmosphere. This report outlines the relevant air quality policy and legislative context. It assesses the existing air quality conditions in the vicinity of the Proposed Development and outlines the likely air quality impacts from the construction and operation of the development. Mitigation measures are proposed which would be implemented to reduce the effect of the Proposed Development on air quality as far as practicable.

The main pollutants of concern for local air quality are oxides of nitrogen (NOx), including nitrogen dioxide ($NO_2$), particulate matter ($PM_{10}$ and $PM_{2.5}$) and dust.

The proposed development is to repurpose the existing Debenhams department store to create a City Campus as part of the UoG. This will involve refurbishment of the existing building, and landscaping, these activities will be assessed for dust risk within this assessment.

It is understood that the energy strategy will comprise of mechanical heat recovery units and reverse air source heat pumps located at roof level. Therefore, there will be no emissions associated with this plant, and we have accordingly scoped out further assessment of energy-related emissions.

The Proposed Development will include a 5-space car park, however, it is proposed in line with the GCC Parking Manual[1] that one in five spaces should be for electric vehicles. Based on the proposed number of staff and students on Site, the Proposed Development will provide 128 cycle spaces during its operation. It is anticipated that any traffic changes as a result of the Proposed Development will be below relevant screening criteria, and therefore, a detailed assessment has been scoped out.

[1] Gloucester City Council. 2020. Available at: https://www.gloucestershire.gov.uk/media/2099344/2020-july-mfgs.pdf. [Accessed 23/11/2021].

# 2 Air Quality Standards and Guidelines

## 2.1 The Environment Act 2021

The Environment Bill become an Act[2] (law) in November 2021. The Environment Act 2021 amends the Environment Act 1995[3]. It also amends the Clean Air Act 1993[4] to give local authorities more power at reducing local pollution, particularly that from domestic burning. It also amends the Environmental Protection Act 1990[5] to reduce smoke from residential chimneys by extending the system of statutory nuisance to private dwellings.

The following sections of the Environment Act 1995[3] have been transposed into the Environment Act 2021:

For the Secretary of State to develop, implement and maintain an Air Quality Strategy. This includes the statutory duty, also under Part IV of the Environment Act 1995, for local authorities to undergo a process of local air quality management and declare an AQMA where pollutant concentrations exceed the national air quality objectives. Where an AQMA is declared, the local authority needs to produce an Air Quality Action Plan (AQAP) which outlines the strategy for improving air quality in these areas.

The Act will implement key parts of the government's Clean Air Strategy and include targets for tackling air pollution in the UK.

Relevant to air quality[6]:

- For the Secretary of state for DEFRA to set long-term legally binding targets on air quality. These targets must be of at least 15 years in duration, and be proposed by late 2022;
- For the Secretary of State to publish a report reviewing the Air Quality Strategy every five years;
- For the government to set two targets by October 2022: the first on the amount of $PM_{2.5}$ pollutant in the ambient air (the figure and deadline for compliance remain unspecified) and a second long-term target set at least 15 years ahead to encourage stakeholder investment;
- For the Office for Environmental Protection to be established[7] to substitute the watchdog function previously exercised by the European Commission;

[2] Environment Act 2021. Available at: https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted. Accessed 23/11/2021.
[3] Environment Act 1995, Chapter 25, Part IV Air Quality
[4] Clean Air Act 1993. Available at: https://www.legislation.gov.uk/ukpga/1993/11/contents. Accessed 23/11/2021.
[5] Environmental Protection Act 1990. Available at: https://www.legislation.gov.uk/ukpga/1990/43/contents. Accessed 23/1/2021.
[6] Environment Act 2021. Part 4 Air Quality and Environmental Recall.
[7] Environment Act 2021. Chapter 2. The Office for Environmental Protection.

- For local authorities' powers to be extended under the current Local Air Quality Management framework, including responsibilities to improve local air quality and to reduce public exposure to excessive levels of air pollution;
- For "air quality partners" to have a duty to share responsibility for dealing with local air pollution among public bodies; and
- Introduces a new power for the government to compel vehicle manufacturers to recall vehicles and non-road mobile machinery if they are found not to comply with the environmental standards that they are legally required to meet.

## 2.2 Air Quality Standards

Air quality limit values and objectives are quality standards for clean air. Some pollutants have standards expressed as annual average concentrations due to the chronic way in which they affect health or the natural environment, i.e., effects occur after a prolonged period of exposure to elevated concentrations. Other pollutants have standards expressed as 24-hour, 1-hour or 15-minute average concentrations due to the acute way in which they affect health or the natural environment, i.e., after a relatively short period of exposure. Some pollutants have standards expressed in terms of both long and short-term concentrations.

In this assessment, the term 'air quality standard' has been used to refer to both the UK objectives and European limit values. Table 1 sets out the national air quality objectives for $NO_2$, $PM_{10}$ and $PM_{2.5}$. Other pollutants have been screened out of this air quality assessment, since they are not likely to cause exceedances of their respective standards.

Table 1: Air quality standards

| **Pollutant** | **Averaging Period** | **Air Quality Standard** |
|---|---|---|
| **Human Health** | | |
| Nitrogen dioxide ($NO_2$) | Annual mean | 40µg/m$^3$ |
| | 1-hour mean | 200µg/m$^3$ |
| Particulate matter ($PM_{10}$) | Annual mean | 40µg/m$^3$ |
| | 24-hour mean | 50µg/m$^3$ |
| Particulate matter ($PM_{2.5}$) | Annual mean | 20µg/m$^3$ |
| *[1] not to be exceeded more than 18 times a year (99.79th percentile)* | | |
| *[2] not to be exceeded more than 35 times a year (90.41th percentile)* | | |

## 2.3 Non-Road Mobile Machinery regulations

The Non-Road Mobile Machinery (NRMM) (Emission of Gaseous and Particulate Pollutants) (Amended) Regulations 2014 (SI 2014/1309)[8], which implement EU Directive 2012/46/EU[9] has been superseded by the Environment Act 2021[6].

The Act introduces a new power for the government to compel vehicle manufacturers to recall vehicles and NRMM if they are found not to comply with the environmental standards that they are legally required to meet.

## 2.4 Dust Nuisance

Dust is the generic term used in the British Standard document BS 6069 (Part Two) to describe particulate matter in the size range 1–75µm in diameter. Dust nuisance is the result of the perception of the soiling of surfaces by excessive rates of dust deposition. Under provisions in the Environmental Protection Act 1990[10], dust nuisance is defined as a statutory nuisance.

There are currently no standards or guidelines for dust nuisance in the UK, nor are formal dust deposition standards specified. This reflects the uncertainties in dust monitoring technology and the highly subjective relationship between deposition events, surface soiling and the perception of such events as a nuisance. In law, complaints about excessive dust deposition would have to be investigated by the local authority and any complaint upheld for a statutory nuisance to occur.

However, dust deposition is generally managed by suitable on-site practices and mitigation rather than by the determination of statutory nuisance and/or prosecution or enforcement notice(s).

[8] Non-Road Mobile Machinery (Emission of Gaseous and Particulate Pollutants) (Amendment) Regulations 2014, SI 2014/1309
[9] Commission Directive 2012/46/EU of 6 December 2012 amending Directive 97/68/EC of the European Parliament and of the Council on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery
[10] Environmental Protection Act 1990, Chapter 43, Part III Statutory Nuisances and Clean Air

# 3 Planning Policy and Guidance

## 3.1 National Policy and Guidance

The land-use planning process is a key means of improving air quality, particularly in the long term, through the strategic location and design of new developments. Any air quality consideration that relates to land-use and its development can be material planning consideration in the determination of planning applications, dependent on the details of the Proposed Development.

### 3.1.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF)[11] was updated in July 2021 with the purpose of planning to achieve sustainable development. Paragraph 186 of the NPPF on air quality 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."*

In addition, paragraph 105 states that:

*"The planning system should actively manage patterns of growth in support of these objectives. 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.*

*However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making."*

Paragraph 174(e) discusses how planning policies and decisions should contribute to and enhance the natural and local environment. In relation to air quality, NPPF notes that this can be achieved 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 instability. Development should, wherever possible, help to improve local environmental conditions such as air*

[11] Ministry of Housing, Communities and Local Government (2021) National Planning Policy Framework

*and water quality, taking into account relevant information such as river basin management plans."*

### 3.1.2 Planning Practice Guidance

National Planning Practice guidance (PPG)[12] on various topics, including air quality was developed in order to support the NPPF. The guidance provides a concise outline as to how air quality should be considered in order to comply with the NPPF and states when air quality is considered relevant to a planning application. This includes factors such as changes in traffic volumes, vehicle speeds, congestion or traffic composition, the introduction of new point sources of air pollution, exposure of people to existing sources of air pollutants, and the potential to give rise to air quality impacts at nearby sensitive receptors.

### 3.1.3 Clean Air Strategy

Defra published an updated Clean Air Strategy in 2019[13], which sets targets for improving air quality across the country. It is aimed at tackling all sources of air pollution across the country, making air healthier to breathe, protecting nature and boosting the economy. It also includes actions for reducing emissions from various sources, such as transport, domestic activities, farming and industry. There is also a long-term target for reducing population exposure to $PM_{2.5}$ concentrations to meet the World Health Organisation (WHO) target of $10\mu g/m^3$as an annual mean. In particular, the Clean Air Strategy states:

*"New legislation will create a stronger and a more coherent framework for action to tackle air pollution. This will be underpinned by new England-wide powers to control major sources of air pollution, in line with the risk they pose to public health and the environment, plus new local powers to take action in areas with an air pollution problem. These will support the creation of Clean Air Zones to lower emissions from all sources of air pollution, backed up with clear enforcement mechanism."*

It is important to note that in September 2021, the WHO published updated air quality guideline (AQG) levels [14], these include interim targets and ultimately, lower annual mean levels than previous. These include an annual mean reduction of $NO_2$ from the previous level of $40\mu g/m^3$ to $10\mu g/m^3$, $PM_{2.5}$ from $10\mu g/m^3$ to $5\mu g/m^3$ and $PM_{10}$ from the previous level of $20\mu g/m^3$ to $15\mu g/m^3$. However, the new WHO guidelines are currently not legally binding in the UK, and the Clean Air Strategy will continue with the aim of meeting the previous WHO levels until an amendment or new legislation supersedes this document.

[12] Department for Housing, Communities and Local Government (2019) Planning Practice Guidance: Air Quality
[13] Defra (2019). Clean Air Strategy 2019.
[14] WHO Global Air Quality Guidelines, 2021. Available at: https://apps.who.int/iris/bitstream/handle/10665/345334/9789240034433-eng.pdf?sequence=1&isAllowed=y

### 3.1.4 Local Air Quality Management Policy Guidance and Technical Guidance

The policy guidance note, LAQM.PG(16)[15] provides additional guidance on the links between transport and air quality and the links between air quality and the land use planning system. It summarises the main ways in which the land-use planning system can help deliver compliance with the air quality objectives. This is relevant to any external organisations who may wish to engage with the local authority to assist in the delivery of their statutory duties on managing air quality. The technical guidance, LAQM.TG(16)[16] is designed to support local authorities in carrying out their duties to review and assess air quality in their area. It provides detailed guidance on how to assess the impact of measures using existing air quality tools. Where relevant, this guidance has been taken into account in this assessment.

### 3.1.5 Institute of Air Quality Management Dust Guidance

The latest Institute of Air Quality Management (IAQM) guidance[17] provides guidance to development consultants and environmental health officers on how to assess air quality impacts from construction. The IAQM guidance provides a method for classifying the significance of effect from construction activities based on the 'dust magnitude' (high, medium or low) and proximity of the site to the closest receptors. The guidance recommends that once the significance of effect from construction is identified, the appropriate mitigation measures are implemented. Experience has shown that once the appropriate mitigation measures are applied in most cases the resulting dust impacts can be reduced to negligible levels.

## 3.2 Local Policy and Guidance

### 3.2.1 Gloucester, Cheltenham, and Tewkesbury Joint Core Strategy

The Gloucester, Cheltenham, and Tewksbury Joint Core Strategy, 2017[18] will guide the location, scale and type of future development in the city of Gloucester up to 2031. This strategy is the adopted local plan. The strategy provides policies that will be used in determining planning applications and will guide the local plan for air quality.

Relating to air quality, 'Policy SD14 – Health and Environmental Quality' states that "*new developments must not result in unacceptable levels of air pollution*

[15] Defra (2016) Local Air Quality Management Policy Guidance PG(16).
[16] Defra (2016) Local Air Quality Management Technical Guidance TG(16)
[17] IAQM (2016) Guidance on the Assessment of Dust from Demolition and Construction (Version 1.1)

[18] Gloucester, Cheltenham and Tewksbury Joint Core Strategy 2011-2031. Available at: https://www.gloucester.gov.uk/media/5441/jcs.pdf

*with respect to relevant national and EU limit values or result in exposure to unacceptable risk from existing or potential sources of pollution*".

# 4 Methodology of Assessment

The overall approach to the air quality assessment comprises:

- A review of existing air quality conditions at, and in the vicinity of the Site;
- An assessment of the dust risk from construction phase activities; and
- Formulation of mitigation measures, where appropriate, to ensure any adverse effects on air quality are minimised.

## 4.1 Methodology of Baseline Assessment

Existing or baseline ambient air quality refers to the concentrations of relevant substances that are already present in the environment. These are present from various sources, such as industrial processes, commercial and domestic activities, traffic and natural sources.

The following data sources have been used to determine the baseline and future conditions of air quality in the study area:

- GCC Air Quality Annual Status Report (ASR)[19];
- The Defra Local Air Quality Management website[20]; and
- The Environment Agency (EA) website[21].

The review identified the main sources of air pollution within a radius of 2km around the Site, local air quality monitoring data for recent years and local background pollutant concentrations.

## 4.2 Methodology of Construction Assessment

### 4.2.1 Construction Dust

It is anticipated that the Proposed Development will include demolition, construction and trackout activities.

The IAQM dust guidance[19] has been used to assess the impacts from dust on local sensitive receptors.

An 'impact' is described as a change in pollutant concentrations or dust deposition, while an 'effect' is described as the consequence of an impact. The main impacts that may arise during demolition and construction of the Proposed Development are:

- Dust deposition, resulting in the soiling of surfaces;

[19] Gloucester City Council. 2020 Air Quality Annual Status Report (ASR).
[20] Defra, Local Air Quality Management website. Available at: http://laqm.defra.gov.uk/[Accessed: November 2021]
[21] Environment Agency website, https://environment.data.gov.uk/public-register/view/searchindustrial-installations [Accessed: November 2021]

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

The IAQM guidance[19] considers the potential for dust emissions from dust generating activities such as demolition of existing structures, earthworks, construction of new structures and trackout. Trackout is the transport of dust and dirt from the site onto the public road network where it may be deposited and then re-suspended by vehicles using the network. This arises when vehicles leave the site with dust materials, which may then spill onto the road, or when they travel over muddy ground on site and then transfer dust and dirt onto the road network. For the Proposed Development, scope for earthworks is limited as the proposed works are largely a refurbishment and refit, therefore this source of dust emission is Small.

For each of these dust-generating activities, the guidance considers three separate effects: annoyance due to dust soiling; harm to ecological receptors; and the risk of health effects due to a significant increase in $PM_{10}$ exposure. The receptors can be human or ecological and are chosen based on their sensitivity to dust soiling and $PM_{10}$ exposure.

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

There are five steps in the assessment process described in the IAQM guidance. These are summarised in Figure A.1, presented in Appendix A, and a further description is provided in the following paragraphs.

**Step 1: Need for assessment**

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

**Step 2: Assess the risk of dust impacts**

This step is split into three sections as follows:

- 2A. Define the potential dust emission magnitude;
- 2B. Define the sensitivity of the area; and
- 2C. Define the risk of impacts.

Each of the dust-generating activities is given a dust emission magnitude depending on the scale and nature of the works (step 2A) based on the criteria shown in Table A.1.

The sensitivity of the surrounding area is then determined (step 2B) for each dust effect from the above dust-generating activities, based on the proximity and number of receptors, their sensitivity to dust, the local $PM_{10}$ background concentrations and any other site-specific factors. The criteria for defining the sensitivity of the area to different dust effects is shown in Table A.1 to Table A.4.

The overall risk of the impacts for each activity is then determined (step 2C) prior to the application of any mitigation measures using Table A.5 and an overall risk for the site derived.

**Step 3: Determine the site-specific mitigation**

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

**Step 4: Determine any significant residual effects**

Once the risk of dust impacts has been determined and the appropriate dust mitigation measures identified, the final step is to determine whether there are any residual significant effects. The IAQM guidance notes that it is anticipated that with the implementation of effective site-specific mitigation measures, the environmental effect will not be significant in most cases.

**Step 5: Prepare a dust assessment report**

The last step of the assessment is the preparation of a Dust Assessment Report. This forms part of this report.

### 4.2.2 Construction Traffic

#### 4.2.2.1 Construction traffic data

The construction traffic movements for the Proposed Development have not been finalised, however, an estimate of between 10-50 HDVs at any one time has been given, furthermore, our experience on projects of similar size and scope indicate that construction traffic will be below the EPUK/IAQM**Error! Bookmark not defined.** threshold criteria. However, if, when details are finalised that the criteria are exceeded, a detailed assessment may be required after discussion with GCC and the Client.

### 4.2.3 Other on-site sources

There will also be minor emissions associated with various on-site activities during construction from associated vehicles, however these will be temporary. During operation, minor emission sources will be from vehicles using the car park, however this will be decreased from its current capacity to 5 car park spaces.

# 5 Baseline Assessment

## 5.1 Sources of Air Pollution

### 5.1.1 Industrial Processes

Industrial air pollution sources are regulated through a system of operating permits or authorisations, requiring stringent emission limits to be met and ensuring that any releases to the environment are minimised or rendered harmless. Regulated (or prescribed) industrial processes are classified as Part A or Part B processes and are regulated through the Pollution Prevention and Control (PPC) system[22,23]. The lcarger more polluting processes are regulated by the EA, and the smaller less polluting ones by the local authorities. Local authorities tend also to regulate only for emissions to air, whereas the EA regulates emissions to air, water and land.

There are no EA regulated processes with relevant releases to air within 2km of the Proposed Development.

The contribution of all industrial processes to local air quality are assumed to be included in the background concentrations for this assessment (Section 5.3).

### 5.1.2 Road Traffic

In recent decades, atmospheric emissions from transport on a national basis have grown to match or exceed other sources in respect of many pollutants, particularly in urban areas.

The main air quality issues are associated with the emission of pollutants from road traffic. The main pollutant of concern is $NO_2$. Within the ASR[19], road traffic has consistently been cited as the principal cause of poor air quality in GCC.

The Proposed Development is located at the former Debenhams department store in Gloucester city centre. The Site is bound by St. Aldate Street to the north, King's Square to the east, and shopping streets, Oxbode Lane and Northgate Street to the south and west, respectively.

The main source of pollution in the local area is the A430 and other local roads which given its urban nature, can be frequently congested. However, immediately fronting the Site, King's Square to the east is pedestrianised and The Oxebode to the south is a no-through road used predominately for taxi pick up and drop off, it is therefore considered that the Site will not be significantly affected by road traffic emissions.

[22] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)
[23] The Environmental Permitting (England and Wales) (Amendment) Regulations 2013, SI 2013/390

## 5.2 Local Air Quality

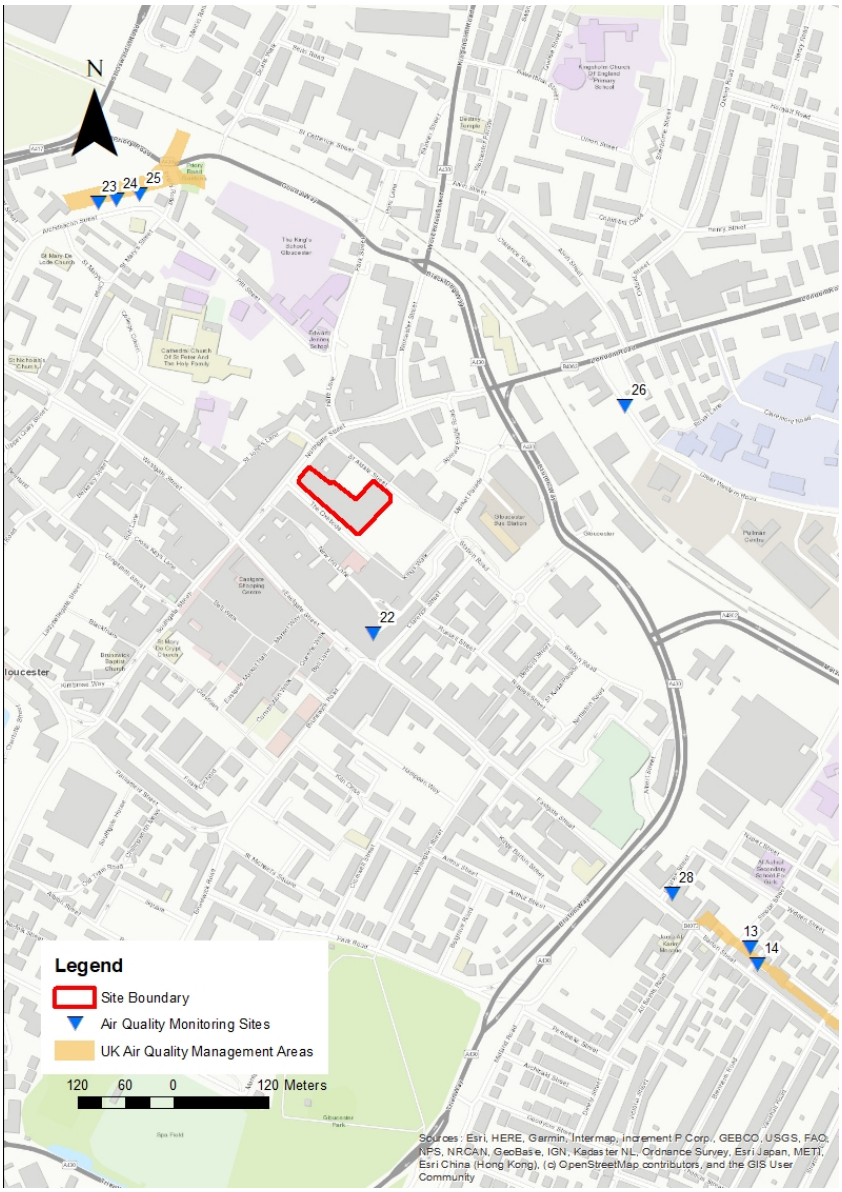
The Environment Act 1995[6] requires local authorities to review and assess air quality with respect to the objectives for seven pollutants specified in the National Air Quality Strategy. Local authorities are required to carry out an assessment and produce an ASR. If the ASR identifies potential hotspot areas likely to exceed air quality objectives, then a detailed assessment of those areas is required. Where objectives are not predicted to be met, local authorities must declare the area an AQMA. In addition, local authorities are required to produce an AQAP, which includes measures to improve air quality within the AQMA.

There are 8 Air Quality Management Areas (AQMA) declared by GCC, and the main source of the pollutants in these areas is road traffic. The Proposed Development is not within an AQMA. The nearest AQMAs are Priory Road and Barton Street, approximately 380m and 650 m from the site, respectively. These AQMAs were both declared in 2005 for exceedances in the annual mean nitrogen dioxide ($NO_2$) standard.

### 5.2.1 Local Monitoring Data

GCC undertakes passive monitoring of air quality with the use of diffusion tubes. There are four diffusion tube sites for $NO_2$ within 2km of the Proposed Development, with the nearest site being approximately 130m south of the Site. Table 3 presents details and monitoring data for these sites for the past five years. There are no continuous monitoring sites within 2km of the Proposed Development. The locations of the monitoring sites considered in this assessment are provided in Figure 2.

Figure 2: Local authority monitoring and AQMA locations




The $NO_2$ annual mean standard was exceeded at two monitoring sites in 2015 – 2019, with one, site 23, in exceedance in 2019, however this site is located within the Priory Road AQMA. Sites 28, 23, and 20 are located closer to road sources that are more heavily trafficked than that of the Site, and therefore represent a worst-case. However, sites 28 and 20 were all in compliance of the annual mean $NO_2$ objective. ID 22, an urban background site approximately 130m south of the Site, is considered most representative of the conditions across the Proposed Development. Site 22, Gloucester Guildhall, has been below the annual mean $NO_2$ standard across the past five years; in 2019 the $NO_2$ concentration was 17.7µg/m$^3$, there has been a general downtrend in $NO_2$ concentrations since 2016.

Table 3: Local air quality monitoring data for annual mean $NO_2$ concentrations

| ID | Site | X OS Grid Ref | Y OS Grid Ref | Location Type | Distance from Site (km) | Annual mean $NO_2$ Concentration ($\mu g/m^3$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 2015 | 2016 | 2017 | 2018 | 2019 |
| 22 | Gloucester Guildhall | 383243 | 218489 | Urban Background | 0.1 (S) | 18.7 | 18.6 | 17.3 | 18.1 | 17.7 |
| 28 | GL1 | 383619 | 218162 | Roadside | 0.6 (SE) | - | **42.4** | 36.8 | 38.1 | 24.2 |
| 23 | 46 Priory Road | 382898 | 219029 | Roadside | 0.6 (NW) | **40.3** | **44.9** | **42.8** | **46.3** | **40.5** |
| 20 | 53 Barnwood Road | 385113 | 218595 | Roadside | 2.1 (E) | 35.0 | 36.5 | 36.5 | 33.0 | 34.7 |
| Note: **Bold** indicates an exceedance of the $NO_2$ annual mean concentration of $40\mu g/m^3$. | | | | | | | | | | |

## 5.3 Background Concentrations

Background concentrations refer to the existing levels of pollution in the atmosphere, produced by a variety of stationary and non-stationary sources, such as roads and industrial processes. To compliment the GCC monitoring data, Defra predicted background concentrations are used in this assessment.

The Defra website includes estimated background pollutant concentrations for NOx, $NO_2$, $PM_{10}$ and $PM_{2.5}$ for each 1 km by 1 km OS grid square. Background pollutant concentrations for the existing baseline year of 2019 and the indicative opening year of the Proposed Development of 2023, have been obtained for the grid squares surrounding the Site and are shown in Table 4.

Grid Square 383500; 218500 represents the grid location of the Site. It can be observed that the annual mean background concentrations are all below the relevant air quality standards for all pollutants. Moreover, all relevant pollutants are trending downwards in future years as a result of continued fleet renewal, improved technologies and more stringent policy and regulations.

Table 4: Defra background pollutant concentrations for baseline, interim and opening year

| OS Grid Square | Year | Annual mean Concentration (µg/m$^3$) | | |
|---|---|---|---|---|
| | | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ |
| 383500; 218500 | 2019 | 15.3 | 14.7 | 9.8 |
| | 2021 | 14.2 | 14.2 | 9.4 |
| | 2023 | 13.4 | 14.0 | 9.3 |
| **Air Quality Standard (µg/m$^3$)** | | 40 | 40 | 20 |

## 5.4 Summary

Monitoring sites 28, 23, and 20 represent a worst-case and are likely to most closely reflect conditions at the northern boundary fronting Northgate Street of the Proposed Development.

Site 22 is considered most representative of the Site and has been below the annual mean standard across the past five years; in 2019 the $NO_2$ concentration was 17.7µg/m$^3$. Furthermore, Defra predicted background concentrations are in compliance with all relevant standards.

It is therefore expected that concentrations will below the standards across the Site for all relevant objectives.

# 6 Construction Assessment

## 6.1 Construction Activities

The effects of demolition, construction and trackout activities on local air quality, are considered below. It is important to note that a CMP has not yet been produced, and therefore, the following section is based on professional judgement and Arup's experience on projects of similar size and scope.

### 6.1.1 Sensitive Receptors

Sensitive human receptors are defined as those residential properties/ schools/ hospitals/ places of work that are likely to experience a change in pollutant concentrations and/or dust nuisance due to the construction of the Proposed Development. There are no national or international designated ecological sites within 50m of the Site nor within 50m of the 500m of likely construction trackout routes from the Site. Note that 500m is given to provide a worst-case conservative scenario.

### 6.1.2 Dust Emission Magnitude

Following the methodology outlined in Section 4.2, each dust-generating activity has been assigned a dust emission magnitude as shown in Table 5.

Table 5: Dust emission magnitude for construction activities

| Activity | Dust Emission Magnitude | Reasoning |
|---|---|---|
| Demolition | Small | The Proposed Development will include the refit of the existing Debenhams building including works to the façade.<br><br>The Proposed Development is predominately a refit, and therefore demolition is limited.<br><br>The potential dust risk magnitude is therefore **'Small'**. |
| Earthworks | N/A | The Proposed Development is to predominantly retain the existing building and refurbish with some minor works taking place in the service yard, however, there is limited scope for earthwork activities to occur. |
| Construction | Small | The majority of the planed works will consist of refit of the existing building. |

| Activity | Dust Emission Magnitude | Reasoning |
|---|---|---|
| | | The potential dust risk magnitude is therefore **'Small'**. |
| Trackout | Medium | There will be between 10 - 50 outward movements of HGV in any one day. Given our experience on projects of similar size and scope, this assumption is reasonable. Details regarding the construction trackout route are yet to be confirmed, however, it is assumed this will occur from the service yard towards St. Aldate Street.<br><br>The potential dust risk magnitude is therefore **'Medium'**. |

### 6.1.3 Sensitivity of the Area

There are 10-100 receptors within 20m of the Proposed Development. The closest residential receptors are on St Aldate Street above the ground floor commercial premises. As such the area's sensitivity has been classified as 'high' for dust soiling according to the IAQM guidance.

The annual mean background $PM_{10}$ concentration is less than 24µg/m$^3$. As there are an estimated to be 10-100 high sensitivity receptors within 20m of the Proposed Development, the sensitivity of the area to human health impacts has been assigned as 'low'. The construction dust buffer distances for the Site are provided in Figure 3. The trackout dust buffer distances for the indicative trackout route are provided in Figure 4.

There are no ecological receptors within 50 m of the Proposed Development, therefore, it is not considered any further.

The overall sensitivity has been summarised as shown in Table 6.

Table 6: Sensitivity of the surrounding area to impacts on dust soiling and human health

| Potential impact | Sensitivity of the surrounding area for all construction activities |
|---|---|
| Dust soiling | High |
| Human health | Low |

Using the criteria set out in the risk of dust impacts table (Table A1:5) the impacts on the area without mitigation are defined.

Figure 3: Construction dust buffers

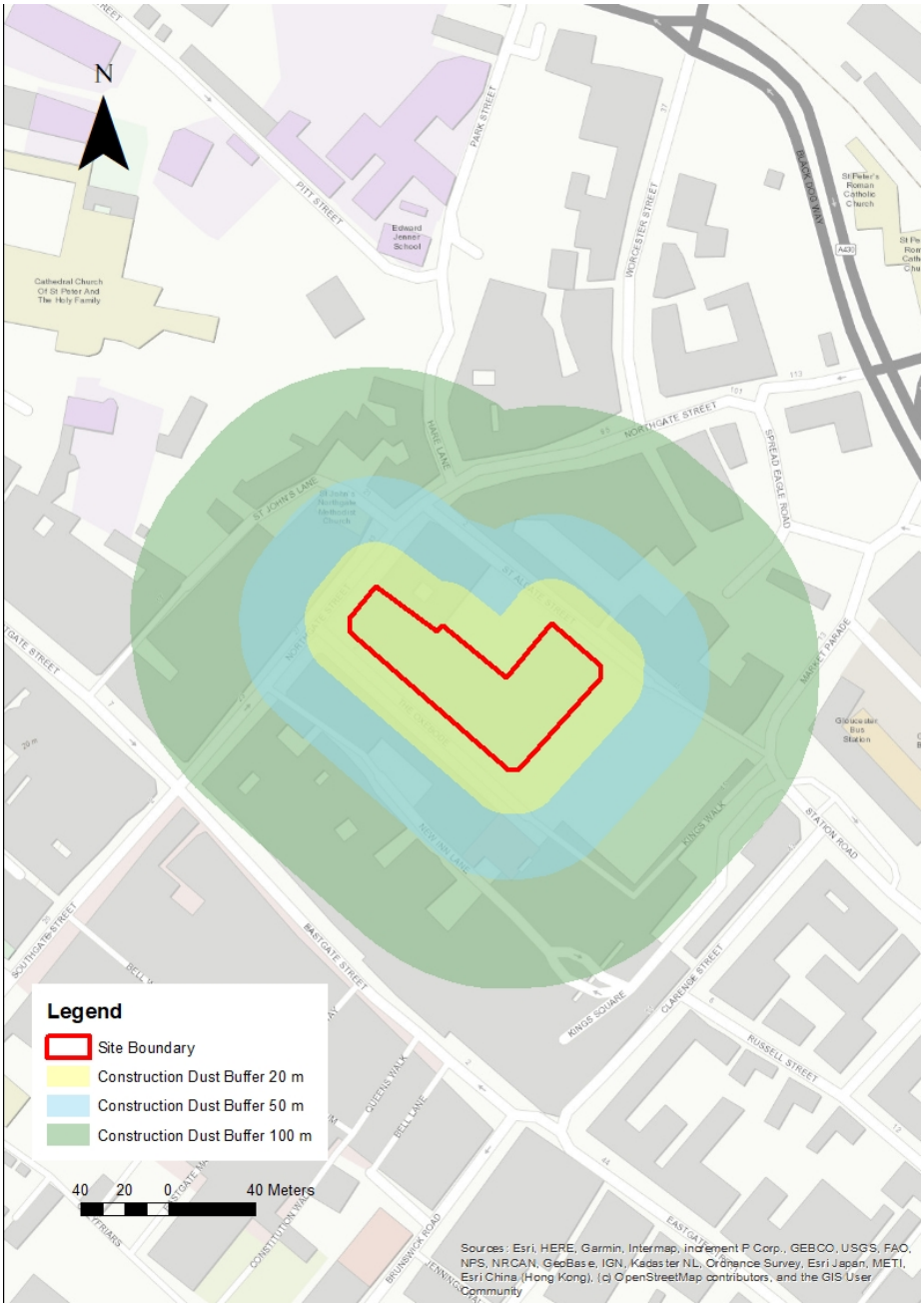
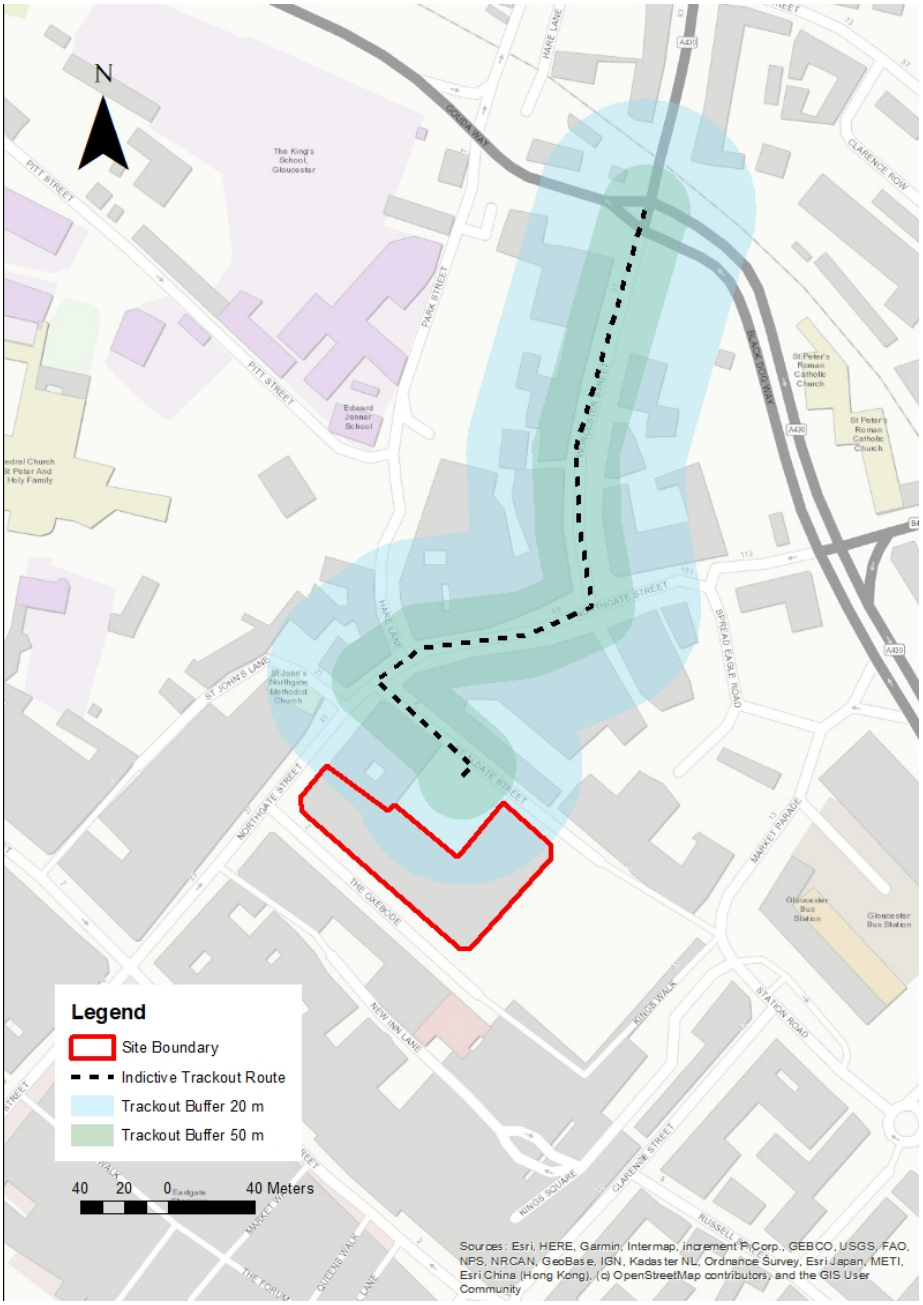



Figure 4: Trackout dust buffers




### 6.1.4 Risk of impacts

Taking into consideration the dust emission magnitude and the sensitivity of the area, the risk of impacts has been derived and presented in Table 7. The dust risk ranges from low to high, while the human health risk is low for all activities. With the appropriate best practice mitigation measures (outlined in Section 8.1) in place, there is likely to be a negligible effect from the dust-generating activities on site.

Table 7: Summary dust risk table prior to mitigation

| **Sensitivity of the Area** | **Dust mission Magnitude** | | |
|---|---|---|---|
| | **Demolition** | **Construction** | **Trackout** |
| Dust Soiling | Low Risk | Low Risk | Medium Risk |
| Human Health | Negligible | Negligible | Low Risk |

# 7 Mitigation

## 7.1 Construction

### 7.1.1 Construction Dust

The dust generating activities assessed can be greatly reduced or eliminated by applying the site-specific mitigation measures for the Site according to the IAQM guidance. The guidance notes that it is anticipated that with the implementation of effective site-specific mitigation measures, the environmental effect is likely to be 'not significant' in most cases.

Medium risk mitigation measures for the general site, and measures specific to the risks identified for construction activities, are identified following the assessment.

The following measures from the guidance are relevant and should be included in a Construction Environmental Management Plan (CEMP) for the Site.

**General**

- Develop and implement a stakeholder communications plan that include community engagement before work commences 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 environment manager/engineer or the site manager.
- Display the head or regional office contact information.
- Develop and implement a Dust Management Plan, to be incorporated into the wider CEMP, which will include measures to control other emissions, approved by GCC.

**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 GCC when asked.
- Record any exceptional incidents that cause dust and/or air emissions, either on-site or off-site and the action taken to resolve the situation in the log book.

**Monitoring**

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to GCC when asked. This should include regular dust soiling checks of surfaces such as street furniture and cars within 100m of site boundary.
- Carry out regular site inspections to monitor compliance with the Dust Management Plan, record inspection results and make an inspection log available GCC, 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.
- Liaise with GCC regarding the need for air quality monitoring during construction. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

**Site Maintenance**

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible.
- 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.

**Operating Vehicles/Machinery and Sustainable Travel**

- Ensure all vehicles switch off 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.
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
- Ensure vehicles entering and leaving the Site are covered to prevent escape of materials during transport.
- Implement a Travel Plan that supports and encourages sustainable 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.
- 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 and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use the fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on site to clean and dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet clean methods.

**Measures Specific to Construction**

- Avoiding scabbling (roughening of concrete surfaces).

- For smaller supplies of final 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.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving the Site are covered to present escape of materials during transport;
- Access gates to be located at least 10m from receptors where possible.

## 7.2 Operational

The change in pollutant concentrations attributable to the additional vehicle movements during the operational phase of the Proposed Development is negligible for all relevant pollutants, and therefore, no mitigation is required for any human receptor locations.

# 8 Conclusion

An assessment of the potential impacts on local air quality impacts arising from operation of the Proposed Development has been undertaken.

Site impacts were screened and all elements other than the construction dust risk assessment were scoped out of requiring further assessment following industry best practice.

A qualitative assessment of the potential impacts on local air quality from construction activities for the Proposed Development has been carried out using the IAQM methodology. This identified low to medium risk for dust soiling and negligible to low risk for health impacts. However, with the appropriate best practice mitigation measures in place as defined in section 7, the residual effect from the dust-generating activities on site is likely to be 'not significant'.

Following review of the current monitoring and Defra predicted background data, it is likely that the Proposed Development would be in compliance of all relevant air quality objectives based on the most recent published data. Furthermore, come the likely opening year of the development, it is likely concentrations will have fallen further due to national trends.

# Appendix A – Construction Dust

An 'impact' is described as a change in pollutant concentrations or dust deposition, while an 'effect' is described as the consequence of an impact. The main impacts that may arise during construction of the proposed development are:

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

The IAQM guidance considers the potential for dust emissions from dust-generating activities, such as demolition, earthworks, construction of new structures and trackout. Earthworks refer to the processes of soil stripping, ground levelling, excavation and land capping, while trackout is the transport of dust and dirt from the site onto the public road network where it may be deposited and then re-suspended by vehicles using the network. This arises when vehicles leave the site with dusty materials, which may then spill onto the road, or when they travel over muddy ground on-site and then transfer dust and dirt onto the road network.

For each of these dust-generating activities, the guidance considers three separate effects: annoyance due to dust soiling; harm to ecological receptors; and the risk of health effects due to a significant increase in $PM_{10}$ exposure. The receptors can be human or ecological and are chosen based on their sensitivity to dust soiling and $PM_{10}$ exposure. Human receptors include locations where people spend time and where property may be impacted by dust. Ecological receptors include international and European designations and habitats that might be sensitive to dust.

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

There are five steps in the assessment process described in the IAQM guidance. These are summarised in **Error! Reference source not found.** and a further description is provided in the following paragraphs.

### Step 1: Need for assessment

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

## Step 2: Assess risk of dust impacts

This step is split into three sections as follows:

- 2A. Define the potential dust emission magnitude;
- 2B. define the sensitivity of the area; and
- 2C. Define the risk of impacts.

Each of the dust-generating activities is given a dust emission magnitude depending on the scale and nature of the works (step 2A) based on the criteria shown in Table A.1.

Table A.1: Dust emission magnitude

| **Dust emission magnitude** | | |
|---|---|---|
| **Small** | **Medium** | **Large** |
| **Demolition** | | |
| • total building volume <20,000m$^3$<br>• construction material with low potential for dust release (e.g. metal cladding or timber)<br>• demolition activities <10m above ground<br>• demolition during wetter months | • total building volume 20,000 - 50,000m$^3$<br>• potentially dusty construction material<br>• demolition activities 10 - 20m above ground level | • total building volume >50,000m$^3$<br>• potentially dusty construction material (e.g. concrete)<br>• on-site crushing and screening<br>• demolition activities >20m above ground level |
| **Earthworks** | | |
| • total site area <2,500m$^2$<br>• soil type with large grain size (e.g. sand)<br>• <5 heavy earth moving vehicles active at any one time<br>• formation of bunds <4m in height<br>• total material moved <10,000 tonnes<br>• earthworks during wetter months | • total site area 2,500m$^2$ - 10,000m$^2$<br>• moderately dusty soil type (e.g. silt)<br>• 5 – 10 heavy earth moving vehicles active at any one time<br>• formation of bunds 4 – 8m in height<br>• total material moved 20,000 - 100,000 tonnes | • total site area >10,000m$^2$<br>• potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size)<br>• >10 heavy earth moving vehicles active at any one time<br>• formation of bunds >8m in height<br>• total material moved >100,000 tonnes |
| **Construction** | | |
| • total building volume <25,000m$^3$<br>• construction material with low potential for dust release (e.g. metal cladding or timber) | • total building volume 25,000 - 100,000m$^3$<br>• potentially dusty construction material (e.g. concrete)<br>• on-site concrete batching | • total building volume >100,000m$^3$<br>• on-site concrete batching<br>• sandblasting |
| **Trackout** | | |

| Dust emission magnitude | | |
|---|---|---|
| **Small** | **Medium** | **Large** |
| • <10 HDV (>3.5t) outward movements in any one day<br>• surface material with low potential for dust release<br>• unpaved road length <50m | • 10 – 50 HDV (>3.5t) outward movements in any one day<br>• moderately dusty surface material (e.g. high clay content)<br>• unpaved road length 50 – 100m; | • >50 HDV (>3.5t) outward movements in any one day<br>• potentially dusty surface material (e.g. high clay content)<br>• unpaved road length >100m |

The sensitivity of the surrounding area is then determined (step 2B) for each dust effect from the above dust-generating activities, based on the proximity and number of receptors, their sensitivity to dust, the local $PM_{10}$ background concentrations and any other site-specific factors. Table A.2 to

Table A.4 show the criteria for defining the sensitivity of the area to different dust effects.

Table A.2: Sensitivity of the area to dust soiling effects

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

Table A.3: Sensitivity of the area to human health impacts

| **Background $PM_{10}$ concentrations (annual mean)** | **Number of receptors** | **Distance from the source (m)** | | | | |
|---|---|---|---|---|---|---|
| | | **< 20** | **< 50** | **< 100** | **< 200** | **< 350** |
| **High receptor sensitivity** | | | | | | |
| > 32µg/m$^3$ | > 100 | High | High | High | Medium | Low |
| | 10 – 100 | | | Medium | Low | |
| | < 10 | | Medium | Low | | |
| 28 – 32µg/m$^3$ | > 100 | High | High | Medium | Low | Low |
| | 10 – 100 | | Medium | Low | | |
| | < 10 | | | | | |
| 24 – 28µg/m$^3$ | > 100 | High | Medium | Low | Low | Low |
| | 10 – 100 | | | | | |
| | < 10 | Medium | Low | | | |

| Background $PM_{10}$ concentrations (annual mean) | Number of receptors | Distance from the source (m) | | | | |
|---|---|---|---|---|---|---|
| | | < 20 | < 50 | < 100 | < 200 | < 350 |
| < 24µg/m$^3$ | > 100 | Medium | Low | Low | Low | Low |
| | 10 – 100 | Low | | | | |
| | < 10 | | | | | |
| **Medium receptor sensitivity** | | | | | | |
| > 32µg/m$^3$ | > 10 | High | Medium | Low | Low | Low |
| | < 10 | Medium | Low | | | |
| 28 – 32µg/m$^3$ | > 10 | Medium | Low | Low | Low | Low |
| | < 10 | Low | | | | |
| 24 – 28µg/m$^3$ | > 10 | Low | Low | Low | Low | Low |
| | < 10 | | | | | |
| < 24µg/m$^3$ | > 10 | Low | Low | Low | Low | Low |
| | < 10 | | | | | |
| **Low receptor sensitivity** | | | | | | |
| – | > 1 | Low | Low | Low | Low | Low |

Table A.4: Sensitivity of the area for ecological impacts

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

The overall risk of the impacts for each activity is then determined (step 2C) prior to the application of any mitigation measures (Table A.5) and an overall risk for the site derived.

Table A.5: Risk of dust impacts

| Sensitivity of area | Dust emission magnitude | | |
|---|---|---|---|
| | Large | Medium | Small |
| **Demolition** | | | |
| High | High risk site | Medium risk site | Medium risk site |
| Medium | High risk site | Medium risk site | Low risk site |
| Low | Medium risk site | Low risk site | Negligible |
| **Earthworks** | | | |
| High | High risk site | Medium risk site | Low risk site |
| Medium | Medium risk site | Medium risk site | Low risk site |
| Low | Low risk site | Low risk site | Negligible |

| Sensitivity of area | Dust emission magnitude | | |
|---|---|---|---|
| | **Large** | **Medium** | **Small** |
| **Construction** | | | |
| High | High risk site | Medium risk site | Low risk site |
| Medium | Medium risk site | Medium risk site | Low risk site |
| Low | Low risk site | Low risk site | Negligible |
| **Trackout** | | | |
| High | High risk site | Medium risk site | Low risk site |
| Medium | Medium risk site | Low risk site | Negligible |
| Low | Low risk site | Low risk site | Negligible |

### Step 3: Determine the site-specific mitigation

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

### Step 4: Determine any significant residual effects

Once the risk of dust impacts has been determined and the appropriate dust mitigation measures identified, the final step is to determine whether there are any residual significant effects. The IAQM guidance notes that it is anticipated that with the implementation of effective site-specific mitigation measures, the environmental effect will not be significant in most cases.

### Step 5: Prepare a dust assessment report

The last step of the assessment is the preparation of a Dust Assessment Report. This forms part of this report

Figure A.1: IAQM dust assessment methodology