

**M Block, Former Gravesend &
Kent Hospital, Gravesend**

Air Quality Assessment

Gravesend Borough Council

M Block, Former Gravesend & Kent Hospital, Gravesend

Air Quality Assessment

Revision	Date	Notes	Author	Checked	Approved
1.0	29/04/2019	E2527	EP	AB	Dr Nick Davey
1.1	19/08/2022	E3331	EP	ND	Dr Nick Davey

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1 INTRODUCTION

1.1 Entran Limited has been commissioned to undertake an assessment of air quality impacts associated with the proposed provision of a mixed-used development (the 'Proposed Development') at M Block, Former Gravesend & Kent Hospital, Bath Street, Gravesend DA11 0DG.

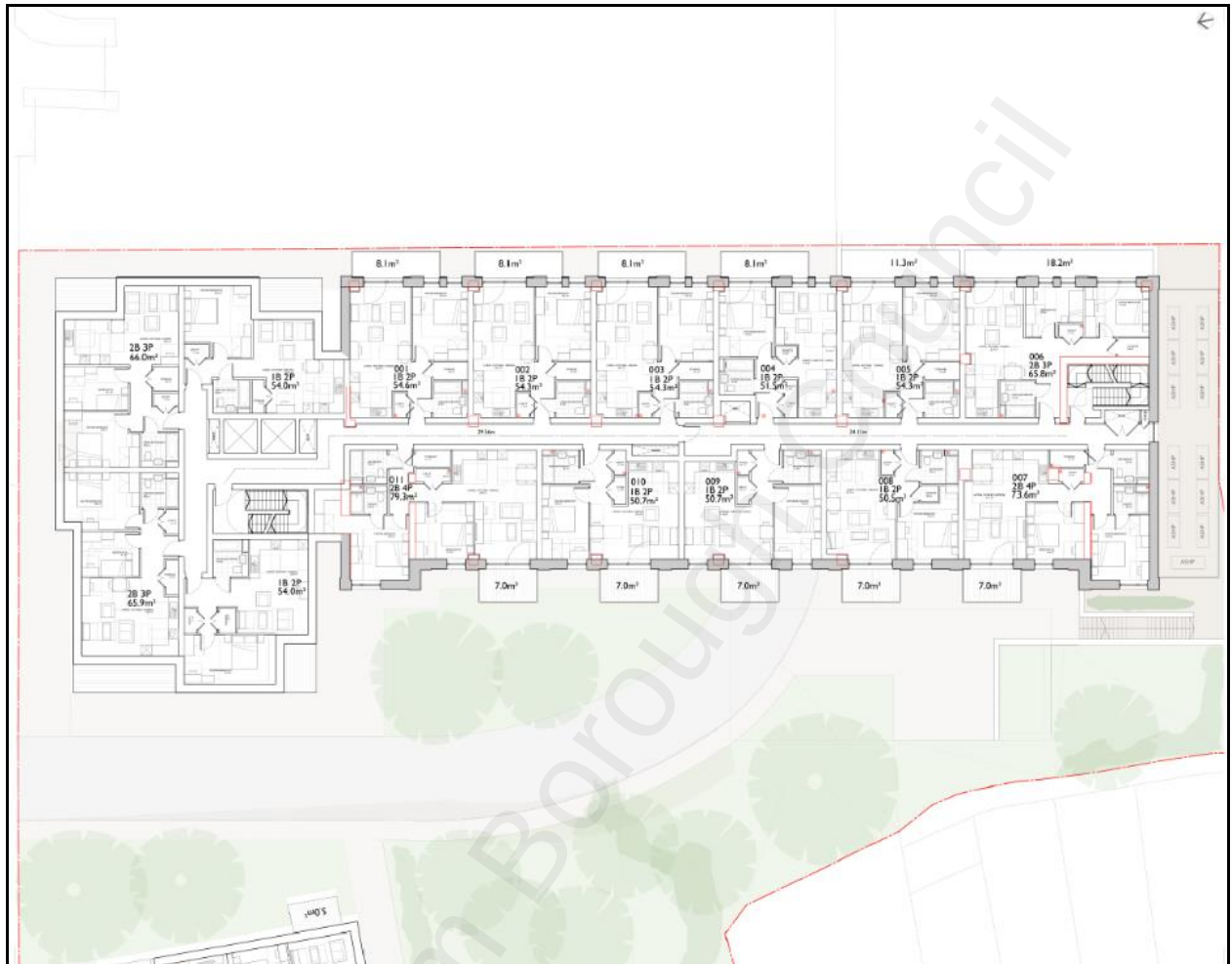
1.2 The Proposed Development will provide 61 residential units, amenity space and associated car and cycle parking. An indicative layout is shown in Figure 1.1.

1.3 The Proposed Development lies within the administrative area of Gravesham Borough Council (GBC). GBC has declared seven Air Quality Management Areas (AQMA). Six were declared due to exceedences of the AQS objective level for annual mean nitrogen dioxide (NO₂) and three were declared due to exceedences of the AQS objective levels for annual and 24-hour mean particulate matter (PM₁₀). The Proposed Development is not located within an AQMA; however, Bath Street, which borders the Proposed Development, is within the Gravesham A226 One-way System AQMA.

1.4 This report presents the findings of a detailed air quality assessment of the potential impacts of the Proposed Development on local air quality during the construction and operational phases. The source and significance of potential impacts are identified and the measures that should be employed to minimise these impacts are described. Consideration is also given to the suitability of the Proposed Development Site for its proposed end-use with regards to air quality.

1.5 A glossary of common air quality terminology is provided in **Appendix A**.

Figure 1.1: Proposed Site Layout (First Floor)



2 LEGISLATION AND POLICY

Air Quality Strategy for England, Scotland, Wales & Northern Ireland

2.1 The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007¹, pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

2.2 The AQS sets standards and objectives for ten main air pollutants to protect health, vegetation and ecosystems. These are benzene (C₆H₆), 1,3-butadiene (C₄H₆), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), particulate matter (PM₁₀, PM_{2.5}), sulphur dioxide (SO₂), ozone (O₃) and polycyclic aromatic hydrocarbons (PAHs).

2.3 The air quality standards are long-term benchmarks for ambient pollutant concentrations which represent negligible or zero risk to health, based on medical and scientific evidence reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). These are general concentration limits, above which sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

2.4 The air quality objectives are medium-term policy-based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedances of the standard over a given period.

2.5 For some pollutants, there is both a long-term (annual mean) standard and a short-term standard. In the case of nitrogen dioxide (NO₂), the short-term standard is for a 1-hour averaging period, whereas for fine particulates (PM₁₀) it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road).

¹ The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – July 2007.



2.6 The AQS also contains a framework for considering the effects of a finer group of particles known as 'PM_{2.5}'. Local Authorities are required to work towards reducing emissions / concentrations of PM_{2.5}, but there is currently no statutory objective incorporated into UK law at this time.

2.7 The AQS objective levels relevant to this assessment are set presented in **Appendix B**.

Local Air Quality Management (LAQM)

2.8 Part IV of the Environment Act 1995 also requires local authorities to periodically Review and Assess the quality of air within their administrative area. The Reviews have to consider the present and future air quality and whether any air quality objectives prescribed in Regulations are being achieved or are likely to be achieved in the future.

2.9 Where any of the prescribed air quality objectives are not likely to be achieved the authority concerned must designate that part an Air Quality Management Area (AQMA).

2.10 For each AQMA, the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the air quality objectives. Local authorities are not statutorily obliged to meet the objectives, but they must show that they are working towards them.

2.11 The Department of Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities in their Review and Assessment work². This guidance, referred to in this chapter as LAQM.TG(16), has been used where appropriate in the assessment.

National Planning Policy Framework

2.12 The National Planning Policy Framework (NPPF)³ sets out the Government's planning policies for England and how these are expected to be applied. At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with the principles and policies set out in the NPPF with the objective of contributing to the achievement of sustainable development.

² Department for Environment, Food and Rural Affairs (DEFRA), (2016): Part IV The Environment Act 1995 Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(16).

³ Ministry of Housing, Communities and Local Government: *National Planning Policy Framework* (July 2021).



2.13 The NPPF states that the planning system has three overarching objectives in achieving sustainable development including a requirement to *‘to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.’*

2.14 Under Section 15: Conserving and Enhancing the Natural Environment, the NPPF (paragraph 174) requires that *‘planning policies and decisions should contribute to and enhance the natural and local environment by ...preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible help to improve local environmental conditions such as air and water quality.’*

2.15 In dealing specifically with air quality the NPPF (paragraph 186) 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’.*

2.16 Paragraph 188 states that *‘the focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively.’*

Gravesham Local Plan

2.17 The Local Plan Core Strategy⁴ was adopted in September 2014 and is the main document in the Gravesham Local Plan. The following policy relevant to air pollution and the Proposed Development is contained within this document:

Policy CS19 – Development and Design Principles, which states

⁴ Gravesham Borough Council. (2014). Gravesham Local Plan Core Strategy.

'New development will be visually attractive, fit for purpose and locally distinctive. It will conserve and enhance the character of the local built, historic and natural environment, integrate well with the surrounding local area and meet anti-crime standards. The design and construction of new development will incorporate sustainable construction standards and techniques, be adaptable to reflect changing lifestyles, and be resilient to the effects of climate change. This will be achieved through the criteria set out below: [...]

New development will be located, designed and constructed to: [...]

- *Avoid adverse environmental impacts from pollution, including noise, air, odour and light pollution, and land contamination [...]*

Control of Dust and Particulates associated with Construction

2.18 Section 79 of the *Environmental Protection Act (1990)* provides the following definitions of statutory nuisance relevant to dust and particles:

- 'Any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance', and
- 'any accumulation or deposit which is prejudicial to health or a nuisance'.

2.19 Following this, Section 80 states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

2.20 In the context of the Proposed Development, the main potential for nuisance of this nature will arise during the construction phase – potential sources being the clearance, earthworks, construction and landscaping processes.

2.21 There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist – 'nuisance' is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred. However, research has been undertaken by a number of parties to determine community responses to such impacts and correlate these to dust deposition rates.



EPUK & IAQM Land Use Planning and Development Control

2.22 Environmental Protection UK (EPUK) & Institute of Air Quality Management (IAQM) published the Land Use Planning and Development Control Air Quality guidance in January 2017⁵ to provide guidance on the assessment of air quality in relation to planning proposals and ensure that air quality is adequately considered within the planning control process.

2.23 The main focus of the guidance is to ensure all developments apply good practice principles to ensure emissions and exposure are kept to a minimum. It also sets out criteria for identifying when a more detailed assessment of operational impacts is required, guidance on undertaking detailed assessments and criteria for assigning the significance of any identified impacts.

2.24 This guidance has been used within this assessment.

Assessment of Dust from Demolition and Construction

2.25 The IAQM published guidance in 2014 on the assessment of emissions from demolition and construction activities⁶. The guidance sets out an approach to identifying the risk of impacts occurring at nearby sensitive receptors from dust generated during the construction process and sets out recommended mitigation measures based on the identified risk.

2.26 This guidance has been used within this assessment.

Kent & Medway Air Quality Partnership Planning Guidance

2.27 The Kent & Medway Partnership Planning Guidance⁷ provides a methodology for assessing the air quality impacts of proposed developments in the Kent and Medway area. This guidance has been used within this assessment.

⁵ EPUK & IAQM. Land-use Planning and Development Control: Planning for Air Quality, January 2017

⁶ IAQM. Guidance on the assessment of dust from demolition and construction (version 1.1), February 2014.

⁷ Kent and Medway Air Quality Partnership Air Quality Planning Guidance (Mitigation Option B)

3 METHODOLOGY

Scope of Assessment

3.1 The scope of the assessment has been determined in the following way:

- Review of air quality data for the area surrounding the Proposed Development and background pollutant maps; and
- Review of the traffic flow data, which has been used as an input to the air quality modelling assessment.

3.2 There is the potential for impacts on local air quality during both the construction and operational phases of the Proposed Development. During the construction phase, there is the potential for impacts to occur as a result of dust and PM₁₀ emissions. Guidance provided by the IAQM includes the following criteria for assessing the effects of construction dust:

- A sensitive 'human receptor' within 350m of the Proposed Development site boundary or within 50m of the route used by construction vehicles on public highways up to 500m from the site entrance; and /or
- A sensitive 'ecological receptor' within 50m of the Proposed Development site boundary or within 50m of the route used by construction vehicles on the public highway, up to 500m from the site entrance.

3.3 There are several residential properties as well as Gravesham Community Hospital within 350m of the Proposed Development. An assessment of construction phase impacts of dust and particulate matter has therefore been included in this assessment. There are no sensitive ecological receptors within 50m of the site boundary or within 50m of the route used by construction vehicles up to 500m from the site entrance. An assessment of the impact of the construction phase on sensitive ecological habitats has therefore not been considered further.

3.4 During the operation of the Proposed Development there is the potential for impacts on local air quality to occur as a result of emissions from road vehicle trips generated by the operation of the Proposed Development. Based on the Department for Transport (DfT) thresholds for transport assessments as set out in Appendix 2 of the Kent and Medway Air Quality Planning Guidance the Proposed Development is classed as a 'major' development (i.e. >50 residential units). Following a review of the Proposed Development against checklist 1 and checklist 2 set out within the Guidance it is concluded that an air quality assessment is required.

3.5 Guidance provided by the EPUK & IAQM provides threshold criteria for establishing when significant impacts on local air quality may occur during the operation of a development and when a detailed assessment of potential impacts is required. At locations within an AQMA, a change in light duty vehicles (LDV) of more than 100 per day and / or a change in heavy duty vehicles (HDV) of more than 25 per day is considered to result in potentially significant impacts on air quality.

3.6 The Proposed Development is predicted to generate up to 313 trips per day. A detailed assessment of potential impacts from traffic related emissions has therefore been undertaken. Details of the assessment methodology and the specific issues considered are provided below.

Construction Phase Methodology

Introduction

3.7 To assess the potential impacts associated with dust and PM₁₀ releases during the construction phase and to determine any necessary mitigation measures, an assessment based on the latest guidance from the IAQM has been undertaken.

3.8 This approach divides construction activities into the following dust emission sources:

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

3.9 The risk of dust effects (low, medium or high) is determined by the scale (magnitude) and nature of the works and the proximity of sensitive human and ecological receptors.

3.10 The significance of dust effects is based on professional judgement, taking into account the sensitivity of receptors and existing air quality.

Dust Emission Magnitude

3.11 The magnitude of the dust impacts for each source is classified as Small, Medium or Large depending on the scale of the proposed works. Table 3.1 summarises the IAQM criteria that may be used to determine the magnitude of the dust emission. These criteria are used in combination with site specific information and professional judgement.

Table 3.1: Dust Emission Magnitude Criteria

Source	Large	Medium	Small
Demolition	- Total building volume >50,000m³ - Potentially dusty material (e.g. concrete) - Onsite crushing and screening - Demolition activities >20m above ground level.	- Total building volume 20,000 - 50,000m³ - Potentially dusty material - Demolition activities 10 - 20m above ground level.	- Total building volume <20,000m³ - Construction material with low potential for dust release - Demolition activities <10m above ground level - Demolition during wetter months
Earthworks	- Total site area >10,000m² - Potentially dusty soil type (e.g. clay) >10 heavy earth moving vehicles active at any one time - Formation of bunds >8m in height - Total material moved >100,000 tonnes	- Total site area 2,500 - 10,000m² - Moderately dusty soil type (e.g. silt) 5 - 10 heavy earth moving vehicles active at any one time - Formation of bunds 4 - 8m in height - Total material moved 20,000 - 100,000 tonnes	- Total site area <2,500m² - Soil type with large grain size (e.g. sand) <5 heavy earth moving vehicles active at any one time - Formation of bunds <4m in height - Total material moved <20,000 tonnes - Earthworks during wetter months
Construction	- Total building volume >100,000m³ - On site concrete batching - Sandblasting	- Total building volume 25,000 - 100,000m³ - Potentially dusty construction material (e.g. concrete) - On site concrete batching	- Total building volume <25,000m³ - Material with low potential for dust release (e.g. metal cladding or timber)
Trackout	>50 HGV movements in any one day (a) - Potentially dusty surface material (e.g. high clay content) - Unpaved road length >100m	10 - 50 HGV movements in any one day (a) - Moderately dusty surface material (e.g. silt) - Unpaved road length 50 - 100m	<10 HGV movements in any one day (a) - Surface material with low potential for dust release - Unpaved road length <50m
(a) HGV movements refer to outward trips (leaving the site) by vehicles of over 3.5 tonnes.			

Receptor Sensitivity

3.12 Factors defining the sensitivity of a receptor are presented in Table 3.2.

Table 3.2: Factors Defining the Sensitivity of a Receptor

Sensitivity	Human (health)	Human (dust soiling)	Ecological
High	- Locations where members of the public are exposed over a time period relevant to the air quality objectives for PM₁₀ (a) - Examples include residential dwellings, hospitals, schools and residential care homes.	- Regular exposure - High level of amenity expected. - Appearance, aesthetics or value of the property would be affected by dust soiling. - Examples include residential dwellings, museums, medium and long-term car parks and car showrooms.	- Nationally or Internationally designated site with dust sensitive features (b) - Locations with vascular species (c)
Medium	- Locations where workers are exposed over a time period relevant to the air quality objectives for PM₁₀ (a) - Examples include office and shop workers (d)	- Short-term exposure - Moderate level of amenity expected - Possible diminished appearance or aesthetics of property due to dust soiling - Examples include parks and places of work	- Nationally designated site with dust sensitive features (b) - Nationally designated site with a particularly important plant species where dust sensitivity is unknown
Low	- Transient human exposure - Examples include public footpaths, playing fields, parks and shopping streets	- Transient exposure - Enjoyment of amenity not expected. - Appearance and aesthetics of property unaffected - Examples include playing fields, farmland (e), footpaths, short-term car parks and roads	Locally designated site with dust sensitive features (b)
(a) In the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day. (b) Ecosystems that are particularly sensitive to dust deposition include lichens and acid heathland (for alkaline dust, such as concrete). (c) Cheffing C. M. & Farrell L. (Editors) (2005), The Vascular Plant. Red Data List for Great Britain, Joint Nature Conservation Committee. (d) Does not include workers exposure to PM₁₀ as protection is covered by Health and Safety at Work legislation. (e) Except commercially sensitive horticulture.			



3.13 The sensitivity of a receptor will also depend on a number of additional factors including any history of dust generating activities in the area, likely cumulative dust impacts from nearby construction sites, any pre-existing screening such as trees or buildings and the likely duration of the impacts. In addition, the influence of the prevailing wind direction and local topography may be of relevance when determining the sensitivity of a receptor.

Area Sensitivity

3.14 The sensitivity of the area to dust soiling and health impacts is dependent on the number of receptors within each sensitivity class and their distance from the source. In addition, human health impacts are dependent on the existing PM₁₀ concentrations in the area. Tables 3.3, 3.4 and 3.5 summarise the criteria for determining the overall sensitivity of the area to dust soiling, health impacts and ecological impacts respectively.

Table 3.3: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the source (a)			
		<20m	<50m	<100m	<350m
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low
(a) For trackout, the distance is measured from the side of roads used by construction traffic. Beyond 50m, the impact is negligible.					

Table 3.4: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM ₁₀ (µg/m ³)	Number of Receptors	Distance from the source (a)				
			<20m	<50m	<100m	<200m	<350m
High	> 32	> 100	High	High	High	Medium	Low
		10 - 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 - 32	> 100	High	High	Medium	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 - 28	> 100	High	Medium	Low	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	< 24	> 100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Medium	>32	> 10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	28-32	> 10	Medium	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	<28	-	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low
(a) For trackout, the distance is measured from the side of roads used by construction traffic. Beyond 50m, the impact is negligible.							

Table 3.5: Sensitivity of Area to Ecological Impacts

Sensitivity of Area	Distance from the Source	
	<20m	<50m
High	High Risk	Medium Risk
Medium	Medium Risk	Low Risk
Low	Low Risk	Low Risk

3.15 For each dust emission source (demolition, construction, earthworks and trackout), the worst-case area sensitivity is used in combination with the dust emission magnitude to determine the risk of dust impacts.

Risk of Dust Impacts

3.16 The risk of dust impacts prior to mitigation for each emission source is presented in Tables 3.6, 3.7 and 3.8.

Table 3.6: Risk of Dust Impacts – Demolition

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

Table 3.7: Risk of Dust Impacts – Earthworks and Construction

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

Table 3.8: Risk of Dust Impacts - Trackout

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

Mitigation and Significance

3.17 The IAQM guidance provides a range of mitigation measures which are dependent on the level of dust risk attributed to the Proposed Development. Site specific mitigation measures are also included where appropriate.

3.18 The IAQM assessment methodology recommends that significance criteria are only assigned to the identified risk of dust impacts occurring from a construction activity following the application of appropriate mitigation measures. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effects will normally be negligible.

Construction Traffic

3.19 Construction traffic will contribute to existing traffic levels on the surrounding road network. The greatest potential for impacts on air quality from traffic associated with this phase of the Proposed Development will be in the areas immediately adjacent to the principal means of access for construction traffic.

3.20 Information is not currently available regarding the numbers of vehicles associated with construction; however, the flows are not predicted to be significant in terms of total emissions or construction duration.

Operational Phase Methodology

3.21 Air quality at the Proposed Development has been predicted using the ADMS Roads dispersion model (Version 5.0.0, April 2020). This is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

3.22 The ADMS Roads model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. Meteorological data from London City Airport the year 2019 has been used for the assessment.

3.23 The model has been used to predict road specific concentrations of oxides of nitrogen (NO_x) and Particulate Matter (PM₁₀ and PM_{2.5}) at selected receptors. The predicted concentrations of NO_x have been converted to NO₂ using the NO_x to NO₂ calculator available on the Defra air quality website⁸.

3.24 Traffic data for road links adjacent to the Proposed Development have been sourced from the Department for Transport website⁹.

3.25 A summary of the traffic data used in the assessment can be found in **Appendix C**. The data includes details of annual average daily traffic flows (AADT), vehicle speeds and percentage Heavy Duty Vehicles (HDV) for the assessment years considered. Low traffic speeds have been assigned to appropriate road links to account for congestion and queuing vehicles.

3.26 The following scenarios have been included in the assessment:

- 2019 – baseline traffic (for verification purposes);
- 2022 – baseline traffic (hereafter referred to as ‘without development’ scenario); and
- 2022 – baseline and development traffic (hereafter referred to as ‘with development’ scenario).

3.27 The emission factors released by Defra in November 2021, provided in the emissions factor toolkit EFT2021 v11.0 have been used to predict traffic related emissions in 2019 (for verification purposes) and 2022.

3.28 To predict local air quality, traffic emissions predicted by the model must be added to local background concentrations. Background concentrations of NO₂, PM₁₀ and PM_{2.5} have been taken from the 2018 Defra background maps (issued August 2020). The maps provide an estimate of background concentrations between 2018 and 2030. The data used for the modelling assessment are set out in Table 4.4.

⁸ <http://uk-air.defra.gov.uk>

⁹ <https://www.dft.gov.uk/traffic-counts/cp.php?la=Kent>

3.29 Background concentrations for 2019 have been used to predict concentrations in 2022 assuming no change in future years. This is considered to represent a worst-case prediction of future concentrations.

3.30 To determine the performance of the model at a local level, a comparison of modelled results with the results of monitoring carried out within the study area was undertaken. This process aims to minimise modelling uncertainty and systematic error by correcting the modelled results by an adjustment factor to gain greater confidence in the final results. This process was undertaken using the methodology outlined in Chapter 7, Section 4 of LAQM.TG(16).

3.31 A verification factor of 4.22 was determined which indicates that the model is under-predicting in this area. This factor was applied to the modelled road-NO_x concentrations prior to conversion to annual mean NO₂ concentrations using the NO_x to NO₂ calculator. Further details of the determination of the verification factor are provided in **Appendix D**.

3.32 Local roadside monitoring data was not available for concentrations of PM₁₀ and PM_{2.5}, the modelled pollutant road-contributions for PM₁₀ and PM_{2.5} were therefore adjusted using the verification factor obtained for NO_x as recommended in the guidance provided in LAQM.TG(16).

3.33 LAQM.TG(16) does not provide a method for the conversion of annual mean NO₂ concentrations to 1-hour mean NO₂ concentrations. However, research¹⁰ has concluded that exceedances of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m³. Care has been taken to ensure that locations where the 1-hour mean objective is relevant are included in the assessment.

3.34 A quantitative assessment of air quality in the vicinity of the Proposed Development has been completed against the Air Quality Strategy objectives set out in **Appendix B** for NO₂, PM₁₀ and PM_{2.5}.

¹⁰ D. Laxen and B Marner (2003) Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites



Sensitive Receptors

3.35 LAQM.TG(16) describes in detail typical locations where consideration should be given to pollutants defined in the Regulations. Generally, the guidance suggests that all locations '*where members of the public are regularly present*' should be considered. At such locations, members of the public will be exposed to pollution over the time that they are present, and the most suitable averaging period of the pollutant needs to be used for assessment purposes.

3.36 For instance, on a footpath, where exposure will be transient (for the duration of passage along that path) comparison with short-term standard (i.e. 15-minute mean or 1-hour mean) may be relevant. For private dwellings, however; where exposure may be for longer periods, comparison with long-term (such as 24-hour mean or annual mean) standards may be most appropriate. In general terms, concentrations associated with long-term standards are lower than short-term standards owing to the chronic health effects associated with exposure to low level pollution for longer periods of time.

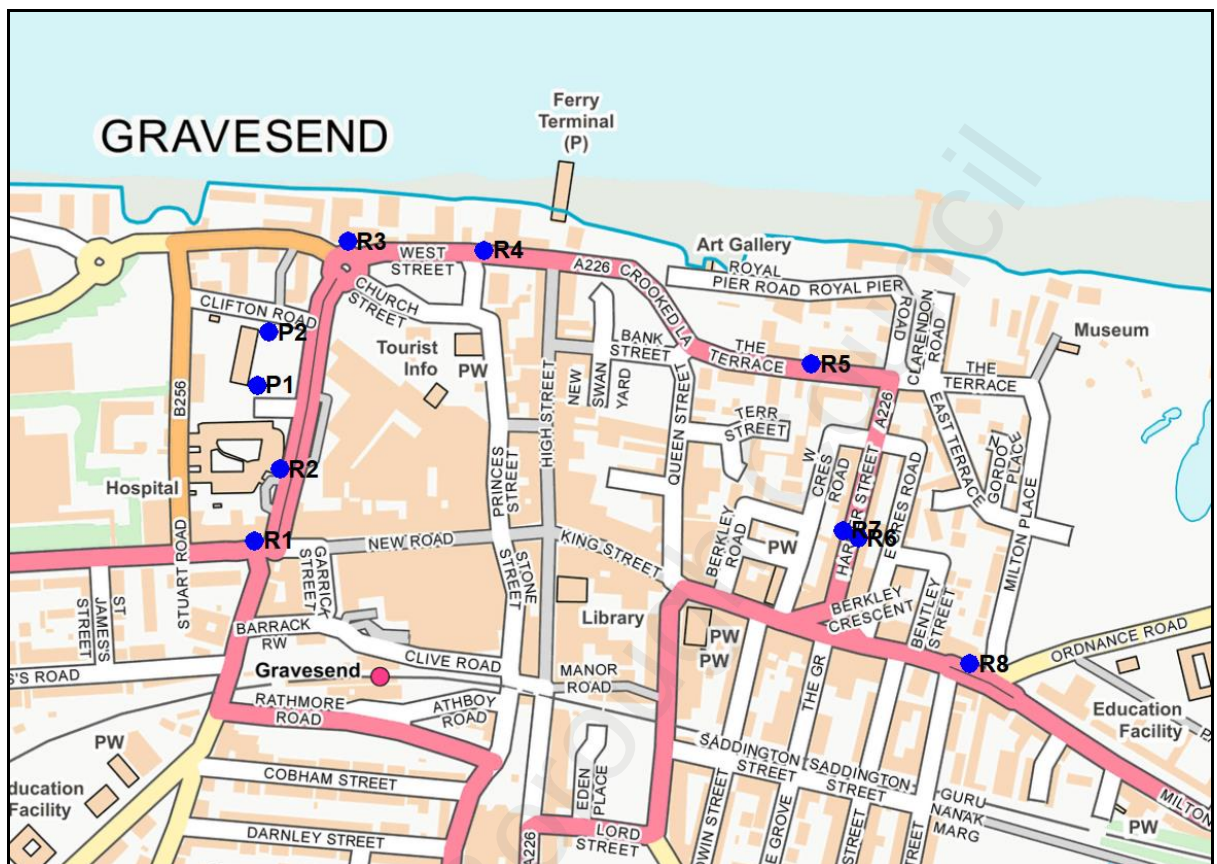
3.37 To assess the impact of traffic generated by the Proposed Development pollutant concentrations have been predicted 8 existing sensitive receptors close to the roads affected by traffic generated by the Proposed Development. There are no sensitive ecological habitats within the vicinity of the Proposed Development or the roads likely to be affected by the Proposed Development. The modelling assessment also predicted concentrations at two of the facades of the Proposed Development. Details of these sensitive receptors are presented in Table 3.9 and the locations are illustrated in Figure 3.1.



Table 3.9: Location of Sensitive Receptors

ID	Receptor	Type	Easting	Northing
R1	49 New Road	Residential	564485	174156
R2	Gravesham Community Hospital	Hospital	564509	174223
R3	West Street	Residential	564573	174438
R4	86 West Street	Residential	564702	174429
R5	64 The Terrace	Residential	565010	174322
R6	Harmer Street	Residential	565055	174158
R7	Harmer Street	Residential	565040	174165
R8	Milton Road	Residential	565160	174040
P1	Façade of the Proposed Development	Proposed	564488	174303
P2	Façade of the Proposed Development	Proposed	564499	174352

Figure 3.1: Location of Receptors Considered within ADMS Model



Significance Criteria

3.1 The significance of the predicted impacts has been determined using the guidance set out within the Kent and Medway Air Quality Planning Guidance. In the first instance the change in pollutant concentrations as a result of the development is calculated as a percentage of the relevant objective limit. The impact is then classified according to the criteria set out in Table 3.10 below.

3.2 Following classification of the impacts the guidance recommends the actions set out in Table 3.11 based on the identified impact.

Table 3.10: Classification of impacts due to changes in pollutant concentrations

Classification of Impact	Concentration change due to development	Or if development contribution causes
Very High	Increase >10%	Breach of air quality objective
High	Increase 5-10%	Exposure to be within 5% of Objective
Medium	Increase 1-5%	Exposure to be within 10% of Objective
Low/Imperceptible	Increase <1%	-

Table 3.11: Recommended Planning Requirements

Magnitude of change in air quality	Likely requirements	Likely Outcomes
Very High	Require mitigation to remove very high air quality impacts. If impact of development on air quality is still very high – strong presumption for recommendation of refusal on air quality grounds	Recommend Refusal
High	Recommend refusal unless appropriate on-site mitigation measures implemented to the satisfaction of the planning authority. Mitigations to include reducing exposure through various measures, emissions reduction technologies and/or development redesign	Refusal, unless recommended mitigation is implemented.
Medium	Seek mitigation to reduce air quality impacts. Mitigations to include reducing exposure through various measures, emissions reduction technologies and/or development redesign	Ensure on-site mitigation options are implemented.
Low/Imperceptible	Recommend the minimum mitigation for development scheme type	Recommend minimum mitigation

3.3 The EPUK & IAQM planning guidance also provides criteria for determining the significance of a development. These criteria are provided below for comparison.

3.4 The EPUK & IAQM guidance recommends that the impact at individual receptors is described by expressing the magnitude of incremental change in pollution concentration as a proportion of the relevant assessment level and examining this change in the context of the new

total concentration and its relationship with the assessment criterion as summarised in Table 3.12.

Table 3.12: Impact Descriptors for Individual Receptors.

Long Term Average Concentration at Receptor in Assessment Year	% Change in concentration relative to AQAL (a)			
	1	2-5	5-10	>10
75% or less of AQAL	Negligible	Negligible	Slight adverse	Moderate adverse
76-94% of AQAL	Negligible	Slight adverse	Moderate adverse	Moderate adverse
95-102% of AQAL	Slight adverse	Moderate adverse	Moderate adverse	Substantial adverse
103-109% of AQAL	Moderate adverse	Moderate adverse	Substantial adverse	Substantial adverse
110% or more of AQAL	Moderate adverse	Substantial adverse	Substantial adverse	Substantial adverse
(a) A change in concentration of less than 0.5% of the AQAL is considered insignificant, however changes between 0.5% and 1% are rounded up to 1%.				

3.5 The EPUK & IAQM guidance notes that the criteria in Table 3.12 should be used to describe impacts at individual receptors and should be considered as a starting point to make a judgement on significance of effects, as other influences may need to be accounted for. The EPUK & IAQM guidance states that the assessment of overall significance should be based on professional judgement, taking into account several factors, including:

- The existing and future air quality in the absence of the Proposed Development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

4 BASELINE CONDITIONS

Gravesham Borough Council Review and Assessment of Air Quality

4.1 GBC has carried out detailed assessments of air quality in the area and as a result has declared seven AQMAs within the borough. Six are due to potential exceedences of the AQS objective for annual mean NO₂ concentrations and three are due to potential exceedences of the AQS objectives for annual and 24-hour mean PM₁₀ concentrations. The closest AQMA to the Proposed Development is the Gravesham A226 One-way system AQMA which is declared for an area incorporating the entire A226 One-way System in Gravesend. Bath Street to the east of the Proposed Development is included within this AQMA.

Automatic Local Monitoring Data

4.2 GBC operates two automatic monitoring sites, the closest is an industrial background site located approximately 2.3km to the west of the Proposed Development. The other automatic monitor is a roadside site located 2.9km to the southwest of the Proposed Development. Bias adjusted data obtained from both monitoring stations is presented in Tables 4.1 and 4.2.

Table 4.1: NO₂ Concentrations recorded at the nearest Continuous Automatic Monitors

Monitoring Site	Statistic	2016	2017	2018	2019	2020
Gravesham Industrial Background	Annual Mean (µg/m ³)	24.1	23.9	23.5	24.5	22.0
	Number of 1-hour means > 200 µg/m ³	0	0	0	0	0
Gravesham A2 Roadside	Annual Mean (µg/m ³)	29.6	31.5	29.9	29.1	23.7
	Number of 1-hour means > 200 µg/m ³	0	0	0	0	0
Data obtained from GBC Air Quality Annual Status Report 2021						

4.3 Exceedences of the AQS objective for annual mean NO₂ concentrations have not been experienced at the Gravesham A2 monitor throughout the five-year period presented, despite being located at a roadside location within an AQMA. No exceedences were recorded at the background site.

4.4 Exceedences of the hourly objective have not been recorded during the five years of the monitoring presented, therefore the objective was met in all five monitoring years.



4.5 Based on the data recorded at these sites, NO₂ concentrations are expected to meet the annual mean and hourly mean objectives at the Site.

Table 4.2: PM₁₀ Concentrations recorded at the nearest Continuous Automatic Monitors

Monitoring Site	Statistic	2016	2017	2018	2019	2020
Gravesham Industrial Background	Annual Mean (µg/m ³)	18.0	19.4	21.9	22.3	21.2
	Number of 24-hour means > 50 µg/m ³	2	4	3	10	8
Gravesham A2 Roadside	Annual Mean (µg/m ³)	19.0	16.7	15.4	15.3	16.3
	Number of 24-hour means > 50 µg/m ³	1	5	1	1	1
Data obtained from GBC Air Quality Annual Status Report 2021						

4.6 Annual mean PM₁₀ concentrations recorded have been consistently below the 40 µg/m³ objective between 2016 and 2020.

4.7 Exceedences of the 24-hour objective have been recorded at both monitoring stations during the five years of the monitoring presented, however the objective allows for 35 exceedences of the 50 µg/m³ limit in any given year therefore the objective was met in all five monitoring years.

4.8 Based on the data recorded at these sites, PM₁₀ concentrations are expected to meet the annual mean and 24-hour objectives at the Site.

Non-Automatic Monitoring

4.9 NO₂ diffusion tube monitoring is also carried out at 59 locations in the borough. A number of diffusion tubes are located in the vicinity of the Site. Bias adjusted data from these monitoring sites are presented in Table 4.3 below.

Table 4.3: NO₂ Concentrations recorded at the nearest Diffusion Tube Monitors

Monitoring Site	Type	Distance to Kerb	2016	2017	2018	2019	2020
GR13 – 88 West Street	Roadside	2	37.5	44.0	47.1	46.1	38.0
GR40 – Somerset Public House	Roadside	1.5	42.4	41.3	45.2	43.4	35.0
GR45 – Princes Street	Roadside	2	26.6	26.8	27.0	29.3	24.1
GR61 – 62 New Road	Roadside	2.6	34.9	34.5	35.5	35.1	27.7
GR66 – Russell Quay	Roadside	2.5	30.2	31.2	30.6	30.8	25.8
Data obtained from GBC Air Quality Annual Status Report 2021							

4.10 At the closest diffusion tube site to the Site, GR66, the AQS objective for annual mean NO₂ concentrations has been met over the five-year period. At the roadside locations close to major roads (GR13 and GR40), concentrations exceeding of the objective level have been measured.

Defra Background Maps

4.11 Additional information on background concentrations in the vicinity of the Site have been obtained from the Defra background pollutant maps. The area considered within the assessment extends over two OS grid squares. A review of the Defra data shows a difference in background concentrations within each grid square. The relevant background concentrations for each grid square are set out in Table 4.4 and have been used to calculate total pollutant concentrations at each receptor according to their location.

4.12 The 2018 Defra background maps, which provide estimated background concentrations between 2018 and 2030, have been used to obtain concentrations for 2019 (the base year) which have been used to predict concentrations in 2022.

Table 4.4: Estimated Annual Mean Background Concentrations from Defra Maps (µg/m³)

Pollutant	564500, 174500	565500, 174500
NO ₂	28.7	26.3
PM ₁₀	16.0	15.6
PM _{2.5}	11.0	10.8

4.13 The data presented in Table 4.4 shows that estimated annual mean background concentrations of NO₂, PM₁₀ and PM_{2.5} are well below the annual mean objectives for each pollutant in the vicinity of the Site.

5 ASSESSMENT OF IMPACT

Construction Phase

Area Sensitivity

5.1 The Site is currently occupied by a vacant hospital building. This building will be retained and refurbished as part of the Proposed Development. The impacts of dust and particulate matter arising from the demolition works and earthworks have therefore been excluded from this assessment.

5.2 The assessment of dust impacts is dependent on the proximity of the most sensitive receptors to the Proposed Development site boundary. A summary of the receptor and area sensitivity to health and dust soiling impacts is presented in Table 5.1.

Table 5.1: Sensitivity of Receptors and the Local Area to Dust and PM₁₀ Impacts

Receptor	Distance from Site Boundary (m)	Approx. Number of Receptors	Sensitivity to Health Impacts (a)		Sensitivity to Dust Soiling Impacts	
			Receptor	Area	Receptor	Area
Residential Properties	<20 m	10-100	High	Low	High	High
Overall Sensitivity of the Area			Low		High	
(a) Estimated background PM ₁₀ concentration is 16.0 µg/m³.						

5.3 The route of the construction traffic is assumed to be Clifton Road and Bath Street. As the Proposed Development Site is medium in size, the sensitivity of the area to impacts arising from track-out is considered within a distance of 200m from the Site entrance. There are several sensitive receptors along the roads within this distance, therefore the sensitivity of the area to impacts from trackout is considered to be high for dust impacts and low for human health impacts.

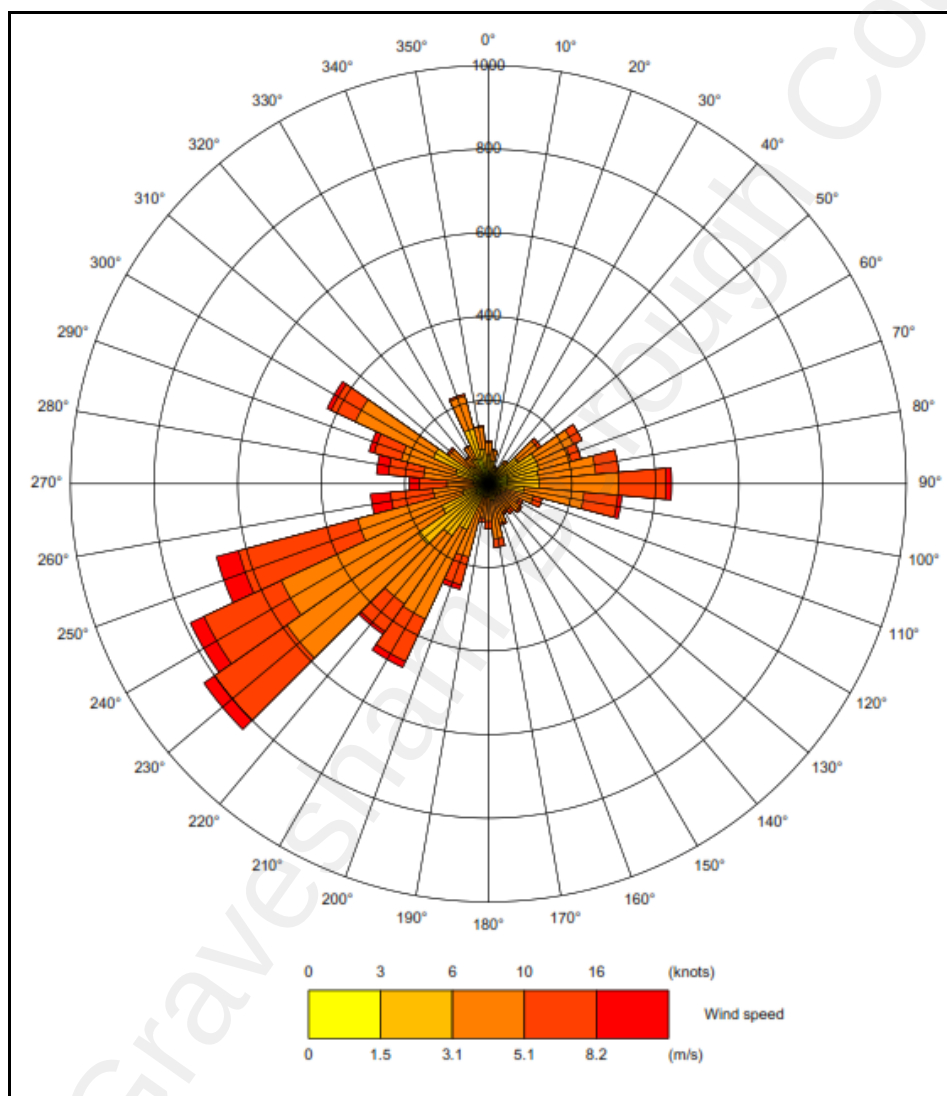
5.4 There are no dust-sensitive habitat sites within 50m of the Site nor within 50m of the route used by construction vehicles, therefore the impact of dust and particulate matter emissions on ecologically sensitive receptors has not been considered further in this assessment.

5.5 The precise behaviour of the dust, its residence time in the atmosphere, and the distance it may travel before being deposited will depend upon a number of factors. These include wind direction and strength, local topography and the presence of intervening structures (buildings, etc.)

that may intercept dust before it reaches sensitive locations. Furthermore, dust would be naturally suppressed by rainfall.

5.6 A wind rose from London City Airport is provided in Figure 5.1, which shows that the prevailing wind is from the southwest, therefore receptors to the northeast of the Site are the most likely to experience dust impacts from the Proposed Development. There are several sensitive residential receptors to the northeast of the Site.

Figure 5.1: Wind Rose for London City Airport Meteorological Station (2019)



Dust Emission Magnitude

5.7 Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling of the site and landscaping. During earthworks there is likely to be between 5 and 10 heavy duty vehicles on site at any given time and materials are likely to be

stored in bunds between 4m and 8m in height. The magnitude of the dust emission for the earthworks phase is therefore considered to be *medium*.

5.8 Dust emissions during construction will depend on the scale of the works, method of construction, construction materials and duration of build. When completed, the Proposed Development will have a volume of between 25,000 m³ and 100,000m³ and the main construction materials will be brick and timber, which have a low to moderate potential for dust release. Based on the overall size of the Proposed Development the dust emission magnitude is considered to be *medium*.

5.9 Factors influencing the degree of trackout and associated magnitude of effect include vehicle size, vehicle speed, vehicle numbers, geology and duration. Construction traffic will likely access the Proposed Development Site via Clifton Road and Bath Street where there are a number of residential properties. The number of HGV movements (leaving the Site) is likely to be less than 25 per day, therefore dust emission magnitude due to trackout is considered to be *medium*.

Dust Risk Effects

5.10 A summary of the potential risk of dust impacts, based on the low overall sensitivity of the area to human health impacts and high overall sensitivity to dust soiling impacts, is presented in Table 5.2.

Table 5.2: Risk of Dust Impacts Prior to Mitigation

Source	Impact Magnitude	Human Health Risk	Dust Soiling Risk
Earthworks	Medium	Low	Medium
Construction	Medium	Low	Medium
Trackout	Medium	Low	Medium

Operational Phase

NO₂ Concentrations

5.11 Annual mean NO₂ concentrations predicted at the existing receptors and at the Site are set out in Table 5.3. The concentrations include the 2019 background NO₂ concentrations estimated within the Defra background maps indicated in Table 4.4.

Table 5.3: Predicted Annual Mean NO₂ Concentrations at Modelled Receptors (µg/m³)

Receptor Number	2022 Without Development	2022 With Development	Change as a result of Development (as % of the AQAL)	Significance of Impact
R1	34.1	34.1	0.1	Low / Imperceptible
R2	34.0	34.1	0.1	Low / Imperceptible
R3	36.4	36.4	0.1	Low / Imperceptible
R4	43.4	43.5	0.3	Low / Imperceptible
R5	36.3	36.4	0.2	Low / Imperceptible
R6	37.2	37.3	0.2	Low / Imperceptible
R7	33.5	33.5	0.1	Low / Imperceptible
R8	33.3	33.4	0.1	Low / Imperceptible
P1	-	30.6	-	-
P2	-	30.8	-	-

5.12 The predicted annual mean NO₂ concentrations are below the 40µg/m³ objective level at all but one of the selected receptor locations under all scenarios.

5.13 In accordance with the Kent and Medway Air Quality Partnership Air Quality Planning Guidance criteria, the impact of the operation of the Proposed Development on annual mean NO₂ concentrations is *low/imperceptible*.

5.14 Based on the EPUK & IAQM significance criteria, the impact on annual mean NO₂ concentrations at all receptors as a result of traffic emissions from the Proposed Development is predicted to be *negligible*.

5.15 As the predicted annual mean NO₂ concentrations are all below 60 µg/m³, it is considered unlikely that the 1-hour objective will be exceeded at any of the selected receptors. The impact of the Proposed Development on hourly mean NO₂ concentrations is therefore also considered to be *negligible*.

5.16 The predicted concentrations within the Site are below the relevant AQS objective level. Therefore, the impact of the Proposed Development with regards new exposure to air quality is also considered to be *negligible*.

PM₁₀ Concentrations

5.17 Annual mean PM₁₀ concentrations predicted at the existing receptors and at the Site are set out in Table 5.4. The concentrations include the 2019 background PM₁₀ concentrations estimated within the Defra background maps indicated in Table 4.4.

Table 5.4: Predicted Annual Mean PM₁₀ Concentrations at Modelled Receptors (µg/m³)

Receptor Number	2022 Without Development	2022 With Development	Change as a result of Development (as % of the AQAL)	Significance of Impact
R1	17.1	17.2	0.0	Low / Imperceptible
R2	17.2	17.2	0.0	Low / Imperceptible
R3	17.6	17.6	0.0	Low / Imperceptible
R4	19.2	19.2	0.0	Low / Imperceptible
R5	18.0	18.0	0.0	Low / Imperceptible
R6	18.2	18.2	0.0	Low / Imperceptible
R7	17.3	17.3	0.0	Low / Imperceptible
R8	17.1	17.1	0.0	Low / Imperceptible
P1	-	16.4	-	-
P2	-	16.5	-	-

5.18 The predicted annual mean PM₁₀ concentrations are well below (less than 75% of) the 40µg/m³ objective level at all the selected receptor locations under all scenarios.

5.19 In accordance with the Kent and Medway Air Quality Partnership Air Quality Planning Guidance criteria, the impact of the operation of the Proposed Development on annual mean PM₁₀ concentrations is *low/imperceptible*.

5.20 Based on the EPUK & IAQM significance criteria, the impact on annual mean PM₁₀ concentrations at all receptors as a result of traffic emissions from the Proposed Development is predicted to be *negligible*.

5.21 LAQM.TG(16) provides a relationship between predicted annual mean concentrations and the likely number of exceedances of the short-term (24-hour mean) PM₁₀ objective of 50µg/m³ (N), where:

$$N = -18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean}).$$

5.22 The objective allows 35 exceedances per year, which is equivalent to an annual mean of $32\mu\text{g}/\text{m}^3$.

5.23 The number of predicted exceedances at all receptors under all scenarios is less than 3 days. The impact of the Proposed Development on the 24-hour objective would also be *negligible*.

5.24 The predicted concentrations within the Site are also well below (less than 75% of) the relevant AQS objective level, therefore the impact with regards new exposure to air quality is considered to be *negligible* in respect of this pollutant.

PM_{2.5} Concentrations

5.25 Annual mean PM_{2.5} concentrations predicted at the existing receptors and at the Site are set out in Table 5.5. The concentrations include the 2019 background PM_{2.5} concentrations estimated within the Defra background maps indicated in Table 4.4.

Table 5.5: Predicted Annual Mean PM_{2.5} Concentrations at Modelled Receptors ($\mu\text{g}/\text{m}^3$)

Receptor Number	2022 Without Development	2022 With Development	Change as a result of Development (as % of the AQAL)	Significance of Impact
R1	11.7	11.7	0.0	Low / Imperceptible
R2	11.7	11.7	0.0	Low / Imperceptible
R3	11.9	11.9	0.0	Low / Imperceptible
R4	12.9	12.9	0.0	Low / Imperceptible
R5	12.1	12.1	0.0	Low / Imperceptible
R6	12.2	12.2	0.0	Low / Imperceptible
R7	11.7	11.7	0.0	Low / Imperceptible
R8	11.6	11.6	0.0	Low / Imperceptible
P1	-	11.3	-	-
P2	-	11.3	-	-

5.26 The predicted annual mean PM_{2.5} concentrations are well below (less than 75% of) the $25\mu\text{g}/\text{m}^3$ objective level at all the selected receptor locations under all scenarios.

5.27 In accordance with the Kent and Medway Air Quality Partnership Air Quality Planning Guidance criteria, the impact of the operation of the Proposed Development on annual mean PM_{2.5} concentrations is *low/imperceptible*.

5.28 In accordance with the EPUK & IAQM significance criteria, the significance of the impact of the operation of the Proposed Development on annual mean PM_{2.5} concentrations is *negligible*.

5.29 The predicted concentrations at the Site are well below (less than 75% of) the relevant AQS objective level, therefore the impact of the Proposed Development with regards new exposure to air quality is considered to be *negligible* in respect of this pollutant.

EMISSIONS MITIGATION CALCULATION

5.30 The Proposed Development is predicted to result in a low/imperceptible impact on local air quality. However, in accordance with the advice provided in the Kent and Medway Air Quality Partnership Air Quality Planning Guidance which is reproduced in Table 3.11, mitigation measures will be implemented to reduce operational emissions.

5.31 In order to assist in determining the value of emissions mitigation required an Emissions Mitigation Assessment was completed including an emissions mitigation calculation in accordance with the advice provided in the Kent and Medway Air Quality Planning Guidance.

5.32 **Table 5.6: Emissions Mitigation Calculation**

	NOx	PM2.5
Proposed Development Trips (as AADT) ⁽¹⁾	313	
Average Trip Length (km) ⁽²⁾	13.8	
Emissions (kg/yr) ⁽³⁾	363.07	28.32
Emissions (tonnes/yr)	0.36	0.03
Damage Cost (per tonne) ⁽⁴⁾	£7,614.00	£66,797.00
Cost of 5 Year Exposure	£13,822.04	£9,459.00
Total	£23,281.04	
(1) Provided by Transport Consultants		
(2) Obtained from National Travel Survey 2017 (Av miles travelled per car per person in a year /av no of trips made per car per person in a year) (5104/594 = 8.6 miles (13.8km))		
(3) Value obtained from EFT spreadsheet (assuming average speed of 48kph)		
(4) IGCB Air Quality Damage Costs per tonne (2017 prices) (Central Estimate for Transport Urban Medium)		

5.33 The Emissions Mitigation Calculation presented above suggests a damage cost of £23,281.04. A range of costs is provided, the above damage cost is based on the Central Estimate.

6 MITIGATION

Construction Phase

6.2 The control of dust emissions from construction site activities relies upon management provision and mitigation techniques to reduce emissions of dust and limit dispersion. Where dust emission controls have been used effectively, construction operations have been successfully undertaken without impacts to nearby properties.

6.3 Overall the Proposed Development is considered to be a medium risk of dust impacts, and low risk to human health from particulate matter concentrations at nearby receptors during the construction phase. Appropriate mitigation measures for the Proposed Development have been identified following the IAQM guidance and based on the risk effects presented in Table 5.2. It is recommended that the 'highly recommended' measures set out in the IAQM guidance and reproduced in **Appendix E** are incorporated into a Dust Management Plan (DMP) and approved by GBC prior to commencement of any work on the Proposed Development Site.

6.4 In addition to the 'recommended' measures, the IAQM guidance also sets out a number of 'desirable' measures which should also be considered. These are also set out in **Appendix E**.

6.5 Following implementation of the 'highly recommended' measures outlined in the IAQM guidance and reproduced in **Appendix E**, the impact of emissions during construction of the Proposed Development would be negligible.

Operational Phase

6.6 The detailed dispersion modelling indicates that the impact of the operation of the Proposed Development on local pollutant concentrations is low/imperceptible in accordance with the Kent and Medway Air Quality Partnership Air Quality Planning Guidance criteria and negligible in accordance with the EPUK & IAQM Guidance criteria. The concentrations of relevant pollutants (NO₂, PM₁₀ and PM_{2.5}) within the Proposed Development will meet the relevant air quality objectives in the opening year.

6.7 The Kent and Medway Air Quality Partnership Air Quality Planning Guidance requires the following mitigation measures for residential developments:



-
- All gas fired boilers to meet a standard of <40mgNO_x/kWh; and
 - 1 Electric Vehicle charging point per dwelling with dedicated parking or 1 charging point per 10 spaces (unallocated parking).

6.8 The cost of implementing the above mitigation measures will exceed the Damage Cost figure calculated in Table 5.6. The implementation of the above mitigation measures should further reduce the impact of emissions during operation of the Proposed Development.

7 CONCLUSIONS

7.1 An air quality impact assessment has been carried out to assess both construction and operational impacts of the Proposed Development.

7.2 An assessment of the potential impacts during the construction phase has been carried out in accordance with the latest Institute of Air Quality Management Guidance. This has shown that for the Proposed Development, limited releases of dust and particulate matter are likely to be generated from on-site activities. However, through good site practice and the implementation of suitable mitigation measures, the impact of dust and particulate matter releases may be effectively mitigated and the resultant impacts are considered to be negligible.

7.3 ADMS Roads dispersion modelling has been carried out to assess both the impact of the operation of the Proposed Development on local pollutant concentrations and the suitability of the Site for its proposed end use with regards to local air quality. The results indicate that predicted concentrations of relevant pollutants (NO₂, PM₁₀ and PM_{2.5}) concentrations are below the relevant objectives within the Proposed Development.

7.4 Predicted concentrations as a result of emissions arising from traffic generated by the operation of the Proposed Development would remain below the objective levels at all but one of the selected receptors. In accordance with the Kent and Medway Air Quality Partnership Air Quality Planning Guidance, the impact of the emissions arising from traffic associated with the operation of the Proposed Development is considered to be *low / imperceptible*. In accordance with the criteria outlined in the EPUU & IAQM Guidance, the impact is considered to be negligible.

7.5 Future occupants of the Proposed Development would not be exposed to pollutant concentrations above the relevant objective levels. The impact of the Proposed Development with regards new exposure to air quality is therefore considered to be negligible.

7.6 It is concluded that air quality does not pose a constraint to the Proposed Development, either during construction or once operational.



APPENDIX A - AIR QUALITY TERMINOLOGY

Term	Definition
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
DEFRA	Department for Environment, Food and Rural Affairs.
Exceedance	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO₂	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O₃	Ozone.
Percentile	The percentage of results below a given value.
PM₁₀	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
ppb parts per billion	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppb means that for every billion (10 ⁹) units of air, there is one unit of pollutant present.
ppm parts per million	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppm means that for every billion (10 ⁶) units of air, there is one unit of pollutant present.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
µg/m³ micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1 µg/m ³ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.



APPENDIX B - AIR QUALITY STRATEGY OBJECTIVES

Table B1: Air Quality Strategy Objectives

Pollutant	Objective Level ($\mu\text{g}/\text{m}^3$)	Averaging Period	No. of Permitted Exceedances
NO ₂	200 (a)	1-Hour	18 per annum (99.8 th percentile)
	40 (a)	Annual	-
PM ₁₀	200 (a)	24-Hour	35 per annum (90.4 th percentile)
	50 (a)	Annual	-
PM _{2.5}	25 (b)	Annual	
(a) Air Quality Standards Regulations (2010)			
(b) EU Directive Limit Value			



APPENDIX C - SUMMARY OF TRAFFIC DATA

Table C1: Traffic Data

Description	Average Speed (kph)		2019 Verification and Baseline		2022 Without Development (a)		2022 With Development	
	Free flow	Junction / Congestion	AADT Traffic Flows	HDV (%)	AADT Traffic Flows	HDV (%)	AADT Traffic Flows	HDV (%)
A226 (West of Proposed Development)	30	20	8786	6.6	8786	6.6	8864	6.6
A226 (East of Proposed Development)	30	20	10611	4.6	10611	4.6	10689	4.6
A226 Milton Road	30	20	15200	3.6	15200	3.6	15278	3.6
(a) Assumed same as 2019 traffic flows								

APPENDIX D – VERIFICATION AND ADJUSTMENT OF MODELLED CONCENTRATIONS

Nitrogen Dioxide (NO₂)

Most nitrogen dioxide (NO₂) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions. Verification of concentrations predicted by the ADMS model has followed the methodology presented in LAQM.TG(16).

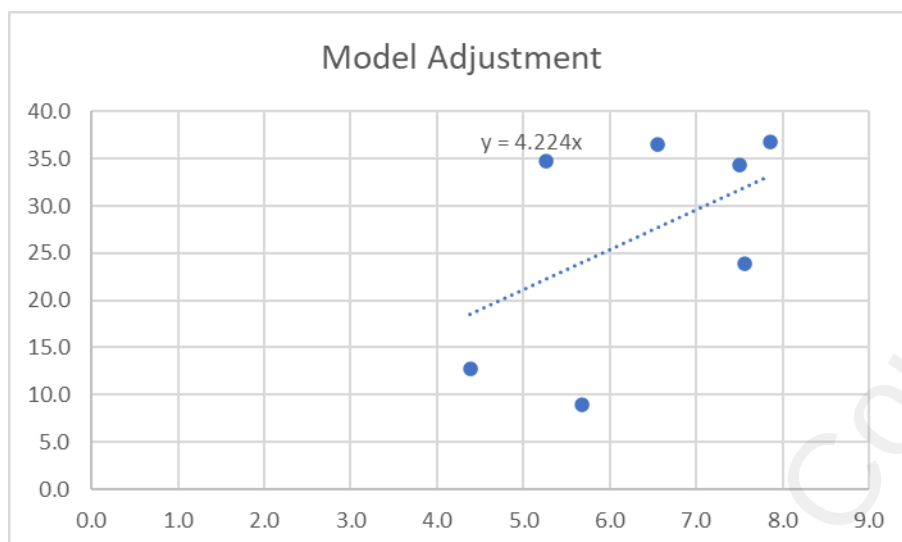
The model has been run to predict annual mean road-NO_x concentrations at seven nearby monitoring sites.

The model output of road-NO_x (i.e. the component of total NO_x coming from road traffic) has been compared to the 'measured' road-NO_x (Table D1). The 'measured' road NO_x has been calculated from the measured NO₂ concentrations by using the Defra NO_x to NO₂ calculator available on the UK-AIR website.

Table D1: Comparison of Modelled and Monitored NO_x concentrations

Monitoring Location	Total Monitored NO ₂	Background NO ₂	Monitored Road NO _x	Modelled Road NO _x	Ratio
GR61	35.1	28.7	12.8	4.4	2.91
GR13	46.1	28.7	36.8	7.9	4.68
GR62	30.8	26.3	9.0	5.7	1.58
GR47	42.9	26.3	34.7	5.3	6.60
GR31	43.7	26.3	36.5	6.6	5.58
GR24	42.7	26.3	34.3	7.5	4.57
GR58	38.0	26.3	23.9	7.6	3.16

Figure D1: Comparison of Modelled and Monitored Road NO_x concentrations



The results in Table D1 and Figure D1 indicate that the ADMS model under-predicted the road NO_x concentrations at the selected monitoring sites. An adjustment factor was therefore determined as the ratio between the measured road-NO_x contribution and the modelled road-NO_x contribution (4.22). This factor has then been applied to the modelled road-NO_x concentration for each location to provide an adjusted modelled road-NO_x concentration.

The annual mean road-NO₂ concentration was determined using the Defra NO_x:NO₂ spread sheet calculation tool and added to the background NO₂ concentration to produce a total adjusted NO₂ concentration.

Particulate Matter (PM₁₀ and PM_{2.5})

There was insufficient roadside monitoring data available against which the modelling could be verified. Consequently, the verification factor determined above for adjusting the road-NO_x contribution has been applied to the predicted road-PM₁₀ and road-PM_{2.5} contributions, consistent with guidance provided in LAQM.TG(16).

Model Uncertainty

An evaluation of model performance has been undertaken to establish confidence in model results. LAQM.TG(16) identifies a number of statistical procedures that are appropriate to evaluate model performance and assess the uncertainty. These include root mean square error (RMSE); fractional bias (FB) and correlation coefficient (CC). These parameters estimate how the model results agree or diverge from the observations. The simplest parameter to calculate and to interpret is the RMSE, which has therefore been used in this assessment to understand the model uncertainty.



The RMSE value calculated after verification was 3.0. Guidance provided in LAQM.TG(16) indicates that for RMSE values higher than 25% of the objective level, that the model should be revisited. Ideally an RMSE value should be within 10% of the air quality objective level. For annual mean NO₂, which has an objective level of 40µg/m³, this equates to 4µg/m³. The RMSE value calculated for this assessment is therefore considered to fall within the acceptable limits, therefore the final predictions can be considered to be robust.



APPENDIX E – CONSTRUCTION MITIGATION MEASURES

The following measures are detailed in the IAQM guidance as being ‘highly recommended’ for sites of the level of risk identified for the Proposed Development. It is therefore recommended that these measures are incorporated into a DMP and approved by GBC prior to commencement of any work on site:

- display the name and contact details of the person accountable for air quality and dust issues on the site boundary (i.e. the environment manager/engineer or site manager);
- display the head or regional office contact information on the site boundary;
- record all dust and air quality complaints, identify cause, take appropriate measures to reduce emissions in a timely manner and record the measures taken;
- make the complaints log available to the local authority when asked;
- record any exceptional incidents that cause dust and/or air emissions, either on- or off- site and the action taken to resolve the situation in the log book;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results and make inspection log available to GBC when asked;
- increase frequency of site inspection 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 periods of dry or windy conditions;
- plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary as necessary that are at least as high as any stockpiles;
- fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing, barriers and scaffolding clean using wet methods;
- remove materials that have a potential to produce dust from site as soon as possible unless being re-used on site.
- Cover, seed or fence stockpiles to prevent wind whipping;
- 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;
- only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction e.g. suitable local exhaust ventilation systems;



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- ensure an adequate water supply on 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 fine water sprays on such equipment wherever appropriate;
 - ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods;
 - avoid bonfires and burning of waste materials;
 - ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed.
 - Avoid explosive blasting, using appropriate manual or mechanical alternatives;
 - Bag and remove any biological debris or damp down such material before demolition;
 - Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
 - Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
 - Avoid dry sweeping of large areas;
 - Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
 - Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;
 - Record all inspections of haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned;
 - Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable);
 - Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits;
 - Access gates to be located at least 10m from receptors where possible;

The guidance also details a number of measures which are considered to be 'desirable'. It is recommended that these measures should also be considered for inclusion within the DMP:

- undertake daily on-site and off-site inspection, where receptors area nearby, to monitor, record inspection results and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary;



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- implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking and car-sharing);
 - soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust);
 - re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
 - use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable;
 - only remove the cover in small areas during work and not all at once;
 - avoid scabbling (roughening of concrete surfaces);
 - ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;
 - for smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust;