Air Quality Report

Bice Investment Ltd

For the site at:

27 Magdalen Road
Oxford
OX4 1RP

Oxford City Council

SRE

Version	Revision	Date	Author	Reviewer	Project Manager
1	A	14.09.2023	Manas Bane	Cara Palmer	Manas Bane
2	A	05.12.2023	Manas Bane	Adam Tucker	Alaister Coffey

SRE Registered Office | Greenforde Farm

Stoner Hill Road | Froxfield

Petersfield | Hampshire | GU32 1DY

01730 710044

info@sre.co.uk

www.sre.co.uk

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Executive Summary

An Air Quality Report has been produced by SRE Ltd for the proposed residential scheme planned at 27 Magdalen Road, Oxford (the Proposed Development) on behalf of Bice Investment Ltd (the Client).

The Proposed Development is located within the Oxford Air Quality Management Area (AQMA) declared in 2010; thus requires Air Quality Report to mitigate the associated impact on the surrounding air quality. The development therefore aims to mitigate the risks of any air pollution to all future residents and has modelled this as part of the Air Quality Report.

A detailed Air Quality Report has assessed the Proposed Development's suitability for future resident occupancy. The report suggests that the Proposed Development is suitable for occupancy in relation to nitrogen oxides and particulate matter concentrations, as annual mean concentrations of NO_2, $PM_{2.5}$ and PM_{10} are shown to be within current UK and EU objectives.

Following the assessment, construction-phase and use-phase impacts on air quality have been considered and will be minimised as far as possible for both the internal air quality of the Proposed Development as well as any contributions to external air quality.

The proposed energy strategy does not incorporate gas-fired or solid-/oil-fuelled heating systems and therefore there are no associated PM_{10} emissions. Through this strategy and the encouragement of sustainable transport methods such as car-parking free development & cycle storage, the Proposed Development's future impact upon local air quality is assessed to be negligible with no further mitigation required.

1.0 Introduction

As stated by the World Health Organisation, air pollution 'defines the contamination of indoor or outdoor areas by biological, chemical, or physical particles that modify the natural characteristics of the atmosphere.'

Depending on the level of exposure, this pollution can provoke a wide range of health effects with the most dangerous forms of air pollution being Particulate Matter (PM_{10}) and Nitrogen Dioxide (NO_2) due to their high concentration. In the UK, power generators and transport are the largest human-made sources of Particulate Matter, with NO_2 also representing a human-made pollutant released through combustion processes such as heating, power generation and vehicle/ship engines[1].

This Air Quality Report has been written by SRE Ltd. On behalf of Bice Investments Limited (the Client) in order to address planning policy requirements for the development at 27 Magdalen Road, Oxford (the Proposed Development). The whole of Oxford City was declared an Air Quality Management Area (AQMA) in September 2010 due to the declared exceedances of NO_2, PM_{10} and $PM_{2.5}$ particulate matter[2].

Figure 1: Location of the Proposed Development (Google Earth)

The Proposed Development involves the construction of 6 no. new 1 bed 2 person (1b2p) residential dwellings located within the City of Oxford. The design team plans include the demolition of an existing retail unit and the associated structures to enable the construction of the Proposed Development. The Proposed Development plans to include 12 no. cycle racks with no provision for on-site car-parking to promote sustainable means of transport.

[1] Demystifying Air Pollution in London: Full Report, January 2018.

[2] https://www.oxford.gov.uk/download/downloads/id/543/air_quality_management_order_2010.pdf

The application site is located towards the south-east of Oxford City Centre at the junction of Hurst Street and Magdalen Road. The Proposed Development is primarily surrounded by residential dwellings, a care home and a school. See Site Plan in Appendix A for further details.

Being a residential development, it is essential that the indoor air quality allows the resident of the building to live in a clean environment which is not detrimental to their health, whilst minimising the impact the Proposed Development may have within the AQMA.

Figure 2: Elevation of the Proposed Development (Re-Format LLP)

1.1 Planning Context

Table 1 below summarises the relevant policies regarding air quality for the Proposed Development, referencing the Adopted Oxford Local Plan and the Air Quality Action Plan 2021-2025.

Planning Policy	Requirement
Adopted Oxford Local Plan 2036	<u>Policy RE6: Air Quality</u> • Planning permission will only be granted where the impact of new development on air quality is mitigated and where exposure to poor air quality is minimised or reduced. • The exposure of both current and new occupants to air pollution during the development's operational and construction phases, and the overall negative impact that proposals may cause to the city's air quality, will be considered in determining planning applications. Where additional negative air quality impacts from a new development are identified, mitigation measures will be required to ameliorate these impacts.

	• Sensitive uses including residential development, schools and nurseries should be located away from areas of poor air quality, with site layout designed to reduce impact and with any residual impact mitigated through air quality measures. • Planning applications for major proposals (10 or more dwellings or 1,000 square metres) which would carry a risk of exposing individuals to unacceptable levels of air pollution must be accompanied by an Air Quality Assessment (AQA). • Where the AQA indicates that a development would cause harm to the air quality, planning permission will not be granted unless specific measures are proposed and secured to mitigate those impacts. • Planning applications for proposals that involve significant demolition, construction or earthworks will also be required to submit a dust assessment as part of the AQA, to assess the potential impacts and health risks of dust emissions from those activities. Any appropriate site-specific dust mitigation measures will be secured as part of the Construction Management Plan (CMP).
Oxford City Council Air Quality Action Plan (2021-2025)	4. Vision and Aims of the Air Quality Assessment 4.1 Oxford NO_2 Target • Achieve a local annual mean NO_2 target of 30 μg/m^3 by 2025 • Achieve compliance with the legal annual mean limit value for NO_2 of 40 μg/m^3 4.3 Priorities and actions • Priority A - Developing partnerships and public education • Priority B - Support for the uptake of Low and Zero emission vehicles • Priority C - Reducing emissions from domestic heating, industry and services • Priority D - Reduce the need to travel, explore opportunities for mode shift and increase the uptake of sustainable transport

Table 1: Local and regional planning policy summary for the Proposed Development.

The Oxford City Council provides guidance for developments in the form of 'Oxford City Council Air Quality Action Plan'.

The Air Quality Report has been provided to determine the how the Proposed Development impacts the local air quality, in order to address the local planning policy requirements.

1.2 Building Regulations Approved Document F: Ventilation

The Proposed Development is being designed as a mechanically ventilated building and will follow the requirements detailed in *Building Regulations Approved Document F: Ventilation* where applicable. This includes providing suitable ventilation rates to avoid the internal collection of air pollutants, whilst also limiting internal ingress of external pollutants into dwellings within areas of sub-standard air.

Air Quality Report

2.0 Removal of Contaminant Sources

The European Air Quality Directive introduced legally binding 'limit value' targets for the member governments to reduce air pollution to concentrations at which minimal effects on health are likely to occur. The directive was integrated into law through the Air Quality (England) Standards Regulations with air quality objectives.

The sensitive locations, at which the standards and objectives apply, are places where the population is expected to be exposed to the various pollutants over the averaging period in question. For objectives to which an annual mean standard applies, the most common sensitive receptor locations used to measure concentrations are areas of residential housing, since it is reasonable to expect that people living in their homes could be exposed to pollutants over such a period of time. For shorter averaging periods of between 15 minutes, 1 hour or 1 day, the sensitive receptor location can be anywhere where the public could be exposed to the pollutant over these shorter periods of time.

The annual mean objectives are not relevant for the building façades of offices or other places of work where members of the public do not have regular access, kerbsides or gardens.

Table 2 below represents the current EU and National limits regarding Air Quality objectives for pollutants which will be used for reference.

Pollutant	Concentration (µg m^{-3})	Averaging Period
$PM_{2.5}$	10	Annual mean
	25	24-hour mean, not to be exceeded on more than 35 occurrences per annum
PM_{10}	40	Annual mean
	50	24-hour mean, not to be exceeded on more than 35 occurrences per annum
NO_2	40	Annual mean
	200	1-hour mean, not to be exceeded on more than 18 occurrences per annum

Table 2 : EU limit levels and National Air Quality Objectives for pollutants

2.1 Background Pollution Levels

Within the local area of Oxford, background concentrations of Particulate Matter (PM_{10}/$PM_{2.5}$) and Nitrogen Dioxide (NO_2/NO_x) are evidenced in Figure 3 below to be relatively high, including the area in which the Proposed Development is located. Background pollutant concentrations have been selected from the year of 2022 due to these representing the latest data points available for analysis.

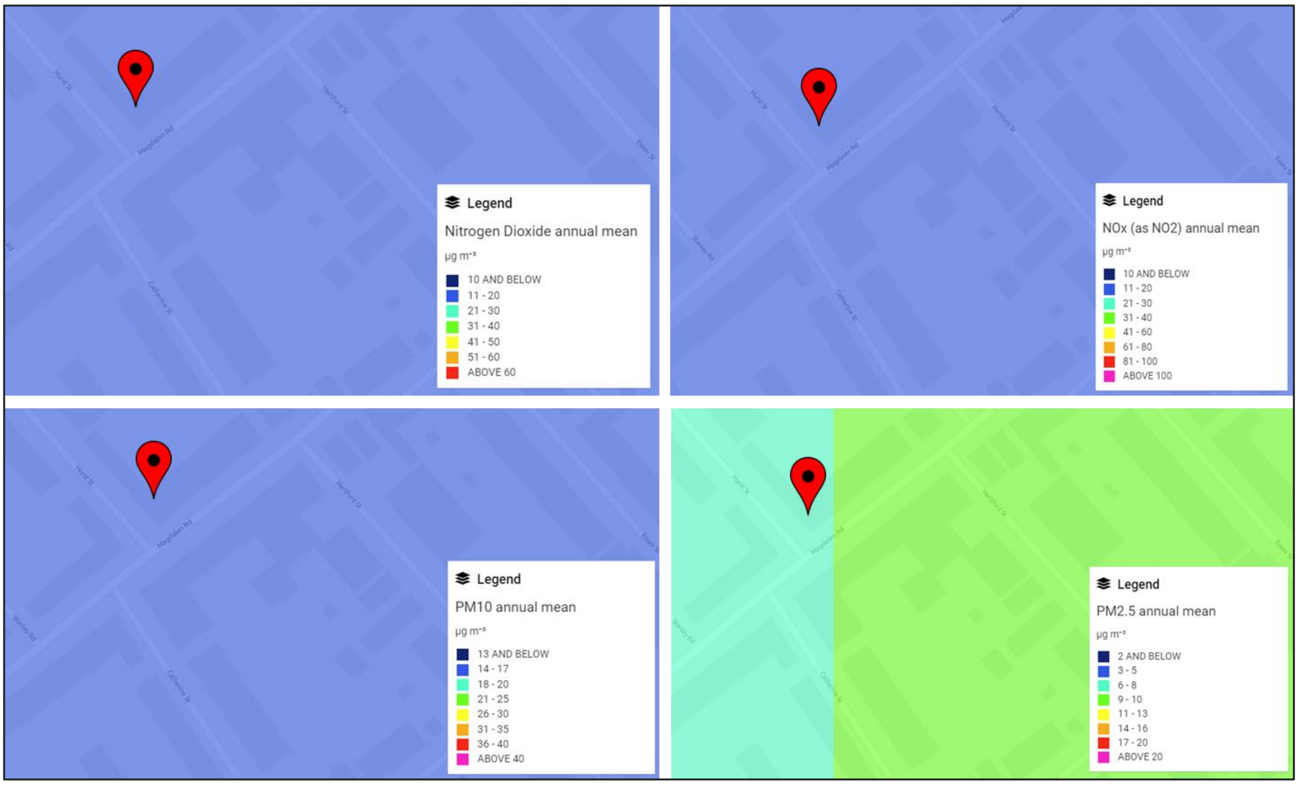

Figure 3: 2022 Concentrations of PM_{10}, $PM_{2.5}$, NO_2, NO_x (DEFRA UK Ambient Air Quality Interactive Map)

In 2021, annual mean background concentrations were 13.91µg m^{-3} PM_{10}, 8.44µg m^{-3} $PM_{2.5}$, 12.89µg m^{-3} NO_2, and 17.97µg m^{-3} NO_x as shown in Figure 3[3] above. According to the latest version of BREEAM (BREEAM UK New Construction V6.1) methodology issue Pollution 02 – Local Air Quality), the concentration on PM_{10} classifies the area as a 'High Pollution Location' and therefore suitable mitigation measures should be considered during the design of the development to reduce health risks to the residents of surrounding dwellings.

2.2 External Sources

2.2.1 Roads

The Proposed Development is situated on the junction at Hurst Street and Magdalen Road within the jurisdiction of Oxford City Council. The application site is located in the Cowley area of Oxford, a short distance from the University of Oxford and the city centre.

The road acts as a key arterial route into and out of the local area, facilitating frequent vehicular movements between Iffley Road (A4158) and B480 with associated emissions hypothesised to be a major driver of air quality degradation in vicinity. According to Oxford's most recent source apportionment study[4], the transport sector continues to be by far the largest contributor (68%) to total emissions of Nitrogen Oxides (NO_x) in the city.

[3] DEFRA UK Ambient Air Quality Interactive Map
[4] Oxford Source Apportionment Study, July 2020

Whilst local background emissions are within the current UK and EU objectives for PM_{10}, $PM_{2.5}$ and NO_2, due to these pollutants being damaging to health at any level, they remain an area of concern. Figure 4 below represents the impact of solely roadside emissions upon the air quality of the local area to gauge the influence of this single variable.

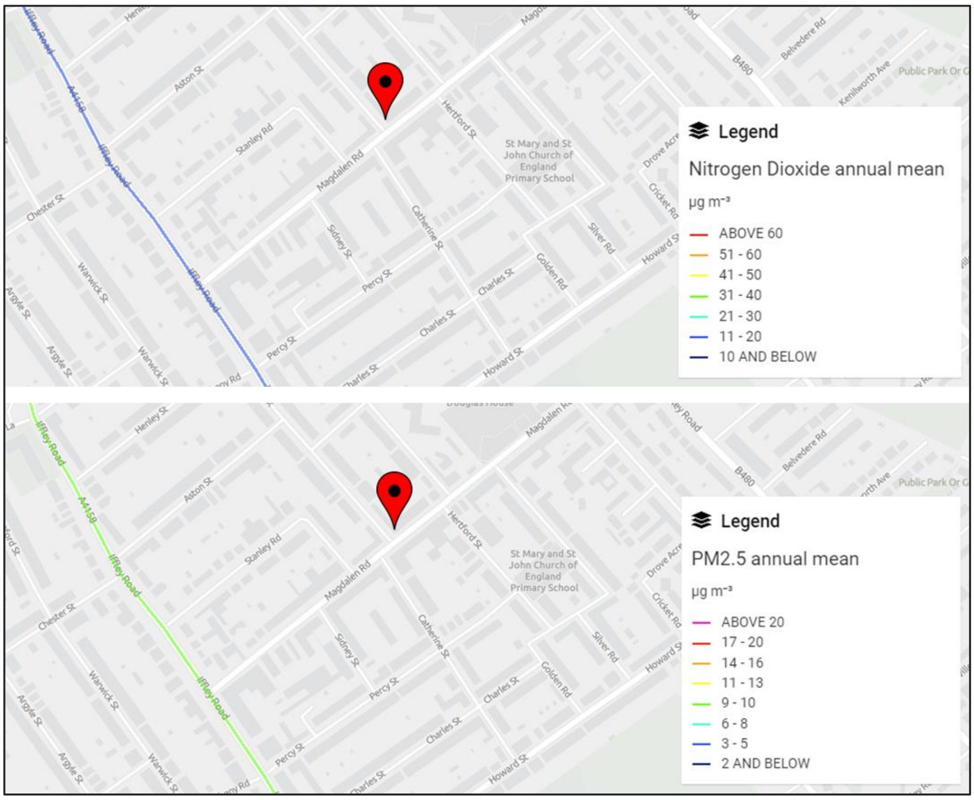

Figure 4: 2022 Average measured roadside NO_2 (top) and $PM_{2.5}$ (bottom) emissions near the Proposed Development (DEFRA UK Ambient Air Quality Interactive Map)

As seen from above, the nearby roads will have significant traffic levels and as a result, represent a dominant source of pollutants to impact the indoor environment of the Proposed Development. Roadside emissions can be seen to record higher than average pollutant emissions on with these located within a close proximity to 27 Magdalen Road.

2.2.2 Wind

Wind plays a vital role in the dispersion of pollutant particles across long distances dependent on the speed and direction of the prevailing wind. Whilst assisting in the removal of pollutants from certain areas simultaneously it acts to worsen air quality in other areas to which the airmass is transported.

Calculated from 30 years of hourly weather model simulations, the dominant wind direction and intensity of the Proposed Development's local area have been portrayed in Figure 5 below. Originating from, and with the highest intensities, any air pollution produced from the site is likely to be transported towards areas such as Headington and eastern areas of Oxford.

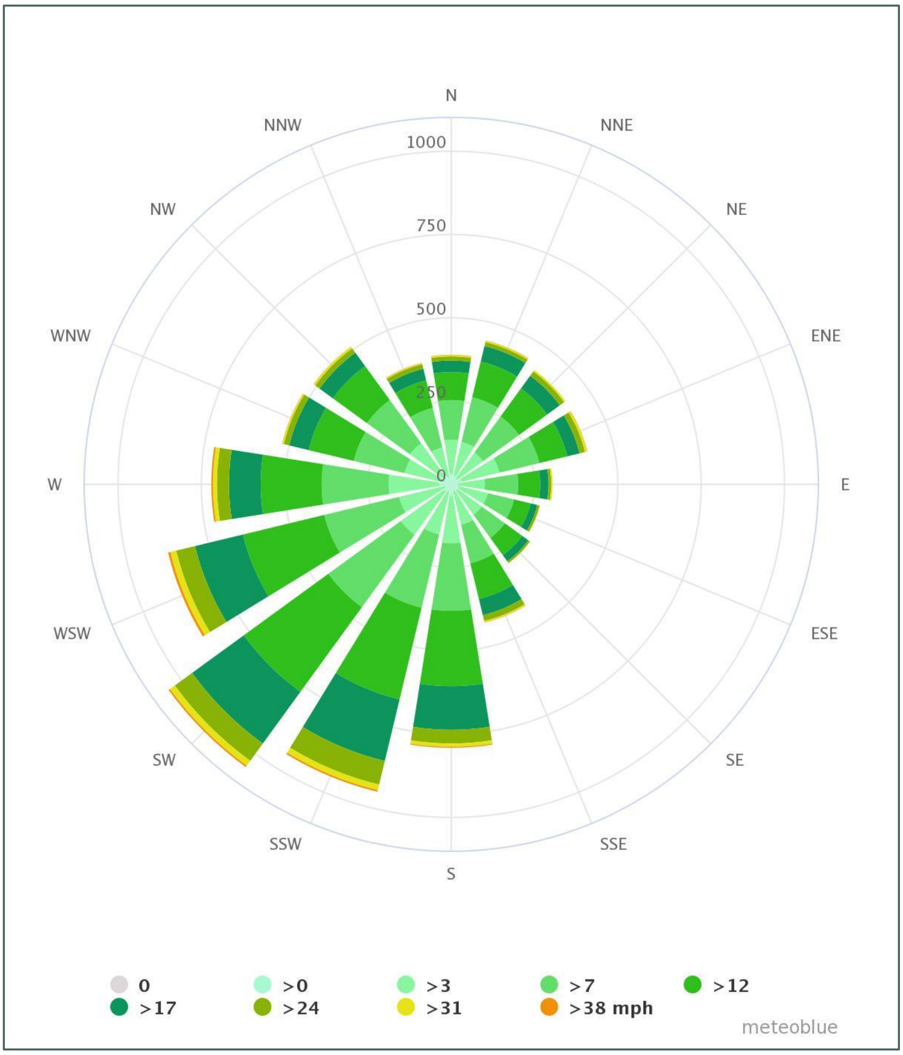

Figure 5: Modelled wind direction for Oxford (meteoblue.com)

Located to the south-west of the site is the lightly urbanised area of New Hinksey and Kennington. Any pollution from this and other areas, could possibly be transported to the location of the Proposed Development, degrading air quality as a result. The proximity of the site to green areas such as Iffey Meadows and Longbridges Nature Park act as a figurative 'green-lung' to remove possible pollutants from the area. These green spaces being located to the southwest of the development could also promote the transportation of filtered air in the direction of Cowley and East Oxford. However, this is vulnerable to contamination through emissions produced within the immediate vicinity.

3.0 Construction Dust Risk Assessment

The Dust Risk Assessment addresses the Air Quality Assessment criteria outline in 'Policy RE6: Air Quality' of Oxford Local Plan. The purpose of this assessment is to identify the category of risk from dust emissions associated with the demolition, earthworks, construction and trackout phases and to put in place a suitable management and mitigation strategy to ensure negative impacts are controlled and reduced. These have been assessed in accordance with methodology outlined within the 'Guidance on the assessment of dust from demolition and Construction[5]'.

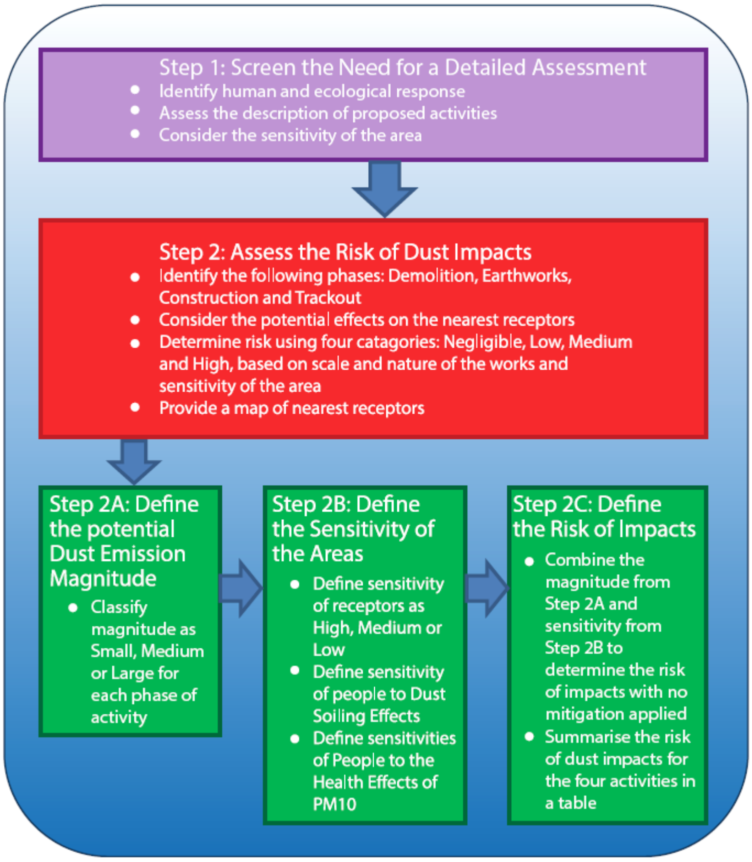

Figure 7 - Summary of Dust Risk Assessment requirements (Control of dust and emissions during construction and demolition SPG)

Dust from demolition and construction processes contains a range of particle types and material sizes that can cause adverse effects. The pollutant of concern in this assessment is PM_{10}, $PM_{2.5}$ and NO_2 are also considered.

Activities on the application site have been divided into four type to reflect their different potential impacts. These are:

- Demolition
- Earthworks
- Construction
- Trackout

The first step of the assessment is to conduct a simplified screening to establish the need to proceed to a detailed assessment. A dust risk assessment usually proceeds to detailed assessment if there is a human receptor within 50 m of the boundary of the site or 50 m of the routes used by construction vehicles on the public highway, up to 500 m from the site entrances (for large sites).

[5] Guidance on the assessment of dust from demolition and construction, Version 1.1 (IAQM)

There are human health and dust soiling receptors within 50m of the site, as a result the assessment proceeded to a detailed assessment.

3.1 Dust Emission Magnitude

The magnitude of the likely dust emission from the demolition and trackout of existing second/third floor has been evaluated as per Appendix C and is presented in Table 3.

Dust Source	IAQM Criteria	Application Site	Magnitude
Demolition	Total Building volume (m^3)	<20,000m^3	Small
	Potentially dusty material	Yes (brick)	Medium
	Maximum height of demolition activities above ground-level (m)	<10m	Small
	Demolition during wetter months	Cannot be guaranteed	Medium
	Overall Dust Emission Magnitude from Demolition		**Small**
Earthworks	Total Site Area (m^2)	<2,500m^2	Small
	Soil Type	Likely loam & clayey	Medium
	Number of heavy earth moving vehicles at any one time	Expected <5	Small
	Formation of bunds in height (m)	<4m	Small
	Total material moved (tonnes)	<20,000	Small
	Earthworks during wetter months	Cannot be guaranteed	Medium
	Overall Dust Emission Magnitude from Earthworks		**Small**
Construction	Total building volume (m^3)	<25,000m^3	Small
	Potentially dusty material	Light buff brick	Medium
	On-site concrete batching/sand-blasting	No	-
	Overall Dust Emission Magnitude from Construction[6]		**Small**
Trackout	Number of outward HGV movement in any one day	Expected <10 HGV movements on proposed works	Small

[6] The Proposed Development design incorporates brickwork, precast stone cills, copings etc., slate tile roof & timber cladding which are anticipated to have minimal impact, therefore a dust emission magnitude of 'small' rather than 'large ' is considered appropriate.

	Dusty Surface Material	Moderate potential for dust	Medium
	Unpaved road length	Hard standing/asphalt road	Small
	Overall Dust Emission Magnitude from Trackout[7]		**Medium**

Table 3 : Evaluation of Dust Emission Magnitude for Proposed Development

3.2 Sensitivity of the Area

The assessment requires the determination of the sensitivity of the area for the purposes of dust soiling, human health and ecological impacts. The sensitivity of the application site takes into account the specific receptors in the vicinity of the site, the proximity and number of those receptors, the local background concentration of PM10 and site-specific factors.

High sensitivity receptors for dust soiling in the vicinity of the site include dwellings. Medium sensitivity receptors for health effects of PM10 include human health receptors in the adjacent residential dwellings. Medium sensitivity receptors for dust soiling include places of work and retail areas. As there over 100 no. high sensitivity receptors within 50m of the site boundary the area is defined as ‘high’ for dust soiling effects.

For trackout, as there are over 100 no. high sensitivity receptors within 50m of the construction routes within 500m of the site access, so the sensitivity of the area is also ‘high’ for dust soiling effects.

For human health effects, there are 10-100 no. residential receptors within 20m of the site along the western and southern boundary of the application site. The background PM10 concentration at the application site is considered to be below 24µg/m3. As a result, within 20m for demolition, earthworks and construction, the sensitivity of the area is considered as ‘low’ for human health effects. For trackout, there are over 100 no. high sensitivity receptors within 50m of the construction routes within 500m of the site access, and the sensitivity of the area is ‘medium’ for trackout human health effects.

Ecological effects are not considered further in this assessment as there are no designated dust sensitive ecological receptors within 50m of the site boundary, or construction route or within 500m of the site entrance.

The sensitivity of the area is summarised below in Table 4.

Receptor Sensitivity	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	High
Human Health	Low	Low	Low	Medium

Table 4 : Sensitivity of the area

3.3 Risk of Impacts

When the dust emission magnitude is combined with the sensitivity of the area, the risk of impacts with no mitigation applied can be determined. The site is considered as Medium risk for dust soiling effects during demolition, earthworks and trackout phase. The site has negligible risk for human health effects during

[7] Small number of HGV’s are expected to access the site per day and use the existing road hard standings, therefore dust emission magnitude of ‘medium’.

demolition, low risk during earthworks and medium risk during trackout for human health effects. The summary of the dust risk assessment can be seen in Table 5.

Summary	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium risk	Low risk	Low risk	Low risk
Human Health	Negligible risk	Negligible risk	Negligible risk	Low risk

Table 5 : Dust Risk summary

3.4 Dust Emission Mitigation Measures

As the site will be undertaking localised demolition activities, the contractors will need to follow the details outlined below, so that the release of emissions of gaseous and particulate pollutants into the atmosphere is limited. A summary of the requirements is outlined below, addressing key measures for dust control. These may be reviewed prior to the commencement of construction works and incorporated into Construction Environmental Management Plan or similar if required by LA.

Assuming the application site integrates the relevant mitigation measures below, the residual impacts from all dust generating activities are predicted to be not significant, in accordance with guidance.

3.4.1 Site management

- Responsible site management is imperative during the demolition phases, which require stakeholder engagement and regular site inspections
- The site must also be prepared through an effective site layout and implementation of green infrastructure while also maintaining runoff, cleaning, and soiling, and effectively dealing with spillages.
- Develop a dust management plan
- Display the name and contact details of person(s) accountable for air quality pollutant emissions and dust issues on the site boundary
- Record and respond to all dust and air quality pollutant emissions complaints, and make the complaints log available to the LA upon request
- Carry out regular site inspections, record inspection results, and make the inspection log available to the LA upon request
- Increase the frequency of site inspections when activities with a high potential to produce dust and emissions and dust are being carried out, and during prolonged dry or windy conditions
- Record any exceptional incidents, either on or off the site, and the action taken to resolve the situation is recorded in the log book.

3.4.2 Preparing and maintaining the site

- Plan site layout: machinery and dust causing activities should be located away from receptors
- Erect solid screens or barriers around dust activities or the site boundary that are, at least, as high as any stockpiles on site
- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period
- Avoid site runoff of water or mud
- Keep site fencing, barriers and scaffolding clean using wet methods
- Remove materials from site as soon as possible
- Cover, seed or fence stockpiles to prevent wind whipping.

3.4.3 Vehicle emissions

- Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone
- Ensure all Non-Road Mobile Machinery comply with the relevant standards
- 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
- Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).

3.4.4 Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques
- Ensure an adequate water supply on the site for effective dust/particulate matter mitigation (using recycled water where possible)
- Use enclosed chutes and conveyors and covered skips
- Minimise drop heights and use fine water sprays 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.

3.4.5 Waste

- Reuse and recycle waste to reduce dust from waste materials
- Avoid bonfires and burning of waste materials.

3.4.6 Demolition

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust)
- Ensure water suppression is used during demolition operations
- Avoid explosive blasting, using appropriate manual or mechanical alternatives
- Bag and remove any biological debris or damp down such material before demolition.

3.4.7 Earthworks

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

3.4.8 Construction

- 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
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.

3.4.9 Trackout

- Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site
- Ensure vehicles entering and leaving site are covered to prevent escape of materials
- Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site.

- Avoid dry sweeping of large areas
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

3.5 Internal Sources

3.5.1 Finishes and furnishings

New buildings or recently redecorated interiors are often associated with high concentrations of Volatile Organic Compounds (VOCs); emitted mainly from paints, carpets, materials and furniture. These emissions are highest when the building is new and reduce over time.

VOCs present a risk to the health and comfort of occupants if air concentrations exceed those known to cause adverse effects. Some are toxic and can impact children, particularly those in vulnerable groups (such as those who suffer from asthma and allergies). At the levels common to residential buildings, the most likely health impact from VOCs is short-term irritation of the eyes, nose, skin and respiratory tract. Odour generated by VOCs can also be a concern to the occupants. Common indoor VOCs include formaldehyde, decane, butoxyethanol, isopentane, limonene, styrene, xylenes, perchloroethylene, methylene chloride and toluene. These products are often used within modern construction and could impact the indoor air quality of the building.

The following are various implementable methods to mitigate this risk:

- Avoid pollutant emissions by choosing interior finishes which adhere to BREEAM Health and Wellbeing 02 criteria: Emissions from Construction Products.
- Dispose of product containers safely and purchase only as much as is necessary to reduce waste and unnecessary release of VOCs.
- Sequence work to ensure that absorbent surfaces (e.g. carpets) are not installed until work that emits high levels of VOCs (e.g. varnishing) is complete.
- Protect HVAC equipment and ductwork from dust and other pollutants during installation and when near to other construction or installation works.
- Check and clean ventilation systems and ductwork prior to and during commissioning, so that pollutants are not released into the building.
- Identify and if possible, remove sources of formaldehyde as this is one of the few pollutants that can be readily measured. If it is not possible to remove, exposure can be reduced by using a sealant on all exposed surfaces of panelling and other furnishings.

3.5.2 Cleaning Products & Storage

VOCs and other pollutants contained within cleaning products may evaporate, contaminating the surrounding air. This can be controlled by ensuring that any cleaning products are stored in areas with suitable levels of ventilation to facilitate adequate dilution and removal. Any storage space (utility room or kitchen) should have mechanical extract to promote dilution. Natural cleaning solutions should be used wherever possible, and residents should always exercise caution and wear suitable protective equipment when handling harsh chemical cleaning solutions.

3.5.3 HVAC equipment

The Proposed Development will not implement a gas-based energy strategy; instead, hot water heat pumps are being used to provide the required space heating and DHW supply. Therefore, there will be no associated on-site NO_x emissions released due to the implementation of an all-electric scheme.

3.5.4 Kitchens

Kitchens can be a significant source of indoor air pollution due to the pollutants given off by cookware, appliances and refrigeration units, as well as harsh chemical degreasers and cleaning solvents that may be used during the cleaning of the kitchen spaces. Carbon monoxide (CO) and other poisonous fumes will therefore not be produced within the individual kitchen areas as all cooking hobs will be electric (no gas and open flames).

Particulates from cooking, such as grease and fat, need to be extracted in a way of preventing respiratory illnesses and fire risks. Odours will also be produced through the preparation and cooking of food which can cause discomfort and upset to neighbouring spaces/buildings, particularly other residential units in close proximity to the source. All kitchens are of a standard size for domestic use and are therefore not assumed to significantly contribute to external pollution. Extraction to the kitchen space via mechanical extraction hoods with suitable filters is proposed, with extraction rates in-line with Building Regulations Part F.

3.5.5 Tobacco

Smoking is not permitted in any communal indoor spaces. Therefore, the risk of indoor air pollution from tobacco (for example Benzene, a known human carcinogen) is low in these spaces. In the individual units, it is presumably the residents' choice as to whether they smoke inside their own dwelling – if these areas are not covered by lease agreement conditions to the contrary.

3.5.6 People

People, as users of the Proposed Development, will generate moisture, CO_2, and odours which contribute to the indoor air quality of the site. CO_2 is an indicator of indoor air quality including odour. Exhaled air and cooking are usually the principal sources of CO_2 in multi-residential spaces. CO_2 levels inside are affected by several factors including the number of occupants and their activity levels, time spent in a room, and the ventilation rate.

3.6 Removal of contaminant sources summary:

There are a variety of both internal and external pollutants that may affect the indoor air quality of the Proposed Development. Construction products and finishes with low VOCs and formaldehyde content will be selected in line with UK regulatory requirements. When in the vicinity of the construction and installation works, HVAC equipment is to be protected and ventilation systems are to be checked and cleaned prior to and during commissioning to avoid releasing pollutants into the building. Ventilation will be present in all dwellings to remove pollutants derived from people and kitchens.

A nominated person within the Design Team will be responsible for ensuring that these thresholds are achieved and will create a VOC schedule supported by drawings and/or datasheets confirming their testing and emission levels.

4.0 Dilution and control of contaminant sources

This section explores different measures that control and regulate concentrations of indoor air pollutants from both external and internal sources.

Indoor concentrations of pollutants such as formaldehyde and VOCs are to be minimised. The following strategy is to be implemented to dilute and control any contaminant sources.

4.1 Indoor Air Pollutant Concentrations

The WHO recommend the following maximum 1-hour indoor pollutant guidelines: NO_2 = 200 µg/m^3, CO = 35 mg/m^3, Formaldehyde = 30 min average at 0.1 mg/m^3. No safe level can be recommended for Benzene[8]. Appendix B summarises all the recommended levels of pollutants.

The ventilation strategy will consist of Mechanical Ventilation with Heat Recovery (MVHR) within each unit of the Proposed Development. Ventilation rates will be in line with *Building Regulations Part F* requirements.

With the correct demand control, MVHR can reduce heating loads by recovering a proportion of the heat from extracted air. Room-based MVHR systems will need to have a minimum heat recovery efficiency factor of 75% to avoid the need to use a heater battery to achieve adequate supply air temperatures in a 100% fresh air MHVR system. The heat recovery efficiency factor should be measured in accordance with BS EN 308. MVHR units should be able to maintain their specified efficiency at both low and high speeds. Although these systems use fan power to overcome duct resistance, require filter replacements and ongoing maintenance; they can provide good air quality in polluted areas while windows are closed.

4.1.1 Kitchens

Small-scale domestic cooking will occur at the Proposed Development, therefore mechanical cooker extractor hoods should be installed within the kitchen area of each dwelling, with appropriate carbon and grease filters to remove contaminants. These will be of a re-circulating type, with extract provided through the MVHR units. This will help protect residents from any fumes and particles/particulates that may be detrimental to health and will also control potent cooking smells that may be a nuisance for the residents and immediate neighbours.

4.1.2 Bathrooms/WCs

Bathrooms/WCs will have an extract ventilation rate of at least 8l/s continuous extract through the MVHR systems, providing extraction of primarily odours, humidity and pollutants from cleaning products.

4.1.3 Air Exhausts

Air intakes for the MVHR systems will be located in a position to reduce the intake of pollution, and in such a manner as to not re-intake air which may have been expelled from other ventilation systems – such as those from other dwellings. Exhaust locations for ventilation systems should:

- Minimise re-entry to the building through natural intakes
- Avoid adverse effects on the surrounding area
- Be located downstream of any potential intakes where there is a prevailing wind direction and discharge away from any air conditioning condensers located nearby.

[8] WHO guidelines for indoor air quality: selected pollutants, 2010

4.2 Dilution and control of contaminant sources summary

To minimise the impact of pollutants on indoor air quality, the WHO guidelines for maximum concentrations should be targeted. The Proposed Development will use mechanical ventilation with appropriately positioned intakes and exhausts to dilute and control both internal and external contaminant sources. As discussed, continuous air changes will be provided to the units through the specification of MVHR.

The provision of mechanical ventilation will mean that the opening of the windows will be minimised – preventing the ingress of external pollution into the space. However, where additional ventilation is needed, openable windows will be provided to purge ventilate the space fully with each dwelling designed as dual aspect to facilitate cross ventilation.

5.0 Procedures for pre-occupancy flush out

This section explores how pre-occupancy flush out can remove residual levels of pollutants that may have accumulated within the buildings during construction. The flush out helps to ensure that the indoor air quality of a specific building is at an acceptable level when it is occupied, and that post-construction testing is carried out in conditions that are representative of the indoor air quality when occupied.

Upon completion of the construction process and once all relevant elements have been fitted, each dwelling will undergo a period of 'flush out'. During this period, all ventilation ducting will be activated and purged as part of the commissioning process. Each dwelling should be flushed-out once construction (including painting, carpet and other finishes) and the cleaning of ventilation systems have been completed, but before the dwelling is occupied.

In line with best practice, an initial flush out of outdoor air is to be carried out prior to occupation. All openable windows including balcony doors, will be opened in order to assist in the removal of any minor levels of VOCs and/or formaldehyde which may have accumulated during the fit-out period.

To avoid the ingress of pollutants where construction has not been completed in other areas of the site, it is essential that the areas being flushed out and tested are kept isolated from any other construction work. Where snagging occurs and some parts of the building need rectifying, there will be a secondary flush out after these final touches have been made. Any changes to the building finishes and furnishings should remain in line with the low VOC strategy outlined within this report.

6.0 Maintaining indoor air quality in-use

This section outlines the commitments and measures in place to maintain indoor air quality at acceptable levels throughout the building's operational life.

Residents will be provided with Home User Guides to inform them of how to correctly use and maintain the HVAC equipment within their dwelling. This will include the procedure for the correct removal, cleaning and replacement of the ventilation filters within the ventilation system.

If there are any comments or complaints regarding the indoor air quality of the dwelling, these are to be raised to the landlord/applicable representative of the property so that all concerns can be monitored, measured and improved where necessary. This might include any comments made by residents about odours or any side effects that appear to be correlated with indoor air quality – e.g., reports of headaches.

7.0 Summary

This Air Quality Report shows that the new residential development complies with Oxford City Council's planning policy and will not harm the local air quality management strategy.

The report has assessed the performance of the Proposed Development to evaluate the site's suitability for residential occupancy. It has been determined that the Proposed Development is suitable for occupancy in relation to nitrogen oxides and particulate matter concentrations, as annual mean concentrations of NO_2, $PM_{2.5}$ and PM_{10} are within the UK and EU objectives. The Proposed Development is therefore deemed suitable for residents in relation to air quality.

The Air Quality report addresses the planning requirements of Oxford City Council, to assist the air quality management strategy. Baseline air quality conditions indicate that the Proposed Development is within a 'High Pollution Location' due to exceedances in PM_{10}. As with any development, there are associated construction-phase and use-phase impacts on air quality that have been considered and will be minimised as far as possible for both the internal air quality of the Proposed Development, and any contributions to external air quality.

The external sources of pollution have been identified as background concentrations of pollutants and road traffic. Internal sources are likely to be VOCs from the use of paints, varnishes and finishes as part of the construction works, and the building users themselves.

To dilute and control the contaminant sources, mechanical ventilation will be included in the building design. MVHR will be installed within all units with appropriate filtration to the system inlets. This will maintain internal ventilation rates with filtered air, without the need for windows to be opened or background ventilators to be installed. Purge ventilation in the form of openable windows is also proposed where additional ventilation is needed.

Construction and demolition/fabric removal on site will be carried out in line with the *'Guidance on the assessment of dust from demolition and Construction'* as a best practice guidance document, to minimise air pollution derived from these activities.

After building completion - but before occupancy - the building will be flushed out to clear the air of any contamination from internal pollutants. To maintain good levels of indoor air quality, residents will be provided with Home User Guides that details measures to keep the ventilation systems working efficiently and sustainably.

In summary, the Proposed Development has addressed the planning policy requirements regarding air quality and is thought to have a limited impact on both future internal and external air quality.

Appendices

Appendix A - Site Plan

RE—FO R MAT

www.re-format.co.uk
mail@re-format.co.uk
+44 (0)1730 778778

drawn by: **AA**
date created:
checked by: **BB**
scale at A3: **1:200**

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Appendix B - WHO IAQ guidelines and UK ambient air quality standards

Pollutants	WHO Indoor Air Quality Guidelines (2010)[9]	The Air Quality Standards Regulations 2010
CO (mg/m^3)	100 (15 min)	
	60 (30 min)	
	30 (1 hr)	
	10 (8 hr)	10 (8 hr)
	7 (24 hr)	
NO_2 (µg/m^3)	200 (1hr)	200 (1 hr) not to be exceeded more than 18 times a calendar year
	40 (1yr)	40 (1yr)
		350 (1 hr) not to be exceeded more than 24 times a calendar year
		125 (24 hr) not to be exceeded more than 3 times a year
PM10 (µg/m^3)		50 (24 hr) not to be exceeded more than 35 times a calendar year
		40 (1 yr)
PM2.5 (µg/m^3)		25 (1 yr)
Ozone (µg/m^3)		125 (8 hr) not to be exceeded on more than 25 days per calendar year averaged over three years
Radon (Bq/m^3)	No safe level	From Ionising Radiations Regulations not AQSR: 400 (approximately equal to annual average of 270)
	Reference level: 100	
	No more than: 300	
Benzene (µg/m^3)	No safe level	
		5 (1 yr)

[9] WHO Indoor Air Quality Guidelines, 2010 online at the WHO website

Trichloroethylene (µg/m^3)	No safe level	
Tetrachloroethylene		
(µg/m^3)	250 (1yr)	
Formaldehyde (µg/m^3)	100 (30 min)	
Napthalene (µg/m^3)	10 (1yr)	
PAHs (ng/m^3 B[a]P)	No safe level	1 (total content in the PM10 fraction averaged over a calendar year)
Arsenic (ng/m^3)		6 (total content in the PM10 fraction averaged over a calendar year)
Cadmium (ng/m^3)		5 (total content in the PM10 fraction averaged over a calendar year)
Nickel (ng/m^3)		20 (total content in the PM10 fraction averaged over a calendar year)

Notes:

1yr: annual mean, 24hr: 24 hour mean, 1hr: 1 hour mean, 30 min: 30 minute mean

Conversion to ppm at 25 °C and 1 atmosphere: X ppm = (Y mg/m^3) (24.45)/(molecular weight)

Appendix C - Dust Risk Assessment Methodology

Table 6 defines the potential magnitude of dust emissions through the construction phase .

Source	Large	Medium	Small
Demolition	- Total building volume >50,000m^3 - Potentially dusty material (e.g., concrete) - Onsite crushing and screening - Demolition activities >20m above ground level.	- Total building volume 20,000 - 50,000m^3 - Potentially dusty material - Demolition activities 10 - 20m above ground level.	- Total building volume <20,000m^3 - Construction material with low potential for dust release - Demolition activities - <10m above ground level - Demolition during wetter months
Earthworks	- Total site area >10,000m^2 - 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 - 10,000m^2 - Moderately dusty soil type (e.g., silt) - 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 <2,500m^2 - Soil type with large grain size (e.g., sand) - <5 heavy earth moving vehicles active at any one time. - Formation of bunds <4m in height - Total material moved <20,000 tonnes. - Earthworks during wetter months
Construction	- Total building volume >100,000m3 - On site concrete batching - Sandblasting	- Total building volume 25,000 - 100,000m^3 - Potentially dusty construction material (e.g., concrete) - On site concrete batching	- Total building volume <25,000m^3 - Material with low potential for dust release (e.g., metal cladding or timber)
Trackout	- >50 HGV movements in any one day - Potentially dusty surface material (e.g., high clay content) - Unpaved road length >100m	- 10 - 50 HGV movements in any one day - Moderately dusty surface material (e.g., silt) - Unpaved road length 50 - 100m	- <10 HGV movements in any one day - Surface material with low potential for dust release - Unpaved road length <50m

Table 6 : Dust Magnitude of emissions

Table 7 defines the sensitivity of a receptor to dust impacts depending on multiple factors.

Receptor Sensitivity	Human Health	Dust Soiling	Ecological
High	- Locations where members of the public are exposed over a time period relevant to the air quality objectives for PM_{10} - 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 - Locations with vascular species
Medium	- Locations where workers are exposed over a time period relevant to the air quality objectives for PM_{10} - Examples include office and shop workers	- 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 - 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, footpaths, short-term car parks and roads	- - Locally designated site with dust sensitive features

Table 7 : Factors defining sensitivity of an area

Table 8 depicts the criteria for determining the sensitivity of the area to dust soiling effects on people and property.

Receptor Sensitivity	Number of Receptors	Distance from Source			
		<20m	<50m	<100m	<350m
High	More than 100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	More than 1	Medium	Low	Low	Low
Low	More than 1	Low	Low	Low	Low

Table 8 : Sensitivity of the Area to Dust Soiling Effects on People and Property

Table outlines the criteria for determining the sensitivity of the area to human health impacts

Receptor sensitivity	Annual Mean PM_{10} concentration	Number of Receptors	Distance from the Source (m)				
			<20m	<50m	<100m	<200m	<350m
High	Greater than 32µg/m^3	More than 100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32µg/m^3	More than 100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low

	24-28$\mu g/m^3$	More than 100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	Less than 24$\mu g/m^3$	More than 100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	More than 10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	More than 1	Low	Low	Low	Low	Low

Table :- Sensitivity of the area to Human health impacts

Table 9 outlines criteria for determining the sensitivity of the area to ecological impacts.

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

Table 9 : Sensitivity of the area to Ecological impacts

The following tables provide risk category for the dust emitting activities:

Receptor sensitivity	Dust Emission Magnitude		
	Large	Medium	Low
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible Risk

Table 10 : Risk of Dust impacts from Demolition activities

Receptor sensitivity	Dust Emission Magnitude		
	Large	Medium	Low
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible Risk

Table 11 : Risk of Dust impacts from Earthworks and Construction activities

Receptor sensitivity	Dust Emission Magnitude		
	Large	Medium	Low
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible Risk
Low	Low Risk	Low Risk	Negligible Risk

Table 12 : Risk of Dust impacts from Trackout activities

SRE Registered Office | Greenforde Farm
Stoner Hill Road | Froxfield
Petersfield | Hampshire | GU32 1DY
01730 710044
info@sre.co.uk
www.sre.co.uk