Dust risk assessment for the proposed development at Jack Straw's Lane, Oxford

Report to Cantay Estates Ltd

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Contents

1 Introduction

Aether has been commissioned by Drennan International to undertake a dust risk assessment for the proposed development at Jack Straw's Lane, Oxford. The development will consist of the demolition of 9 one storey buildings and the construction of 8 dwellings. 8 car parking spaces will be provided with the development.

The development falls within the City of Oxford, which suffers from elevated levels of air pollution, primarily due to high levels of traffic. Due to the location of the development within a residential area, a dust risk assessment is required to identify potential impacts from demolition and from earthworks, construction and trackout and recommend mitigation measures where appropriate. Section 1 provides some background information on air quality near to the development site.

1.1 The Location of the Development

The proposed development is located at Jack Straw's Lane, Oxford (**Figure 1**).

Figure 1: Location of the development site

Source: © OpenStreetMap contributors

1.2 Assessment Criteria

A summary of the air quality objectives relevant to the Jack Straw's Lane development, as set out in the UK Air Quality Strategy[1], is presented in **Table 1** below.

Table 1: UK Air Quality Objectives for NO_2 and PM_{10}

Pollutant	Concentration	Measured as
Nitrogen Dioxide (NO_2)	40 µg/m^3	Annual mean
	200 µg/m^3	Hourly mean not to be exceeded more than 18 times per year (99.8th percentile)
Particulate Matter (PM_{10})	40 µg/m^3	Annual mean
	50 µg/m^3	24 hour mean not to be exceeded more than 35 times a year (90.4th percentile)

The oxides of nitrogen (NO_X) comprise principally of nitric oxide (NO) and nitrogen dioxide (NO_2). NO_2 is a reddish brown gas (at sufficiently high concentrations) and occurs as a result of the oxidation of NO, which in turn originates from the combination of atmospheric nitrogen and oxygen during combustion processes. NO_2 can also form in the atmosphere due to a chemical reaction between NO and ozone (O_3). Health based standards for NO_X generally relate to NO_2, where acute and long-term exposure may adversely affect the respiratory system.

Particulate matter is a term used to describe all suspended solid matter, sometimes referred to as Total Suspended Particulate matter (TSP). Sources of particles in the air include road transport, power stations, quarrying, mining and agriculture. Chemical processes in the atmosphere can also lead to the formation of particles. Particulate matter with an aerodynamic diameter of less than 10 µm is the subject of health concerns because of its ability to penetrate deep within the lungs and is known in its abbreviated form as PM_{10}.

A growing body of research has also pointed towards the smaller particles as a metric more closely associated with adverse health impacts. In particular, particulate matter with an aerodynamic diameter of less than 2.5 µm, known as $PM_{2.5}$. Local Authorities in England have a flexible role[2] in working towards reducing emissions and concentrations of $PM_{2.5}$ as there is no specific objective. However, under EU Directive 2008/50/EC[3], there is an annual mean limit of 25 µg/m^3.

Further information on the health effects of air pollution can be found in the reports produced by the Committee on the Medical Effects of Air Pollutants[4].

As defined by the regulations, the air quality objectives for the protection of human health are applicable:

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[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland

[2] LAQM TG16 – paragraph 1.09

[3] https://ec.europa.eu/environment/air/quality/directive.htm

[4] https://www.gov.uk/government/collections/comeap-reports

- Outside of buildings or other natural or man-made structures above or below ground
- Where members of the public are regularly present.

This assessment considers the short-term dust risk of the proposed development during demolition and construction. Therefore, long-term compliance against the air quality objectives is not considered. Instead, information on local concentrations is used to inform the assessment of dust risks (**Section 2**). Local pollutant concentrations are presented in **Section 1.4**.

1.3 Local Air Quality Management

Local authorities are required to periodically review and assess the current and future quality of air in their areas. Where it is determined that an air quality objective is not likely to be met, the authority must designate an Air Quality Management Area (AQMA) and produce an Air Quality Action Plan (AQAP).

The site lies within the administrative boundaries of Oxford City Council, which declared an AQMA in 2010, covering the entire extent of the city for exceedances against the annual mean NO_2 objective[5]. The proposed development site falls within this AQMA. An AQAP was produced in 2013; this outlines the measures that the Council is taking to improve air quality. The 2013 AQAP replaces the original action plan created in 2006 and prioritises measures to deliver sustainable road transport. The AQAP identifies six key themes[6]:

- Support for development of sustainable transport measures
- Support for the uptake of low and zero emission vehicles
- Reducing freight emissions
- Planning for sustainable transport
- Managing the Council's transport emissions
- Developing partnerships and public education

In addition, Oxford City Council recently announced plans to develop a 'zero emission zone' (ZEZ) building upon the current low emission zone in place[7]. The ZEZ will eventually ban all diesel and petrol vehicles from central Oxford. Although this mainly pertains to transport, the plans demonstrate the motivations of Oxford City Council, and such an emphasis on air quality may result in further scrutiny of developments within the Oxford area in regard to their potential impact.

1.4 Local Pollutant Concentrations

This section provides an overview of the local data available to give an indication of current air pollution concentrations in proximity of the development site.

1.4.1 Local monitoring data

Oxford has three automatic monitoring sites which monitor nitrogen dioxide (NO_2), two of these sites also monitor particulate matter of less than 10 µm (PM_{10}) and of these, one monitors particulate matter of less than 2.5 µm ($PM_{2.5}$). However, all three of these sites lie more than 1.5km from the development site and are therefore unlikely to be representative. NO_2 concentrations are also measured passively at diffusion tube sites

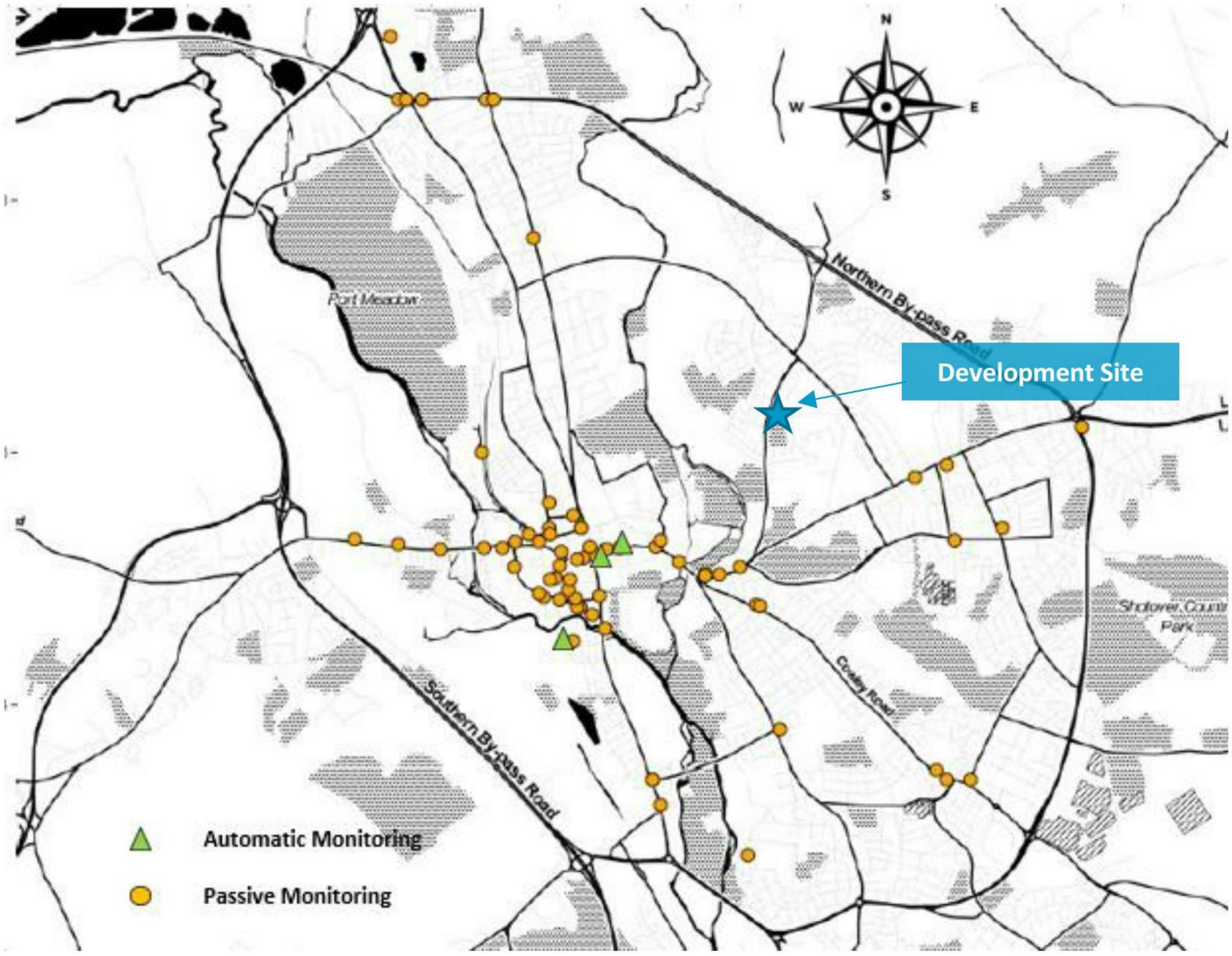
[5] https://www.oxford.gov.uk/info/20216/air_quality_management/206/air_quality_management_in_oxford/3

[6] https://www.oxford.gov.uk/info/20216/air_quality_management/206/air_quality_management_in_oxford/2

[7] https://www.oxford.gov.uk/zez

across the City. Unfortunately, no diffusion tube site is particularly close to the development, as seen in **Figure 2**.

Figure 2: The location of the automatic and passive (diffusion tube) sites in Oxford[8]



The closest three diffusion tube sites are located between 1.2km to 1.5km of the development site. Details of these monitoring sites are given in **Table 2**.

Monitoring results have been taken from the Council's latest Annual Status Report (ASR)[8].

Table 2: The three closest monitoring sites to the Jack Straw's Lane, Oxford development

Site Name	Site Type	Pollutant	Grid Reference	Distance to Kerb (m)	Approx. Distance to development site (m)
Headley Way/London Road	R	NO_2	453982, 206817	2	1230
49 London Road	R	NO_2	454138, 206903	2	1320
St Clements 3	R	NO_2	452625, 206068	1	1440

Note: R = roadside

[8] https://www.oxford.gov.uk/downloads/file/6429/air_quality_annual_status_report_2018

The diffusion tubes were analysed by South Yorkshire Air Quality Samplers, who participate in the Proficiency scheme[9]. Whilst diffusion tubes provide an indicative estimate of pollutant concentrations, they tend to under or over read. The data is therefore corrected using a bias adjustment factor. There are two types of bias adjustment factor – local and national. The local factor is derived from co-locating diffusion tubes (usually in triplicate) with automatic monitors, whereas the national factor is obtained from the average bias from all local authorities using the same laboratory. The City of Oxford has applied a local bias adjustment factor of 0.94 for roadside sites and 1.05 for urban background sites to their 2019 diffusion tube results

Monitoring results are presented in **Table 3**. The data shows that the annual mean NO_2 objective was not exceeded at any of the monitoring sites between 2016 and 2018. Diffusion tubes do not provide information on hourly exceedances, but research[10] identified a relationship between the annual and 1 hour mean objective, such that exceedances of the latter were considered unlikely where the annual mean was below 60 µg/m^3. Therefore, no exceedances of the hourly mean objective are expected at the diffusion tube monitoring sites.

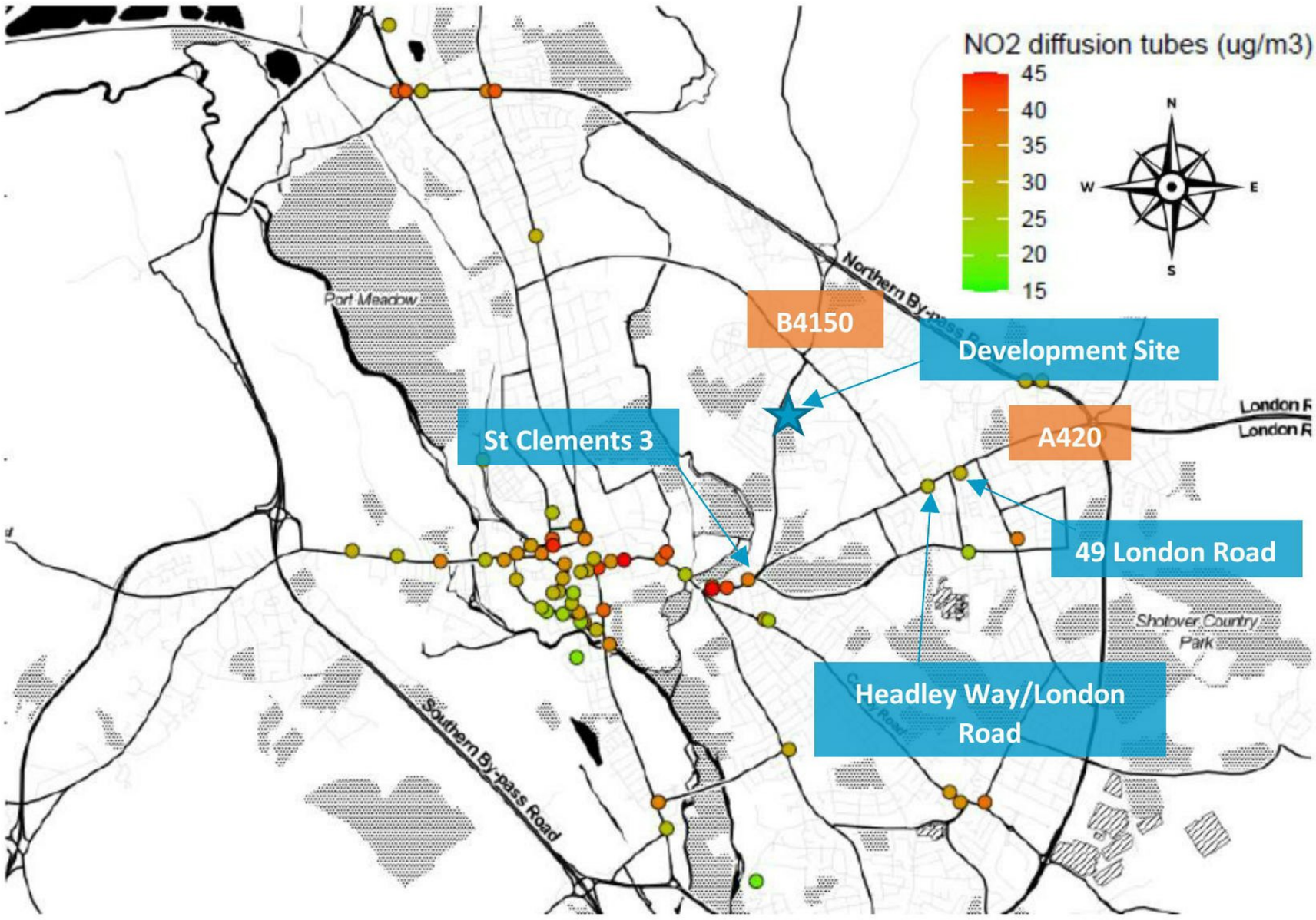
Table 3: Monitoring results for sites close to the proposed development site, 2016-2018

Objective	Site Name	2016	2017	2018
Annual mean NO_2 (µg/m^3)	Headley Way/London Road	27	25	27
	49 London Road	24	25	25
	St Clements 3	-	-	36

Figure 3 below shows the levels of NO_2 in Oxford in 2019 are highest around the city centre and at busy junctions. The elevated levels of NO_2 measured at the St Clements 3 site are likely due to its position at the junction of the B4150 and the A420. This is not representative of the development site, which is situated adjacent to the B4150. The Headley Way/London Road and 49 London Road sites along the A420 may be more representative of the development site.

[9] This is a national QA/QC scheme.
[10] As described in Box 5.2 of LAQM Technical Guidance (TG16).

Figure 3: NO_2 results from diffusion tube sites in Oxford, 2019[8]



1.4.2 Background mapped data

Background pollutant concentration maps are available from the Defra LAQM website and data has been extracted for Jack Straw's Lane, Oxford for this assessment. These 2018 baseline, 1 kilometre grid resolution maps are derived from a complex modelling exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites. The projections in the 2018 LAQM background maps are based on assumptions which were current before the Covid-19 outbreak in the UK. In consequence these maps do not reflect short or longer term impacts on emissions in 2020 and beyond resulting from behavioural change during the national or local lockdowns.

The estimated mapped background PM_{10} concentration around the development site is 15.8 µg/m³ in 2019.

Due to the lack of a nearby PM_{10} monitoring site, the 2019 mapped background concentration has been used as the basis for determining dust risk to human health in this assessment.

2 Demolition & Construction Dust Risk Assessment

Emissions and dust from the construction phase of a development can have a significant impact on local air quality. The Institute of Air Quality Management's (IAQM) Guidance on the Assessment of Dust from Demolition and Construction[11] contains a methodology for determining the significance of construction developments on local air quality. The assessment presented below has been produced in accordance with these guidelines.

The main air quality impacts that may arise during demolition and construction activities are:

- Dust deposition, resulting in the soiling of surfaces
- Visible dust plumes, which are evidence of dust emissions
- Elevated PM_{10} concentrations, as a result of dust generating activities on site
- An increase in concentrations of airborne particles and nitrogen dioxide due to exhaust emissions from diesel powered vehicles and equipment used on site (non-road mobile machinery) and vehicles accessing the site.

The risk of dust emissions from a demolition/construction site causing loss of amenity and/or ecological impacts is related to a number of factors, including: the activities being undertaken; the duration of these activities; the size of the site; the mitigation measures implemented and meteorological conditions. In addition, the proximity of receptors to the site and the sensitivity of these receptors to dust, impacts the level of risk from dust emissions. Receptors include both 'human receptors' and 'ecological receptors'. The former refers to a location where a person or property may experience adverse effects for airborne dust or dust soiling, or exposure to PM_{10}, over a time period relevant to the air quality objectives (see **Table 1**). Ecological receptors are defined as any sensitive habitat affected by dust soiling, through both direct and indirect effects. Details of the assessment procedure in accordance with the IAQM guidance, and the results of the demolition and construction management plan are detailed below.

STEP 1: Screen the requirement for a more detailed assessment

A 'human receptor', as defined by the IAQM Guidance[8,] refers to any location where a person or property may experience the adverse effects of airborne dust or dust soiling, or exposure to PM_{10} over a time period relevant to the air quality objectives, as defined in **Section 1.2**. The guidance states that this will most likely refer to dwellings but may apply to other premises.

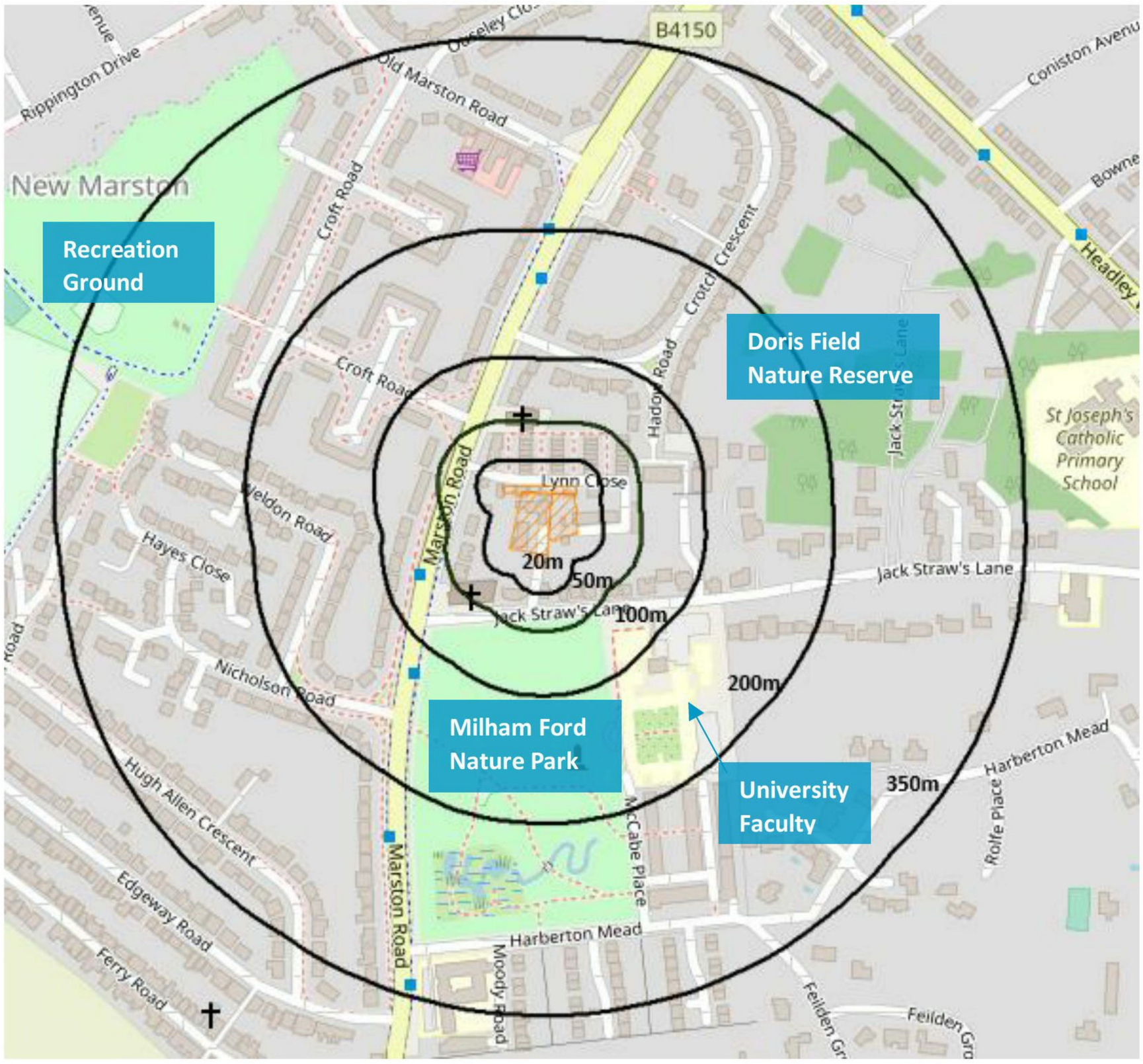
Due to the residential location of the development, there are a large number of human receptors within 350m of the site, including residential dwellings within 50m of the site and a university faculty building within 200m.

An 'ecological receptor' is defined as any sensitive habitat affected by dust soiling, including the direct impacts on vegetation or aquatic ecosystems of dust deposition, and the indirect impacts on fauna (e.g. on foraging habitats). There are potential ecological receptors at Doris Field Nature Reserve and Milham Ford Nature Park, both within 350m of the development site. (See **Figure 4**).

Therefore, a detailed assessment is required to determine potential dust impacts.

[11] http://iaqm.co.uk/guidance/

Figure 4: The location of the proposed development site and potential receptors within 20m, 50m, 100m, 200m and 350m



Source: © OpenStreetMap contributors

STEP 2: Assess the risk of dust impacts

The risk of dusk arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts has been determined using the following risk factors: negligible, low, medium and high risk. The allocated risk category is based upon two factors, the scale and nature of the works (**Table 4**) and the sensitivity of the area to dust impacts (**Table 5**). Sensitivity to dust soiling categorised as **"Medium"** as there are between 1 and 10 human receptors within 50m of the site (the four building blocks directly to the north of the site are car parking garages). Sensitivity to human health is categorised as **"Low"** as the 2019 mapped background concentration of PM_{10} is relatively low at 15.8 µg/m³. The ecological sensitivity of the area is defined as **"Low"** as there are no significant areas of sensitive regions within 50m of the site.

These factors are then combined to determine the risk of dust impacts with no mitigation applied. The results are summarised in **Table 6**. As described in Step 1, the number of human and ecological receptors near to the development have been considered.

Table 4: Dust Emission Magnitude

Activity	Dust Emission Magnitude	Justification
Demolition	Small	Total building volume << 20,000 m^3, construction material with a range of dust potentials, from low (metal sheets/timber) to high (concrete)
Earthworks	Small	Total site area < 2,500 m^2 , paved surface and soil with large grain
Construction	Small	Total building volume << 25,000 m^3, construction material with low potential for dust release (bricks)
Trackout	Small	<10 HDV outward movements estimated in any day

Table 5: Defining the sensitivity of the area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust Soiling	Medium	Medium	Medium	Medium
Human Health	Low	Low	Low	Low
Ecological	Low	Low	Low	Low

Table 6: Summary of the dust risk impacts for the proposed development at Jack Straw's Lane, Oxford

Potential Impact	Risk			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust Soiling	Low Risk	Low Risk	Low Risk	Negligible
Human Health	Negligible	Negligible	Negligible	Negligible
Ecological	Negligible	Negligible	Negligible	Negligible

STEP 3: Determine any required site-specific mitigation

Step 2 identifies that the development is a **"Low Risk Site"** with respect to earthworks and general construction activities due to its relatively small size. However, following best practice measures will help to reduce the impact of the construction activities to an acceptable level.

If an activity at the site results in unacceptable levels of dust being generated, then that activity should cease until sufficient measures have been adapted which prevent or minimise the dust emission. The implementation of such measures will be the responsibility of the site manager. In addition, the likelihood of concurrent dust generating activities on nearby sites should also be considered.

STEP 4: Define post mitigation effects and their significance

Whilst the dust emission magnitude is predicted to be **"Small"** (**Table 4)** in the majority of cases due to the relatively small scale of the development, the sensitivity of the area is defined as **"Medium"** (**Table 5**), due to the proximity of the development to human receptors (**Figure 4**). There are no nearby PM_{10} monitoring sites, but the estimated mapped background PM_{10} concentration around the development site is 15.8 µg/m³ in 2019, below half the objective level, and therefore the risk to human health is considered **"Negligible"**. Overall, the impact of the associated activities are defined as either **"Low Risk"** or **"Negligible"** (**Table 6**). Therefore, compliance with the mitigation measures outlined in the IAQM guidance for **"Low Risk"** developments is considered sufficient to mitigate the potential impacts of construction on local air quality.

The mitigation measures specific to this development, that are designated as 'highly recommended' as outlined in the IAQM guidance, include:

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site
- Ensure all vehicles switch off engines when stationary – no idling vehicles
- Avoid the use of diesel and petrol powered generators and use mains electricity or battery powered equipment where practicable
- Ensure an adequate water supply on the site. Water suppression should be used to damp down dust and other debris that could generate dust, and, where practical, manual or mechanical demolition techniques should be used.
- Ensure all loads entering and leaving the site to be covered.

3 Summary and Conclusions

A dust risk assessment has been undertaken for a proposed residential development at Jack Straw's Lane, Oxford. The City of Oxford council has declared an Air Quality Management Area (AQMA) covering the entire extent of the city due to the exceedance of the annual mean nitrogen dioxide (NO_2) objective. The proposed development lies within this AQMA.

A dust risk assessment has been carried out using the IAQM's 'Guidance on the assessment of dust from demolition and construction' to determine the potential impacts from demolition and from earthworks, construction and trackout. The results of the assessment show that the development is classed as **"Low Risk"**. It is recommended that the developer consults the relevant IAQM guidance and develops a Dust Management Plan in order to mitigate the potential impacts of construction dust on local air quality.

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