Dust risk assessment for the proposed development at Anglia Square, Norwich

Report to Weston Homes PLC

July 2022

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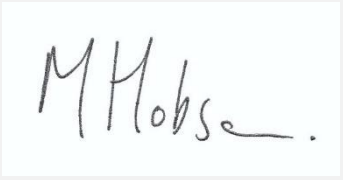
Signature	
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1 Introduction

Aether has been commissioned by Weston Homes PLC to undertake a dust risk assessment for the proposed development at Anglia Square, in Norwich city centre. The site is currently a shopping centre with associated car parking. The hybrid (part full/part outline) application consists of demolition and clearance of all buildings and structures across the 4.65ha site and the phased, comprehensive redevelopment of the site with 14 buildings ranging in height from 1 to 8 storeys, for a maximum of 1,100 residential dwellings, (houses, duplexes and flats) (Use Class C3); a maximum of 8,000 sqm flexible retail, commercial and other non-residential floorspace (retail, business, services, food and drink premises, offices, workshops, non-residential institutions, community hub, local community uses, and other floorspace (Use Classes E/F1/F2/Sui Generis (public conveniences, drinking establishments with expanded food provision, bookmakers and/or nail bars (up to 550sqm), and dry cleaner (up to 150sqm))); service yard, cycle and refuse stores, plant rooms, car parking and other ancillary space; with associated new and amended means of access on Edward Street and Pitt Street, closure of existing means of access on Edward Street, New Botolph Street, Pitt Street and St Crispins Road flyover, formation of cycle path between Edward Street and St Crispins Road, formation of wider footways, laybys and other associated highway works on all boundaries, formation of car club parking area off New Botolph Street, up to 450 car parking spaces (at least 95% spaces for class C3 use, and up to 5% for class E/F1/F2/Sui Generis uses), hard and soft landscaping of public open spaces comprising streets and squares/courtyards for pedestrians and cyclists, other landscape works within existing streets surrounding the site, service infrastructure and other associated work; (All floor areas given as maximum Net Internal Area).

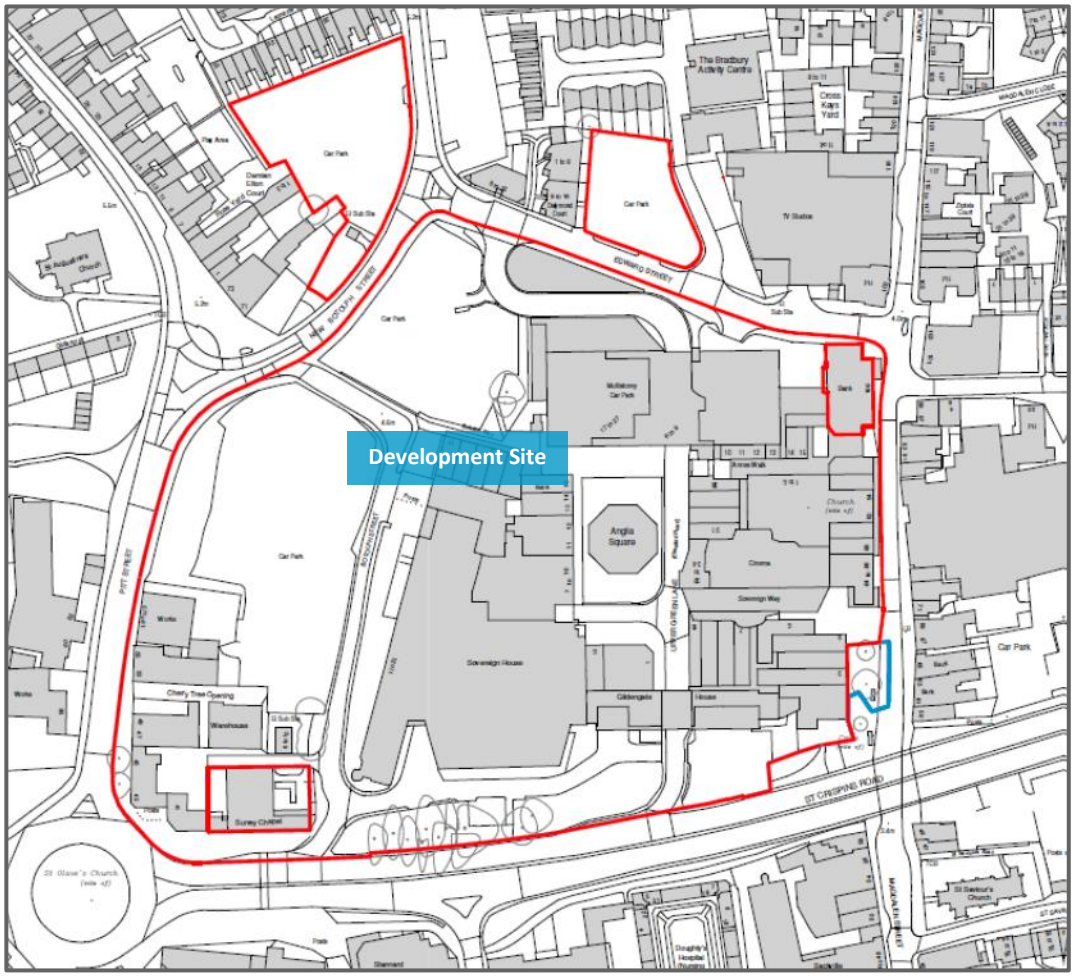
The development falls within Norwich City Council, which suffers from elevated levels of air pollution, primarily due to high levels of traffic. Due to the location of the development within a central and residential area, a dust risk assessment is required to identify potential impacts from demolition 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.

These aspects are provided to protect local air quality. During the Scoping Opinion by Norwich City Council, a dust risk assessment has been requested by the Council as part of the application process. A Construction Environmental Management Plan (CEMP) is also being provided as part of the application, outlining the control measures that will be put in place to control dust levels.

1.1 The Location of the Development

The proposed development is located in the northern part of Norwich City Centre, north of St Crispins Road (**Figure 1**).

Figure 1: Location of the development site



1.2 Assessment Criteria

A summary of the air quality objectives relevant to the Anglia Square 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:

- Outside of buildings or other natural or man-made structures above or below ground

[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

- 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 Norwich City Council which has declared one AQMA[5] covering the centre of the city, broadly covering an area within the inner link road. This AQMA was declared in 2012 due to exceedances of the annual mean NO_2 objective. The proposed development site is located within this AQMA. The latest AQAP[6] was published in 2021.

1.4 Local Pollutant Concentrations

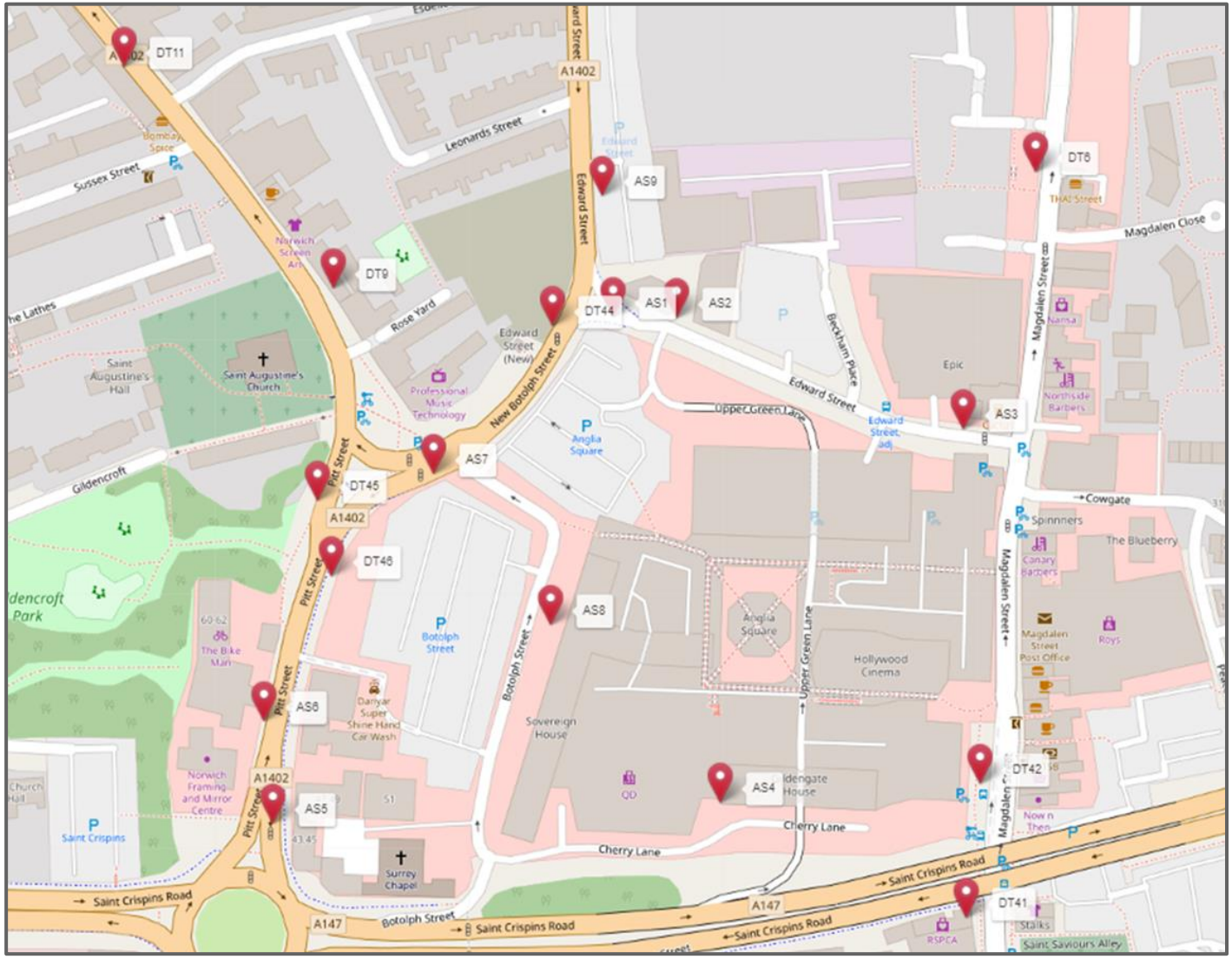
This section provides an overview of the local data available to give an indication of current air pollution concentrations in proximity of the development site.

1.4.1 Local monitoring data

Norwich City Council has two automatic monitoring sites which measure nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$); however, neither of these are located within close proximity of the Site and are therefore not discussed further for NO_2 as they are unlikely to be representative. The results are however presented for PM as this provides the only source of information in Norwich and therefore provides indicative levels for the whole city area. NO_2 concentrations are also measured passively at diffusion tube sites across the Borough. Details of those in the roads surrounding the Site are provided in **Table 2.** In addition, the Applicant instigated via Aether an NO_2 diffusion tube monitoring survey which was undertaken at nine locations across the Site, agreed with NCC, from November 2021 to April 2022 inclusive, and details of these are provided in **Table 3**. These results were bias corrected and annualised to give an estimate of the annual mean NO_2 concentration in 2019. The year 2019 was chosen as it is deemed to be the last 'normal' year prior to the impact of the Covid-19 pandemic. It is worth noting though that the on-Site survey results are provided as indicative only given the inherent uncertainty; however, the results still provide a reasonable indication as to whether air quality is likely to be of concern across the site. For further information on the diffusion tube survey, please see the accompanying diffusion tube survey report[7]. The location of the monitoring sites listed in **Tables 2 and 3** are provided in **Figure 3**.

[5] https://www.norwich.gov.uk/info/20212/pollution/1491/air_pollution
[6] https://www.norwich.gov.uk/download/downloads/id/7493/2021_air_quality_action_plan.pdf
[7] Air quality monitoring survey – Anglia Square, Norwich. Report to Weston Homes. July 2022

Figure 2: The location of the Diffusion Tube (DT) monitoring sites.



Note: NCCs long term diffusion tube locations are prefaced with “DT” and those that are part of the Applicant’s short-term survey are prefaced with “AS”. Map source: Open Street Map

Table 2: NCC's diffusion tube sites around Anglia Square

Site Name	Site Type	Grid Reference	Distance to Kerb (m)
CM1 (Castle Meadow) *	K	623202,308615	1.0
CM2 (Lakenfields) *	UB	623637,306940	N/A
DT 6: 130 Magdalen St	R	623161,309550	4.0
DT 9: 13 St Augustines St	K	622906,309496	1.5
DT 11: 52 St Augustines St	K	622826,309573	1.0
DT16: Zipfel House	R	623186,309650	3.0
DT 41: Magdalen Street (RSPCA)	R	623148,309277	3.5
DT 42: Magdalen St (bus stop)	R	623151,309326	2.5
DT 44: Botolph Street / Edward St jcn	R	622987,309486	2.0
DT 45: Pitt Street W	R	622904,309418	2.2
DT 46: Pitt Street E	R	622910,309391	2.1

*Note: R = roadside, K = kerbside, UB = urban background. *= automatic monitor, N/A = not applicable*

Table 3: The Applicant's Short term diffusion tube sites around Anglia Square

Site Name	Site Type	Grid Reference	Distance to Kerb (m)
AS1: South side of Edward Street	R	623009,309490	1.6
AS2: Dalymond Court, Edward Street	R	623032,309491	1.9
AS3: Epic Studios, Edward Street	R	623139,309455	4.4
AS4: St Crispins Road (Cherry Lane)	UB	623056,309315	N/A
AS5: St Crispins / Pitt Street	R	622893,309300	6
AS6: South end of Pitt Street	R	622888,309337	1
AS7: New Botolph Street	R	622946,309430	3
AS8: St George's Street	UB	622991,309377	N/A
AS9: Edward Street - north of AS	R	623003,309534	2.5

Note: R = roadside, UB = urban background

Both sets of diffusion tubes have been supplied and analysed by Gradko International Ltd using the 50% TEA in acetone method. Grakdo participate in the Proficiency scheme[8]. 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. NCC has applied a local bias adjustment factor (0.88) to their 2020 diffusion tube results. In 2019 (the base year used in the assessment) the Council used a national adjustment factor (0.89). The short-term diffusion tube survey results have been bias corrected by comparing the average concentration recorded by the automatic monitoring site at Lakenfields with the

[8] This is a national QA/QC scheme.

triplicate diffusion tubes placed at the site over the same period. A factor of 0.8 was calculated and applied. The results were then annualised to 2019.

Results have been taken from the Council's latest Annual Status Report (ASR)[9] and supplemented with more recent data for 2021 that is yet to be published. The methodology for the Anglia Square diffusion tube survey is provided in the Monitoring Survey Report.

Monitoring results are presented in **Tables 4, 5 and 6**. The data shows that the annual mean NO_2 objective was exceeded at the DT11 (52 St Augustines St) monitoring location in 2019 and 2021, with the result being very close in 2020. In addition, the DT9 (13 St Augustines St recorded an exceedance in 2019 and a value close to the objective in 2021. However, at the other sites, the objective was met in all years shown.

The results of the site survey show that in 2019, NO_2 concentrations near to the junction of Pitt Street with Crispins Street (where block F will be located) were within 10% of the objective. At all other locations, estimated annual mean NO_2 concentrations are more than 10% below the objective and are therefore not of concern.

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 1 hour mean objective are expected.

Table 4: Monitoring results for NCC tubes, 2019 - 2021

Objective	Site Name	2019	2020	2021*
Annual mean NO_2 (µg/m^3)	DT6 130 Magdalen St	29.8	21.7	26.3
	DT9 13 St Augustines St	**40.1**	33.0	39.5
	DT11 52 St Augustines St	**46.0**	39.4	**48.4**
	DT16 Zipfel House	36.1	30.5	N/A
	DT 41: Magdalen Street (RSPCA)	34.2	27.4	35.4
	DT 42: Magdalen St (bus stop)	33.0	21.4	33.0
	DT 44: Botolph Street / Edward St jcn	N/A	22.5	25.7
	DT 45: Pitt Street W	N/A	25.4	27.3
	DT 46: Pitt Street E	N/A	25.4	28.8

*Note: Values exceeding the 40 µg/m^3 annual mean objective are shown in bold. *2021 data has not been bias corrected and is therefore likely to be an over-estimate. N/A= not available*

[9]https://www.norwich.gov.uk/downloads/download/1917/air_quality_monitoring_reports_and_assessments

[10] As described in Box 5.2 of LAQM Technical Guidance (TG16).

Table 5: Monitoring results from the Anglia Square survey

Objective	Site Name	Unadjusted Period mean	Adjusted annual mean
Annual mean NO_2 ($\mu g/m^3$)	AS1: South side of Edward St	27.4	26.9
	AS2: Dalymond Court	24.5	24.1
	AS3: Epic Studios, Edward St	30.0	29.4
	AS4: St Crispins Road (Cherry Ln)	21.0	20.6
	AS5: St Crispins / Pitt St	**40.2**	39.5
	AS6: South end of Pitt St	34.6	34.0
	AS7: New Botolph St	29.5	29.0
	AS8: St George's St	23.8	23.4
	AS9: Edward Street - north of Anglia Square	29.1	28.6

Note: 'Unadjusted period mean' refers to the average concentration of each diffusion tube across the 6-months of data prior to any bias adjustment or annualisation. The 'estimated 2019 adjusted annualised mean' refers to estimated values for 2019 by undertaking bias adjustment and annualisation into account. Values exceeding the 40 $\mu g/m^3$ annual mean objective are shown in bold.

Table 6: PM Monitoring results for NCC (2019 to 2020)

Objective	Site Name	2019	2020	2021
Annual mean PM_{10} ($\mu g/m^3$)	CM1 (Castle Meadow) *	19	19	19
	CM2 (Lakenfields) *	14	13	N/A
Number of PM_{10} daily means >50 $\mu g/m^3$	CM1 (Castle Meadow) *	5	0	0
	CM2 (Lakenfields) *	4	0	N/A
Annual mean $PM_{2.5}$ ($\mu g/m^3$)	CM1 (Castle Meadow) *	10	10	9
	CM2 (Lakenfields) *	10	8	N/A

The PM_{10} monitoring shows that even at the busy Castle Meadows site, which is effectively a bus interchange / terminus, concentrations were substantially below the objectives. In addition, $PM_{2.5}$ concentrations met the WHO annual mean standard of 10 $\mu g/m^3$ at both automatic monitoring locations.

NCC's Annual Status Report[9] provides information to show that there were very significant decreases in NO_2 levels at the Castle Meadow site due to the Covid lockdown but that there was an insignificant impact on particulate matter levels. The report also provides information to show that in Norwich $PM_{2.5}$ is primarily a transboundary pollutant and that the Lakenfields site, which is outside the urban area, is just as likely to have elevated levels of $PM_{2.5}$ as the urban kerbside site, thus indicating traffic pollution is not the primary source of $PM_{2.5}$.

1.4.2 Background mapped data

Background pollutant concentration maps are available from the Defra LAQM website and data has been extracted for the proposed development 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 NO_x, NO_2 and PM_{10} concentrations around the Site are 23.2 µg/m³, 16.6 µg/m³ and 16.2 µg/m³ respectively in 2019. For 2030 (the latest year for which projected mapped background concentrations are available), the concentrations obtained for the same pollutants are 17.0 µg/m³, 12.5 µg/m³ and 14.9 µg/m³ respectively.

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.

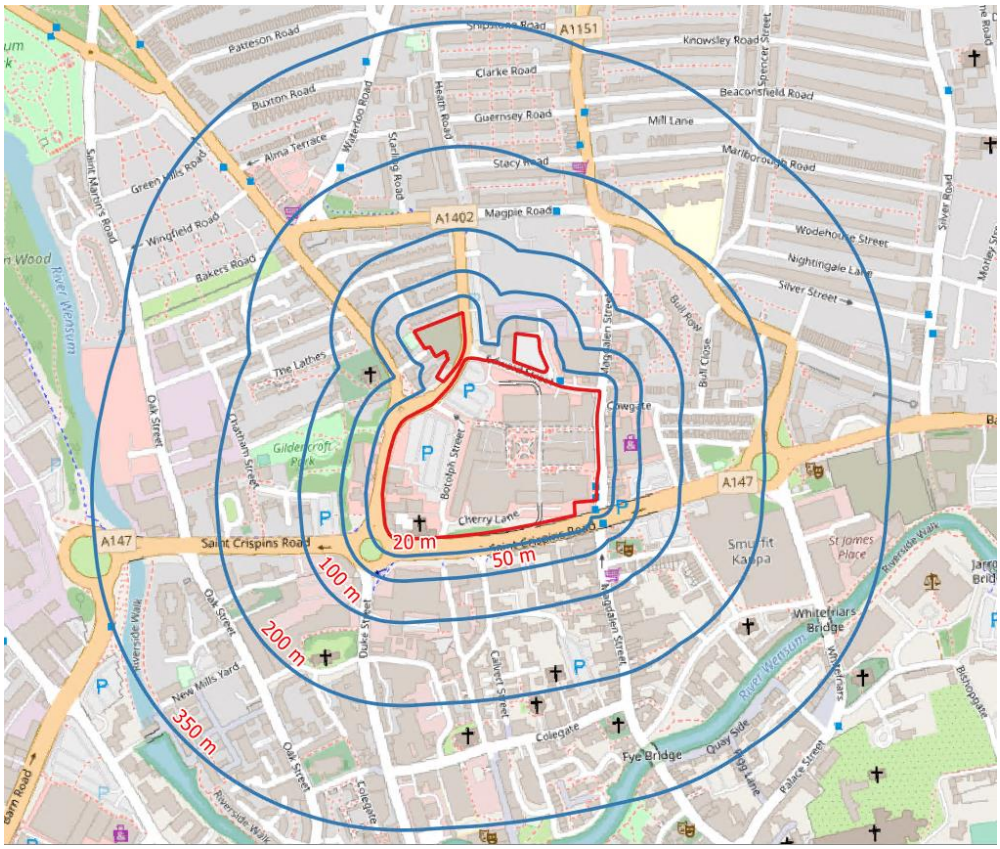
Due to the residential location of the development, there are a large number of human receptors within 350m of the site, including residential dwellings within 50m of the site.

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 no significant ecological receptors identified within 50m of the development site (See **Figure 3**). However, Haggerston Park (NW) and the Regent's Canal (N) are identified as being close to the 350 m buffer zone.

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

A detailed assessment is required to determine potential dust impacts due to the large number of human receptors.

Figure 3: 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 dust 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 7**) and the sensitivity of the area to dust impacts (**Table 8**).

The dust emission magnitude of demolition, earthworks and construction phases is categorised as **"Large"**. The dust emission magnitude due to trackout is categorised as **"Medium"**. Demolition works will be carried out across the site, for a total building volume greater than 50,000 m^3, with some buildings to be demolished greater than 20 m in height. Demolished buildings will be a mixture of concrete and brick. Earthworks are anticipated to take place across the site, which is 46,000 m^2. Using the LandIS soil mapping tool[12], soil at the site is likely to be fen peat which is a medium dusty soil type. The proposed development will consist of construction of high volume (greater than 100,000 m^3) and will have external material that is entirely brick. It is anticipated that

[12] http://www.landis.org.uk/soilscapes/

throughout the phased development, the maximum daily number of outward HDV movements will be 50 but the average will be 40.

Sensitivity to dust soiling is categorised as **"High"** as there are potentially >100 human receptors within 50m of the site. Sensitivity to human health is categorised as **"Low"** as the 2019 mapped background concentration of PM_{10} is relatively low at 16.2 µg/m³. Although Norwich City's PM_{10} monitors do not lie in close proximity to the development site, none showed readings greater than 20 µg/m³ in 2019. This further supports the use of the background mapped value for use in this assessment.

The ecological sensitivity of the area is defined as **"Low"** as there are no significant areas of sensitive regions within 50m of the development site.

These factors are then combined to determine the risk of dust impacts with no mitigation applied. The results are summarised in **Table 9**. As described in Step 1, the number of human and ecological receptors near to the development have been considered.

Table 7: Dust Emission Magnitude

Activity	Dust Emission Magnitude	Justification
Demolition	Large	Demolition of existing concrete and brickwork buildings, of volume greater than 50,000 m³.
Earthworks	Large	Total site area of 46,000 m² and soil with medium grain.
Construction	Large	Total building volume will be greater than 100,000 m³, construction material with low potential for dust release (steel frame and bricks)
Trackout	Medium	A maximum of 50 HDV outward movements estimated across the duration of works,

Table 8: Defining the sensitivity of the area

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

Table 9: Summary of the dust risk impacts for the proposed development

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High Risk	High Risk	High Risk	Medium Risk
Human Health	Negligible	Negligible	Negligible	Negligible
Ecological	NA	NA	NA	NA

STEP 3: Determine any required site-specific mitigation

Step 2 identifies that the development is a **"High Risk Site"** for dust soiling with respect to demolition, earthworks and construction activities. It is a "Medium Risk Site" with respect to trackout. 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

The dust emission magnitude is predicted to be **"High"** (**Table 7)** in the majority of cases due to the large scale of the development, and the sensitivity of the area is defined as **"High"** (**Table 8**) for dust soiling, due to the proximity of the development to human receptors (**Figure 3**). There are no nearby PM_{10} monitoring sites, but the estimated mapped background PM_{10} concentration around the development site is 16.2 µg/m^3 in 2019, smaller than half the objective level, and therefore the risk to human health is considered **"Negligible"**. Overall, the impact of the associated activities range from either **"High Risk"** to **"Negligible"** (**Table 9**). Therefore, compliance with the mitigation measures outlined in the IAQM guidance for **"High Risk"** developments is considered necessary 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, are listed below

2.1 Communications:

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
- Display the head or regional office contact information.
- Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. The DMP may include monitoring of dust deposition, dust flux, real time PM_{10} continuous monitoring and/or visual inspections.

2.1.1 Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Make the complaints log available to the local authority when asked.

- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook.
- Hold regular liaison meetings with other high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.

2.1.2 Monitoring

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100 m of site boundary, with cleaning to be provided if necessary.
- Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Agree dust deposition, dust flux, or real-time PM10 continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

2.1.3 Preparing and Maintaining the Site

- 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 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 actives 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. If they are being re-used on-site cover as described below.
- Cover, seed or fence stockpiles to prevent wind whipping.

2.1.4 Operating Vehicle/Machinery and Sustainable Travel

- Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable.
- 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.
- Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures

provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
- Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).

2.1.5 Operations

- 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.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use 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.

2.1.6 Waste Management

- Avoid bonfires and burning of waste materials.

2.2 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 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. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition.

2.3 Earthworks

- 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.

2.4 Construction

- Avoid scabbling (roughening of concrete surfaces) if possible.

- 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.
- 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.

2.5 Trackout

- 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 and any subsequent action in a site log book.
- Install hard surfaced 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 10 m from receptors where possible.

3 Summary and Conclusions

A dust risk assessment has been undertaken for a proposed mixed-use redevelopment at Anglia Square in Norwich. Norwich City Council has declared an Air Quality Management Area (AQMA) covering the centre of the city, broadly covering an area within the inner link road, due to exceedances 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, earthworks, construction and trackout. The results of the assessment show that the development is classed as **"High Risk" for dust soiling**. The development will require extensive demolition, earthworks and construction activities and lies in a residential area with a high number of neighbouring human receptors. It is recommended that the developer consults the relevant IAQM guidance and develops a Dust Management Plan to mitigate the potential impacts of construction dust on local air quality. It is also highly recommended that the developer implements all mitigation measures itemised in Section 2.

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