1rAQ10030r1

REPORT FOR

AIR QUALITY ASSESSMENT

AT

CALTHORPE STREET, BANBURY

PREPARED FOR

SAMUEL CASTLE
TRI 7

PREPARED BY

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Date

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QUALITY ASSURANCE

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EXECUTIVE SUMMARY

The following Air Quality Assessment has been undertaken and produced by Planning and Environmental Consultants (PEC) Ltd on behalf of Tri 7, in support of the proposed development at Calthorpe Street.

The proposed comprises the removal of the existing commercial units and construction of circa 230 residential units alongside associated infrastructure and parking.

Due to the scale of the development, there is potential for the proposals to cause impacts at sensitive receptors during the construction and operational phases. Additionally, given the proximity to the nearby Air Quality Management area, there is potential to expose future site users to elevated pollutant concentrations. An Air Quality Assessment is therefore required in order to determine baseline conditions at the site, assess site suitability for the proposed end-use and assess the potential impacts as a result of the proposed development.

Potential construction phase air quality impacts from fugitive dust emissions were assessed as a result of demolition, earthworks, construction and trackout activities. It is considered that the use of good practice control measures would provide suitable mitigation for a development of this size and nature and reduce potential impacts to an acceptable level.

Dispersion modelling was undertaken in order to predict annual mean pollutant concentrations across the application site and to predict impacts as a result of additional road vehicle exhaust emissions associated with the proposed development. Results were subsequently verified using local monitoring data provided by Cherwell District Council.

The dispersion modelling results indicated that annual mean pollutant concentrations across the application site were below the relevant air quality objectives at proposed sensitive locations. The site is therefore considered suitable for proposed end use without the implementation of protective mitigation techniques.

The level of anticipated traffic generation from the site concluded that impacts on existing pollutant levels as a result of operational phase pollutant emissions were predicted to be **not significant** in accordance with relevant screening criteria. The use of robust assumptions, where necessary, was considered to provide sufficient results confidence for an assessment of this nature.

Based on the assessment results the site is considered suitable for the proposed end use and complies with the Cherwell Local Plan and the National Planning Policy Framework.

1 INTRODUCTION

1.1 BACKGROUND

Planning and Environmental Consultants (PEC) ltd have been commissioned by Tri 7, hereafter referred to as "the Client" to undertake an Air Quality Assessment in support of a planning application for a residential development at Calthorpe Street, Banbury, herein after referred to as the "Proposed Development".

1.2 SITE LOCATION AND CONTEXT

The application site is located at land off Calthorpe Street, Banbury at approximate National Grid Reference (NGR) 445500, 240400. Reference should be made to Figure 1 within Appendix B for a location plan.

The application site is located adjacent to the Cherwell District Council (CDC) Air Quality Management Area (AQMA) which has been declared due to exceedances of the annual mean Air Quality Objective (AQO) for nitrogen dioxide (NO_2). Subsequently, the Proposed Development has the potential to introduce future residential occupants into an area of elevated NO_2 and particulate matter (PM_{10} and $PM_{2.5}$) concentrations, as well as to cause impacts at sensitive receptor locations during the construction and operational phases.

An Air Quality Assessment has therefore been produced to quantify annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations across the site to consider suitability for the proposed end-use, and to assess potential impacts as a result of the development. The assessment will be undertaken in accordance with the requirements of the National Planning Policy Framework (NPPF) and the CDC Local Planning Policy.

1.3 LIMITATIONS

This report has been produced in accordance with PEC Ltd standard terms of engagement. This report is solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from PEC Ltd at which point a charge may be levied against such approval.

2 LEGISLATION, GUIDANCE AND POLICY

The following legislation, guidance and policy will be considered and adhered to during the preparation of the Air Screening Quality Assessment:

- European Union (EU) Directive 2008/50/EC;
- The NPPF, updated on 20th July 2021);
- The National Planning Practice Guidance (NPPG), relevant chapters produced on 1st November 2019;
- Section 82 of the Environment Act (Part IV), updated 9th November 2021;
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs (DEFRA), 2007[1];
- The Air Quality Standards (Amendment) Regulations (2016);
- Local Air Quality Management Technical Guidance 2022 LAQM.TG(22), DEFRA, August 2022[2];
- Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management (IAQM), v1.1, June 2016[3];
- Land-Use Planning and Development Control: Planning for Air Quality, Environmental Protection UK (EPUK) and IAQM, January 2017[4];

2.1 UK LEGISLATION AND GUIDANCE

The Air Quality Standards (Amendment) Regulations (2016) came into force on 31st December 2016. These Regulations amend the Air Quality Standards Regulations 2010 and transpose the EU Directive 2008/50/EC into UK law. Air Quality Limit Values (AQLVs) were published in these regulations for 7 pollutants, as well as Target Values for an additional 6 pollutants.

Part IV of the Environment Act (2021) requires UK government to produce a national Air Quality Strategy (AQS) which contains standards, objectives and measures for improving ambient air quality. The most recent AQS was produced by the Department for Environment, Food and Rural Affairs (DEFRA) and published in July 2007[1]. The AQS sets out Air Quality Objectives (AQOs) that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedances over a specified timescale. These are generally in line with the AQLVs, although the requirements for compliance vary slightly.

Table 1 presents the AQOs for pollutants considered within this assessment.

Table 1: Air Quality Objectives

Pollutant	Air Quality Objectives	
	Concentration (µg/m³)	Averaging Periods
NO_2	40	Annual mean
	200	1-hour mean; not to be exceeded more than 18 times a year
PM_{10}	40	Annual mean
	50	24-hour mean; not to be exceeded more than 35 times a year
$PM_{2.5}$	25	Annual mean

Table 2 summarises the advice provided in DEFRA guidance LAQM.TG(22)[2] on where the AQOs for pollutants considered within this report apply.

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA, 2007
2 Local Air Quality Management Technical Guidance 2022 LAQM.TG(22), DEFRA, 2022
3 Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management, 2016
4 Land-Use Planning and Development Control: Planning for Air Quality, EPUK and IAQM, 2017

Table 2: Examples of Where the Air Quality Objectives Apply

Averaging Periods	Objectives Should Apply At	Objectives Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer	Kerbside sites where the public would not be expected to have regular access

The monitoring results provided by CDC and background concentrations provided by DEFRA will be compared against the relevant AQOs detailed in Table 1.

2.2 LOCAL PLANNING POLICY

Cherwell District Council's (CDC) Local Plan 2011- 2031 was adopted in December 2016 and contains policies to help deliver the spatial vision for the district. A review of The Cherwell Local Plan indicated the following policy in relation to air quality that is relevant to this assessment:

- Policy ESD 10 – Protection and Enhancement of Biodiversity and the Natural Environment

Reference has been made to this policy during the undertaking of this Air Quality Screening Assessment.

3 METHODOLOGY

There is the potential for the Proposed Development to expose future site users to elevated NO_2, PM_{10} and $PM_{2.5}$ concentrations, as well as to cause impacts at sensitive locations during the construction and operational phases.

3.1 CONSTRUCTION PHASE ASSESSMENT

There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the methodology outlined within the IAQM document 'Guidance on the Assessment of Dust from Demolition and Construction'[3].

Reference should be made to Appendix D for details of the relevant IAQM construction phase assessment criteria, which were utilised in conjunction with site specific information

Activities on the proposed construction site have been divided into four types to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout

The potential for dust emissions was assessed for each activity that is likely to take place and considered three separate dust effects:

- Annoyance due to dust soiling;
- Harm to ecological receptors; and
- The risk of health effects due to a significant increase in exposure to PM_{10} and $PM_{2.5}$

A desk top survey will be undertaken to identify human and ecological receptors within the relevant assessment buffers specified by the IAQM guidance[3]. Should sensitive receptors not be present within the relevant distances then negligible impacts would be expected and further assessment is not necessary.

Following the identification of sensitive receptors, a site is then allocated a risk category which is assigned to each activity, based on the scale and nature of the works, as well as the sensitivity of the area to dust impacts.

The assigned magnitude and sensitivity will then determine the overall risk and appropriate mitigation measures to be employed during construction phase activities.

The IAQM guidance[3] is provided in Appendix D, with the details of the assessor's qualifications and experience. provided in Appendix E.

3.2 OPERATIONAL PHASE ASSESSMENT

3.2.1. FUTURE EXPOSURE

The Proposed Development is located Adjacent to the CDC AQMA. Subsequently, the proposals have potential to introduce new receptors into an area of elevated NO_2, PM_{10} and $PM_{2.5}$ Detailed dispersion modelling was therefore undertaken to quantify NO_2, PM_{10} and $PM_{2.5}$ pollutant exposure across the site and determine suitability for the proposed use. The following modelling scenarios were utilised during the assessment:

- 2019 as baseline year for verification against latest ratified data;
- Opening year do-something (DS) (predicted traffic flows in 2028 should the proposals be completed)

In light of expected emission improvements to the national vehicle fleet guided by government policy, it would be unrealistic not to assume a reduction to vehicle emission factors in future years, given the anticipated development year of 2028.

The 2028 scenario assumes an emission drop off based on assumptions provided by the Emission Factor Tool Kit (Eft v11.0) supported by the uptake of low emission vehicles and government incentives and targets concerning fleet proportions by 2030.

The results of the dispersion modelling assessment will also be compared against the relevant AQOs detailed in Table 1 to determine significance. Full details of data used for the modelling assessment are presented in Appendix C of this report.

3.2.2. ROAD VEHICLE EXHAUST IMPACT ASSESSMENT

Based on the details of the Proposed Development and anticipated trip generation a screening assessment in accordance with the EPUK and IAQM guidance[4] was determined a suitable assessment approach. The assessment will determine road traffic exhaust and combustion emission impacts associated with the Proposed Development, and confirm the requirement for detailed assessment work. The EPUK and IAQM document states the following criteria to help establish when an air quality assessment is likely to be considered necessary:

- Proposals that will cause a change in Light Duty Vehicle (LDV) flows of more than 100 Annual Average Daily Traffic (AADT) within or adjacent to an AQMA or more than 500 elsewhere;
- Proposals that will cause a change in Heavy Duty Vehicle (HDV) flows of more than 25 AADT within or adjacent to an AQMA or more than 100 elsewhere;
- Proposals which include either a centralised plant using biofuel, a combustion plant with single or thermal input >300KWh or a standby emergency generator associated with a centralised energy centre; and
- Proposals which include combustion processes of any size.

Should the above criteria not be met, the EPUK and IAQM document considers air quality impacts associated with the scheme to be not significant and no further assessment is required. Conversely, should the criterion be exceeded it may be deemed necessary that further assessment is required.

4 BASELINE

Existing air quality conditions in the vicinity of the application site were identified in order to provide a baseline for assessment. These are detailed in the following sections.

4.1 LOCAL AIR QUALITY MANAGEMENT

As required by the Environment Act (2021), CDC, has undertaken review and assessment of air quality within their area of administration. This process has indicated that annual mean concentrations of NO_2 are below the AQO within their administration. As such, four AQMAs have been declared, the closest being described as:

- Cherwell District Council Air Quality Management Area no. 2 - The designated area incorporates sections of Oxford Road, Bloxham Road, South Bar, High Street, Horsefair, North Bar, Warwick Road and Southam Road, Banbury.

The application site is located adjacent to the AQMA. As such, there is potential for the Proposed Development to introduce future site users into an area of elevated annual mean NO2 concentrations , and to cause air quality impacts within this sensitive area during the construction and operational phases. This has been considered within this report.

CDC has concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs and as such no further AQMAs have been designated.

4.2 AIR QUALITY MONITORING

Monitoring of pollutant concentrations is undertaken by CDC using passive methods throughout their areas of administration. A review of CDC's most recent Air Quality Monitoring Data[5] indicated 6 diffusion tubes located within the vicinity of the application site, presented in Table 3. Exceedance of the AQO is shown in **bold**. It should be noted that data for 2020 and 2021 has not been included due the to impact of Covid 19 on traffic levels resulting in reduced pollutant levels In these years, it is also unclear as to the long term reliability of 2022 data.

Table 3: NO_2 Diffusion Tube Monitoring Results

ID	Site Name	Type	NGR (m)		Dist' to Site (m)	Annual Mean Concentration (µg/m³)		
			X	Y		2017	2018	2019
3	Banbury- Bridge Street	Kerbside	445,961	240,595	519	33.1	32.0	32.3
5	Banbury- High Street	Kerbside	445,407	240,421	92	35.0	32.3	34.6
6	Banbury- North Bar	Kerbside	445,352	240,774	417	36.9	34.5	34.0
7	Banbury- Cherwell Street	Roadside	445,932	240,499	459	37.3	36.4	29.9
10	Banbury- Oxford Rd/South Bar	Kerbside	445,333	240,100	320	33.4	36.1	35.3
11, 12, 13	Banbury- Horsefair/North Bar 3/3	Roadside	445,351	240,578	241	**41.8**	38.7	38.6

As indicated in Table 3, exceedance of the AQO was monitored at one roadside location within recent years. Tube 11,12,13 is located within the nearby AQMA.

Reference should be made to Figure 2 within Appendix B for a graphical representation of the monitoring locations.

4.3 BACKGROUND POLLUTANT CONCENTRATIONS

[5] Cherwell District Council Air Quality Annual Status Report, 2022

The total concentration of a pollutant is comprised of explicit local emission sources (such as roads and industrial sources) and the background component. The background component consists of indeterminate sources which are transported into an area from further away by meteorological conditions. Background pollutant concentrations are therefore the ambient level of pollution that is not affected by local sources of pollution.

In reality, it is not usually practical to obtain a true representation of background levels in urban areas due to corruption by local sources; background levels used in assessments may contain a mixture of both sources.

Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist LAs in their Review and Assessment of air quality. The Proposed Development site is located across grid square:

- NGR: 445500, 240500

Data for this location was downloaded from the DEFRA website[6]. For the purpose of this assessment, background concentrations are summarised in Table 4 for the current base year (2019) and the predicted development opening year (2028).

Table 4: Predicted Background Pollutant Concentrations

Pollutant	Predicted Background Concentration (µg/m³)	
	2019	2028
NO_x	18.82	14.17
NO_2	13.83	10.67
PM_{10}	15.44	14.22
$PM_{2.5}$	10.63	9.66

As indicated in Table 4, background pollutant concentrations of NO_2, PM_{10} and $PM_{2.5}$ are below the relevant AQOs detailed in Table 1.

4.4 SENSITIVE RECEPTORS

A sensitive receptor is defined as any location which may be affected by changes in air quality as a result of a development. These have been defined for construction dust impacts in the following Sections.

4.4.1. CONSTRUCTION PHASE SENSITIVE RECEPTORS

There are no nationally or European designated ecological receptors within 50m of the Site boundary, or within 50m from a route used by construction vehicles on the public highway (up to 500m from the Site entrance). Therefore, the risk of dust effects at a nationally or European designated ecological receptor site from construction impacts have not been considered further in this assessment.

Human receptors sensitive to potential dust impacts during, demolition, earthworks and construction were identified from a desk-top study of the area up to 350m from the Proposed Development boundary. These are summarised in Table 5.

Table 5: Demolition, Earthworks and Construction Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Human Receptors
Less than 20	10 - 100
20 – 50	More than 100

[6] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

Distance from Site Boundary (m)	Approximate Number of Human Receptors
50 – 100	More than 100
100 – 350	More than 100

Reference should be made to Figure 3 within Appendix B for a graphical representation of demolition, earthworks, and construction dust buffer zones.

Receptors sensitive to potential dust impacts from trackout were identified from a desk-top study of the area up to 50m from the road network within 500m of the site access route. These are summarised in Table 6. The exact construction vehicle access routes were not available for the purpose of this assessment as they will depend on sourcing of materials. This is likely to be decided by the contractor. However, it was assumed that construction traffic would access the Proposed Development via Calthorpe Street, to ensure a worst case trackout assessment is undertaken.

Table 6: Trackout Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Human Receptors
Less than 20	More than 100
20 – 50	More than 100

Reference should be made to Figure 4 within Appendix B for a graphical representation of trackout dust buffer zones.

A number of additional factors have been considered when determining the sensitivity of the surrounding area. These are summarised in Table 7.

Table 7: Additional Area Sensitivity Factors

Guidance	Comment
Whether there is any history of dust generating activities in the area	The site is located in a resuidential area. There is likely to have been a history of dust generating activities due to redevelopment processes in the locality.
The likelihood of concurrent dust generating activity on nearby sites.	A review of the CDC Planning Portal indicated that there are several planning applications within 500m of the Proposed Development. As such, there is potential for concurrent dust generation should the construction phases of the aforementioned developments overlap.
Pre-existing screening between the source and the receptors	There is no dense vegetation present along the development boundaries. Hence, there is no level of natural protective screening in any directions.
Conclusions drawn from analysing local meteorological data which accurately represent the area: and if relevant the season during which works will take place	The wind direction is predominantly from the south west of the development. As such, properties to the north east of the site would be most affected by dust emissions
Conclusions drawn from local topography	The topography of the area appears to be predominantly flat. As such, there are no constraints to dust dispersion.
Duration of the potential impact, as a receptor may become more sensitive over time	Currently the duration of the construction phase is unknown.
Any known specific receptor sensitivities which go beyond the classifications given in the document.	No specific receptor sensitivities identified during the baseline.

4.4.2. OPERATIONAL PHASE SENSITIVE RECEPTORS

A desk top study was undertaken to identify the closest receptor locations to the application site. This indicated residential, educational and medical facility within close proximity to all development boundaries.

5 ASSESSMENT

5.1 CONSTRUCTION PHASE ASSESSMENT

5.1.1. STEP 1 – SCREENING

The desk-study detailed in Section 4.4.1 identified a number of receptors with a high classification of sensitivity within 350m of the site boundary, and within 50m of the anticipated trackout routes. As such, a detailed assessment of potential dust impacts was required, and summarised in the below sections.

5.1.2. STEP 2A – MAGNITUDE

The scale and nature of the works was determined to assess the magnitude of dust arising from each construction phase activity. The determination of magnitude was based upon the criteria detailed in Appendix D with the outcome of Step 2A is summarised below in Table 8.

Demolition

Demolition will involve the removal of the existing commercial units. The volume of buildings to be demolished is therefore likely to be between 20,000m^3 and 30,000m^3. With this considered the magnitude of potential dust emissions related to demolition activities is considered medium.

Earthworks

The Proposed Development site is estimated to cover an area of greater than 10,000m^2. The magnitude of potential dust emissions related to earthwork activities is therefore considered large.

Construction

The proposals comprise the construction of circa 230 residential units. Given the scale of the Proposed Development the total building and infrastructure volume is greater than 100,000m^3. The magnitude of potential dust emissions related to construction activities is therefore considered large.

Trackout

Information on the number of HDV trips to be generated during the construction phase of the Proposed Development was not available at the time of assessment. Similarly, the surface material and unpaved road length was not known at this stage of the project. Based on the site area, it is anticipated that the unpaved road length is likely to be greater than 100m. The magnitude of potential dust emissions from trackout is therefore considered large.

Table 8: Dust Emission Magnitude

Magnitude of Activities			
Demolition	**Earthworks**	**Construction**	**Trackout**
Medium	Large	Large	Large

5.1.3. STEP 2B – SENSITIVITY

The next step (Step 2B) is to determine the sensitivity of the surrounding area, based on general principles such as amenity and aesthetics, as well as human exposure sensitivity.

Dust Soiling

As shown in Section 4.4.1, the desk top study indicated more than 100 sensitive receptors within 350m of the Proposed Development boundary and more than 100 within 50m of the anticipated trackout routes.

Based on the assessment criteria detailed in Appendix D, the sensitivity of the receiving environment to potential dust soiling impacts was considered to be high for all construction phase activities. This is because the site is situated in a predominantly residential area and the people or property would reasonably be expected to be present here for extended periods of time.

Human Health

The annual mean concentration of PM_{10} is 15.44µg/m^3 as detailed in Section 4. Based on the receptor counts provided above, the area is considered to be of low sensitivity for demolition, earthworks and construction phase activities and medium sensitivity for trackout activities.

The sensitivity of the receiving environment to specific potential dust impacts, based on the criteria detailed in Appendix D is summarised in Table 9.

Table 9: Sensitivity of the Surrounding Area

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

5.1.4. STEP 2C – RISK

Both the magnitude and sensitivity factors are combined in Step 2C to determine the risk of dust impacts without the application of best practice mitigation measures.

It should be noted that the potential for impacts depends significantly on the distance between the dust generating activity and receptor location. Risk was predicted based on a worst-case scenario of works being undertaken at the site boundary closest to each sensitive area. Therefore, actual risk is likely to be lower than that predicted during the majority of the construction phase. A summary of the risk from each dust generating activity is provided in Table 10.

Table 10: Summary of Potential Unmitigated Dust Risks

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	High	High	High
Human Health	Low	Low	Low	Medium

5.1.5. STEP 3 – MITIGATION

The IAQM guidance[3] provides a number of potential mitigation measures to reduce impacts during the construction phase. These measures have been adapted for the Proposed Development site as summarised in Table 11.

Table 11: Fugitive Dust Mitigation Measures

Issue	Control Measure
Communication	• 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.
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 off- site, and the action taken to resolve the situation in the log book. • 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.
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 window sills 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.
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 time period • Avoid site runoff of water or mud • Keep site fencing, barriers and scaffolding clean using wet methods.

Issue	Control Measure
	• 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.
Operating vehicle/machinery and sustainable travel	• Ensure all vehicles switch off engines when stationary - no idling vehicles. • Avoid the use of diesel- or petrol-powered 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 un- surfaced 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)
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.
Waste management	• Avoid bonfires and burning of waste materials
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
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

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

5.1.6. STEP 4 – RESIDUAL IMPACTS

Assuming the relevant mitigation measures outlined in Table 11 are implemented, the residual effect from all dust generating activities is predicted to be negligible and therefore **not significant** in accordance with the IAQM guidance[3].

5.2 OPERATIONAL PHASE ASSESSMENT

The assessment was undertaken in accordance with the methodology detailed in Section 3.2.

5.2.1. FUTURE EXPOSURE

Annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations were predicted across the Proposed Development for the 2028 DS scenario at a height of 1.5m to represent exposure across the ground floor level, as shown in Figures 7 to 9 within Appendix B.

Background NO_2 PM_{10} and $PM_{2.5}$ levels are likely to be lower at elevated heights due to increased distance from emission sources, such as roads. Therefore, predicted concentrations at heights above ground floor level are considered acceptable in regards to future exposure and have not been assessed further.

Nitrogen Dioxide (NO_2)

Predicted annual mean NO_2 concentrations across the Proposed Development site during the DS scenario are summarised in Table 12.

Table 12: Modelling Results - Annual Mean NO_2 at Proposed Development

Floor Level	Predicted 2028 Annual Mean NO_2 Concentration (µg/m³)
Ground (1.5m)	11.67 – 17.69

The predicted concentrations shown in Table 12 indicate that there were no exceedances of the AQO across the Proposed Development. As such, it is considered that annual mean NO_2 levels at the Proposed Development site should not be viewed as a constraint to development.

Predictions of 1-hour NO_2 concentrations were not produced as part of the dispersion modelling assessment. LAQM.(TG22)[2] states if annual mean NO_2 concentrations are below 60µg/m³ then it is unlikely that the 1-hour AQO will be exceeded. As such, based on the results in Table 12, it is not predicted that on-site concentrations will exceed the 1-hour mean AQO for NO_2.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for residential use without the implementation of mitigation techniques to protect future site users from elevated NO_2 concentrations.

Particulate Matter (PM_{10} & $PM_{2.5}$)

Predicted annual mean PM_{10} and $PM_{2.5}$ concentrations across the Proposed Development site during the DS scenario are summarised in Table 13.

Table 13: Modelling Results - Annual Mean PM_{10} and $PM_{2.5}$ at Proposed Development

Floor Level	Predicted 2028 Annual Mean Concentration (µg/m³)	
	PM_{10}	$PM_{2.5}$
Ground (1.5m)	14.57 – 16.67	9.85 – 11.16

The predicted concentrations shown in Table 13 indicate that there were no exceedances of the annual mean AQOs for PM_{10} or $PM_{2.5}$ throughout the modelling area. As such, it is considered that annual mean PM_{10} or $PM_{2.5}$ levels at the Proposed Development site should not be viewed as a constraint to development.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for proposed end use without the implementation of mitigation techniques to protect future site users from elevated PM_{10} and $PM_{2.5}$ concentrations.

24-hour Particulate Matter (PM_{10})

For consideration of the 24-hour mean PM_{10} AQO, the number of days with 24-hour mean PM_{10} concentrations greater than 50µg/m³ must not exceed 35 in any given calendar year. In order to assess modelled results against the 24-hour mean AQO for PM_{10}, the guidance document LAQM.TG(22)[2] confirms the method by which the number of days in which the PM_{10} 24-hour AQO is exceeded can be obtained based on a relationship with the predicted PM_{10} annual mean concentration using the formula below, where (C) denotes the annual mean concentration of PM_{10}:

$$\text{No. of } Exceedances = 0.0014 * C^3 + \frac{206}{C} - 18.5$$

The number of days was calculated to be between 0 and 0.34 days across the Proposed Development. As such, the permitted number of 35 days has not been exceeded, and onsite 24-hour mean PM_{10} concentrations are classified as APEC-A.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for the proposed end use without the implementation of mitigation techniques to protect future site users from elevated 24-hour mean PM_{10} concentrations.

5.2.2. IMPACT ASSESSMENT - PREDICTED CONCENTRATIONS AT EXISITING SENSITIVE USE

Any additional vehicle movements associated with the Proposed Development will generate exhaust emissions, such as NO_2, PM_{10} and $PM_{2.5}$ on the local and regional road networks.

Traffic data provided by Calibro Consultants Ltd, the appointed traffic consultant for the scheme, indicated the change of use from commercial to the Proposed residential Development is anticipated to generate a maximum AADT flow of 104 on the local road network outside of the AQMA and result in net reductions at all roads within the AQMA. As such, it is considered that the operational phase of the site will not result in a change of AADT flows of more than 100, produce over 25 HDV movements per day or significantly affect average speeds on the local road network.

Subsequently, potential air quality impacts associated with operational phase road vehicle exhaust emissions are predicted to be **not significant** in accordance the EPUK and IAQM[4] screening criteria shown in Section3.2.2.

6 CONCLUSION

PEC Ltd were commissioned by the Client to undertake an Air Quality Assessment in support of the proposed residential development at land off Calthorpe Street Banbury.

During the construction phase of the Proposed Development there is the potential for air quality impacts as a result of fugitive dust emissions from the site. These were assessed in accordance with the IAQM methodology. Assuming good practice dust control measures are implemented, the residual potential air quality impacts from dust generated by construction, earthworks and trackout activities was predicted to be **not significant**.

Dispersion modelling was undertaken to quantify annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations across the application to assess suitability for proposed use. Modelling results were subsequently verified using CDC local monitoring data.

The dispersion modelling results indicated that annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations across the application site were below the relevant AQOs at the proposed sensitive use. The site is therefore considered suitable for the proposed end-use without the implementation of protective mitigation techniques to protect future amenity.

An assessment was undertaken using the EPUK and IAQM screening criteria to determine the potential for vehicle trips generated by the Proposed Development to affect local air quality. The traffic data provided by Calibro Consultants Ltd, indicated that Proposed Development is anticipated to generate a maximum AADT flow of 104 on the local road network outside of the AQMA and result in net reductions at all roads within the AQMA. Anticipated development traffic flows are **below** the relevant EPUK and IAQM assessment thresholds and operational impacts could be screened out as **not significant**.

Based on the assessment results the site is considered suitable for the proposed end use and complies with the CDC Local Plan and the NPPF.

APPENDIX A – ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADM	Atmospheric Dispersion Modelling
APPLE	Air Pollution Planning and the Local Environment
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objectives
AQS	Air Quality Strategy
CDC	Cherwell District Council
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMP	Dust Management Plan
EPUK	Environmental Protection UK
EU	European Union
GIA	Gross Internal Area
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LLAQM	London Local Air Quality Management
LA	Local Authority
LDV	Light Duty Vehicle
NGR	National Grid Reference
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NRMM	Non Road Mobile Machinery
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5µm
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10µm
TEMPRO	Trip End Model Presentation Program
z_0	Roughness Length

APPENDIX B - FIGURES

Legend

Site Boundary

Title

Figure 1

Site Location

Project

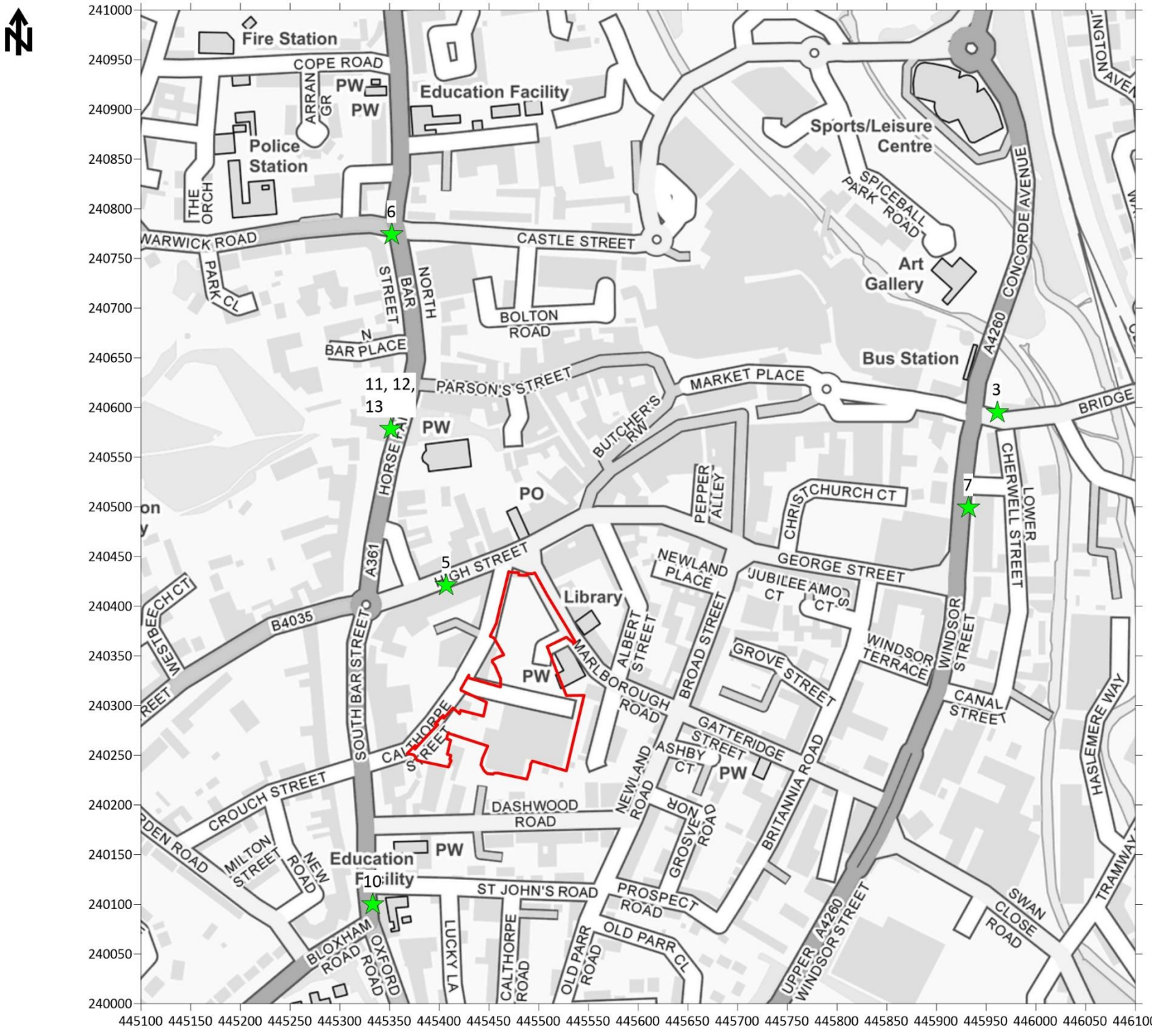
Calthorpe Street, Banbury, Oxford

Project Number

AQ10030

Planning and Environmental Consultants Ltd

Second Floor, 198 Elliott Street,
Tyldesley, Manchester, M29 8DS
www.pecltd.org
info@pecltd.org
01942 556259



Legend

Site Boundary

Diffusion Tube Monitoring Locations

Title

Figure 2

Diffusion Tube Monitoring Locations

Project

Calthorpe Street, Banbury, Oxford

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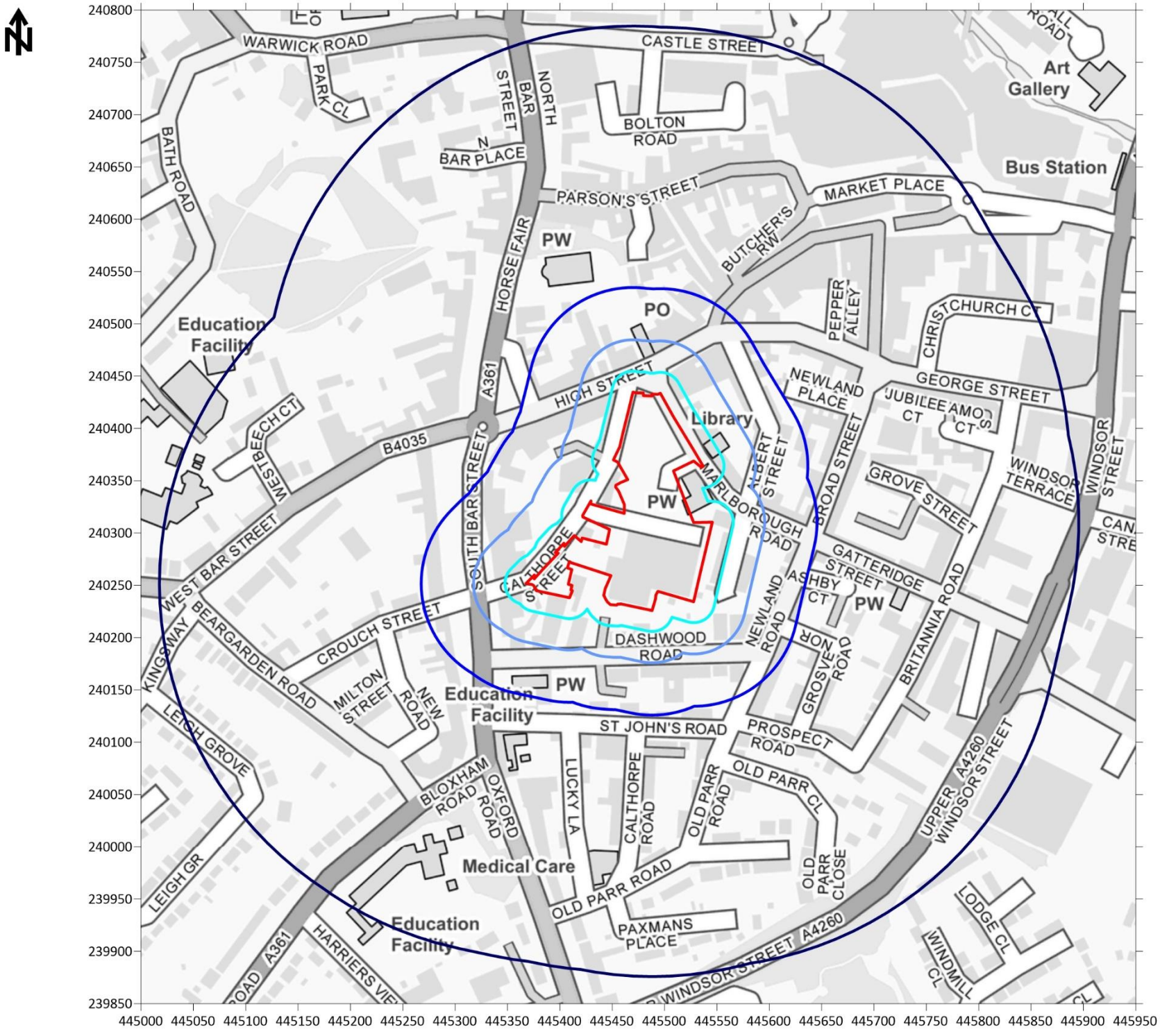

Legend

- Site Boundary
- 20m from Site Boundary
- 50m from Site Boundary
- 100m from Site Boundary
- 350m from Site Boundary

Title

Figure 3

Demolition, Earthworks and Construction Dust Buffer Zones

Project

Calthorpe Street, Banbury, Oxford

Project Number

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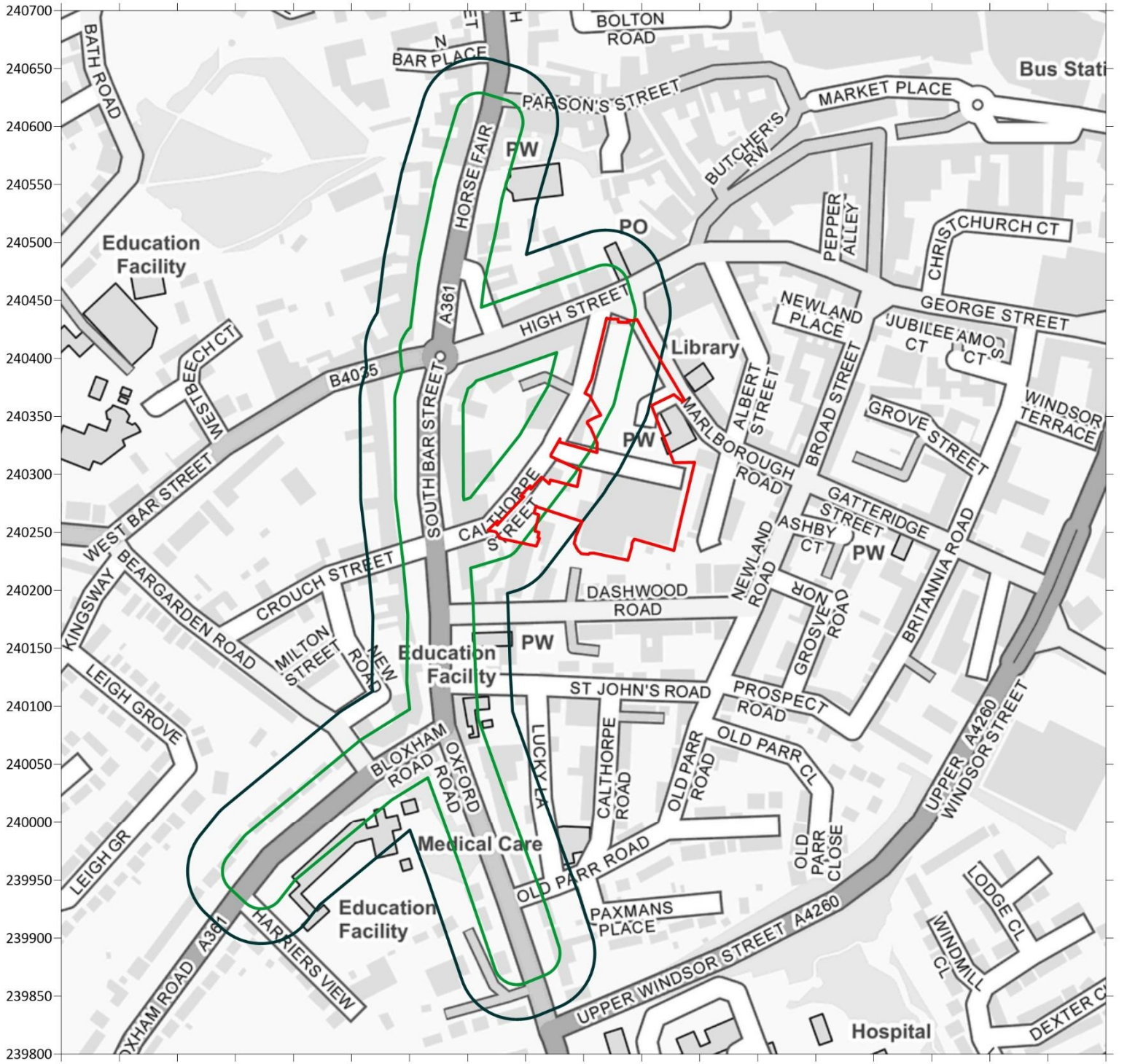

Legend

- Site Boundary
- 20m from Site Access Route
- 50m from Site Access Route

Title

Figure 4

Trackout Dust Buffer Zones

Project

Calthorpe Street, Banbury, Oxford

Project Number

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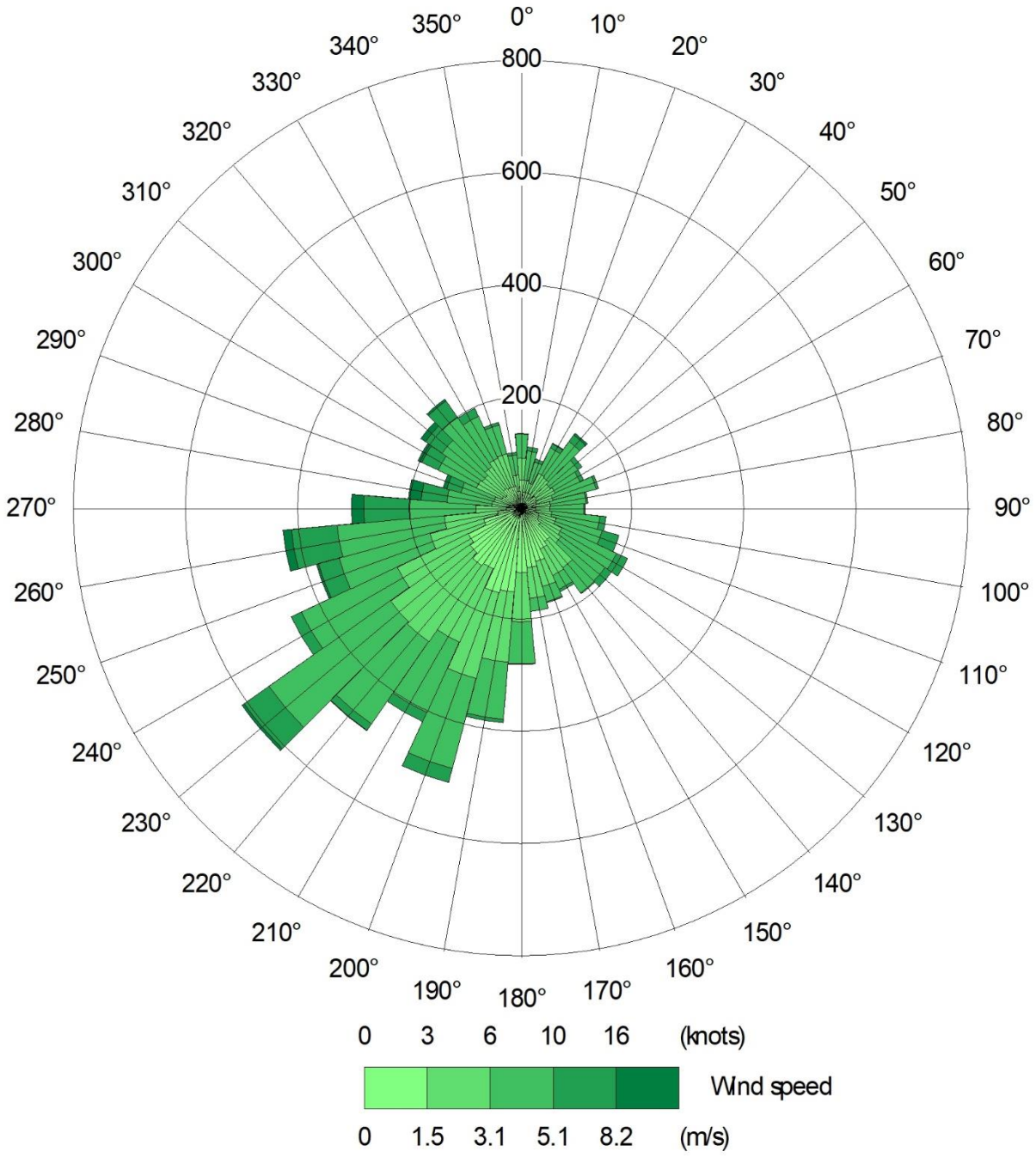

Legend

Title

Figure 5

Wind Rose
Church Lawford Meteorological Station
2019

Project

Calthorpe Street, Banbury, Oxford

Project Number

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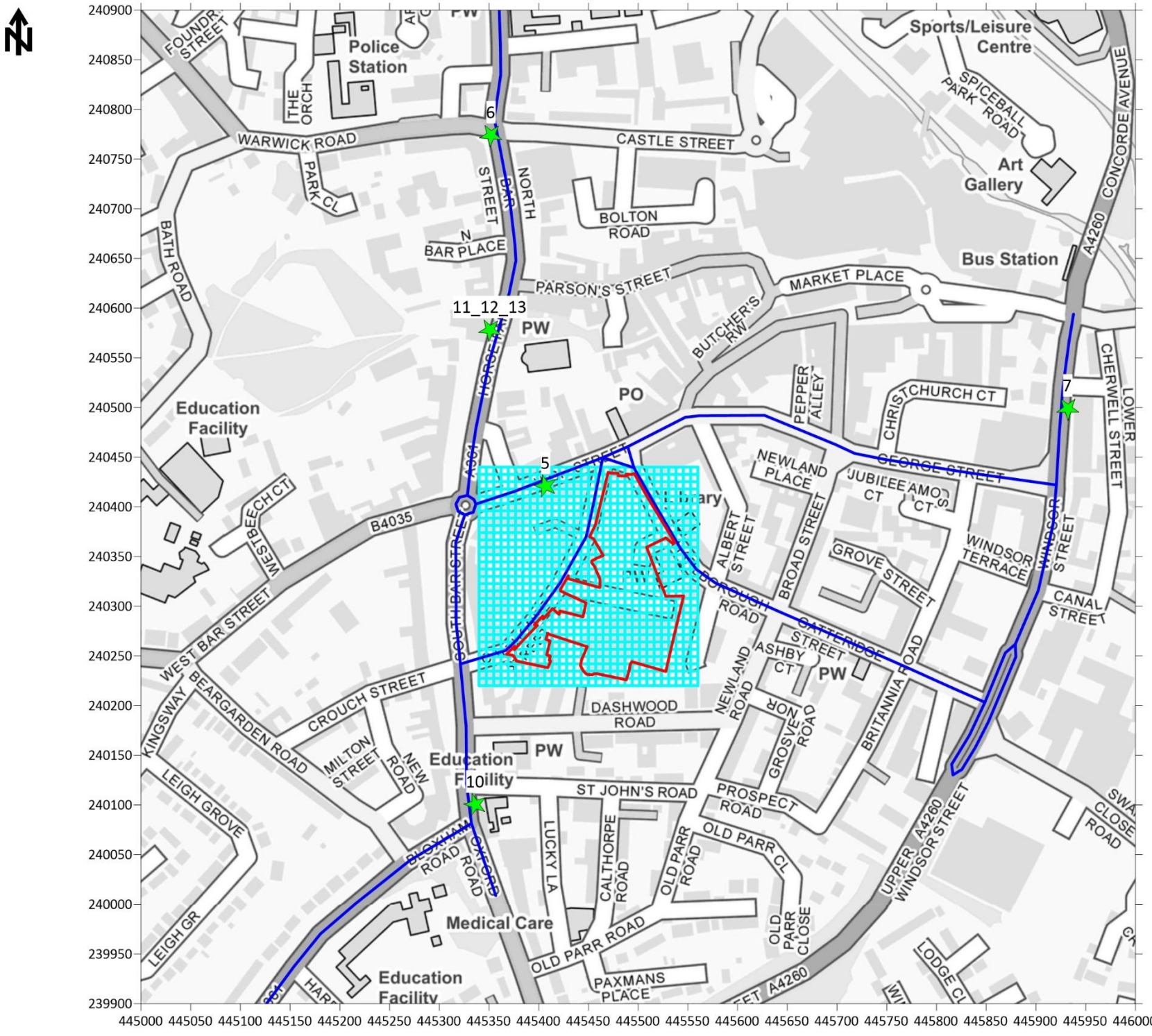

Legend

- Site Boundary
- Modelled Road Link
- Cartesian Grid
- Diffusion Tube Monitoring

Title

Figure 6

ADMS-Roads Input

Project

Calthorpe Street, Banbury, Oxford

Project Number

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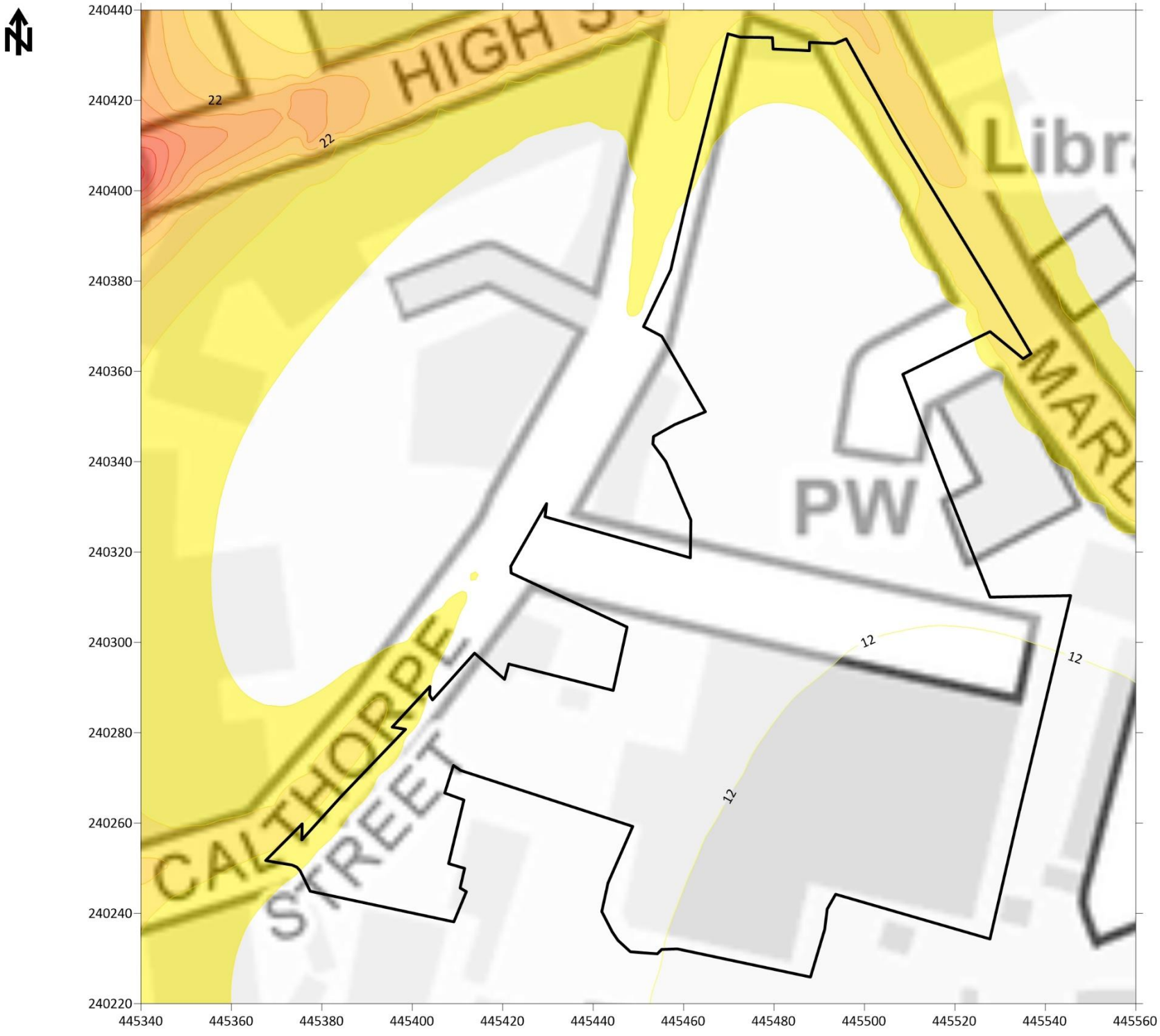

Legend

Site Boundary

34
32
30
28
26
24
22
20
18
16
14
12

Predicted Annual Mean NO_2 Concentration (µg/m³)

Title

Figure 7

Predicted Annual Mean NO_2 Concentrations (µg/m³)

Project

Calthorpe Street, Banbury, Oxford

Project Number

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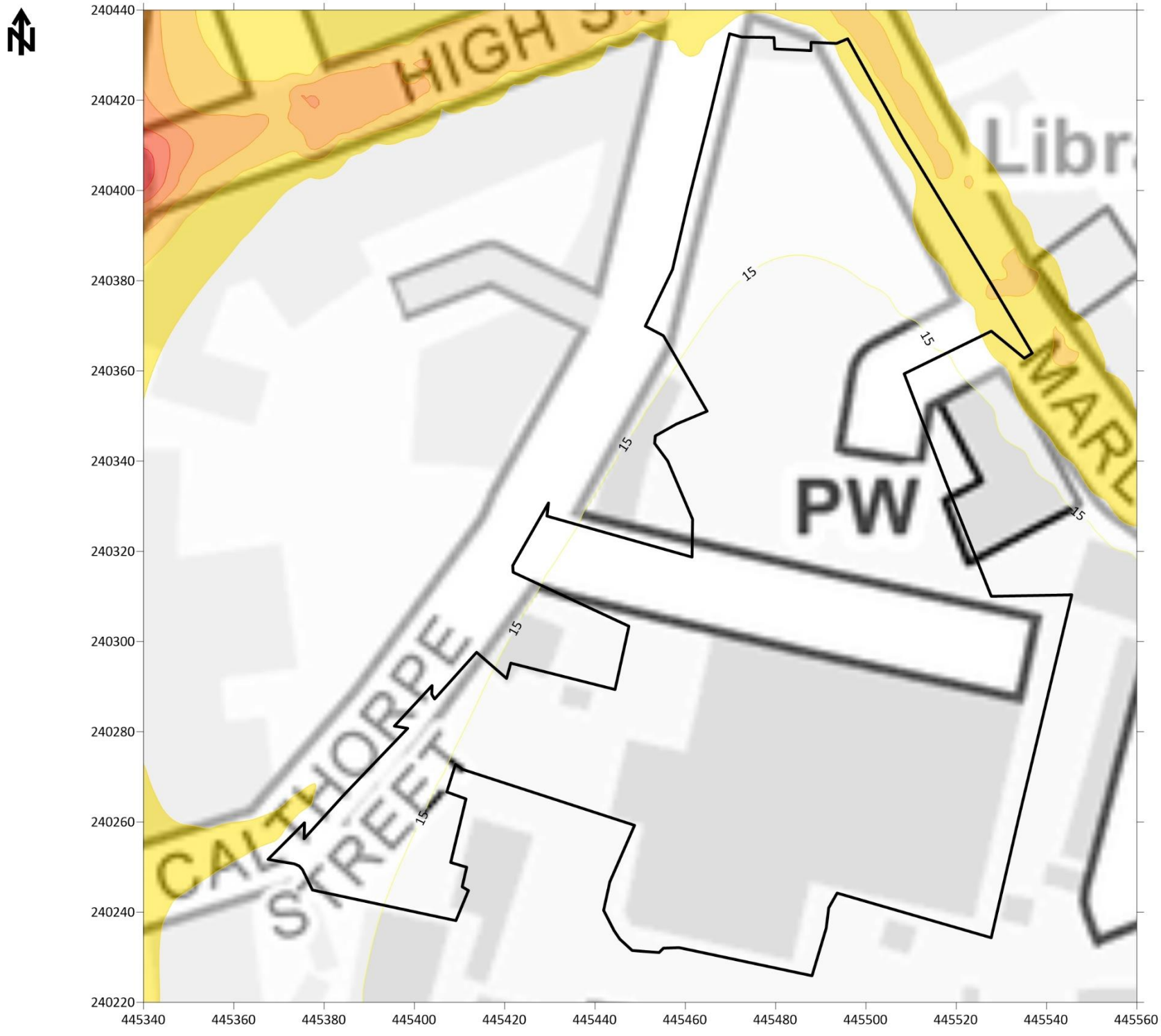

Legend

Site Boundary

21
20
19
18
17
16
15

Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)

Title

Figure 8

Predicted Annual Mean PM_{10} Concentrations ($\mu g/m^3$)

Project

Calthorpe Street, Banbury, Oxford

Project Number

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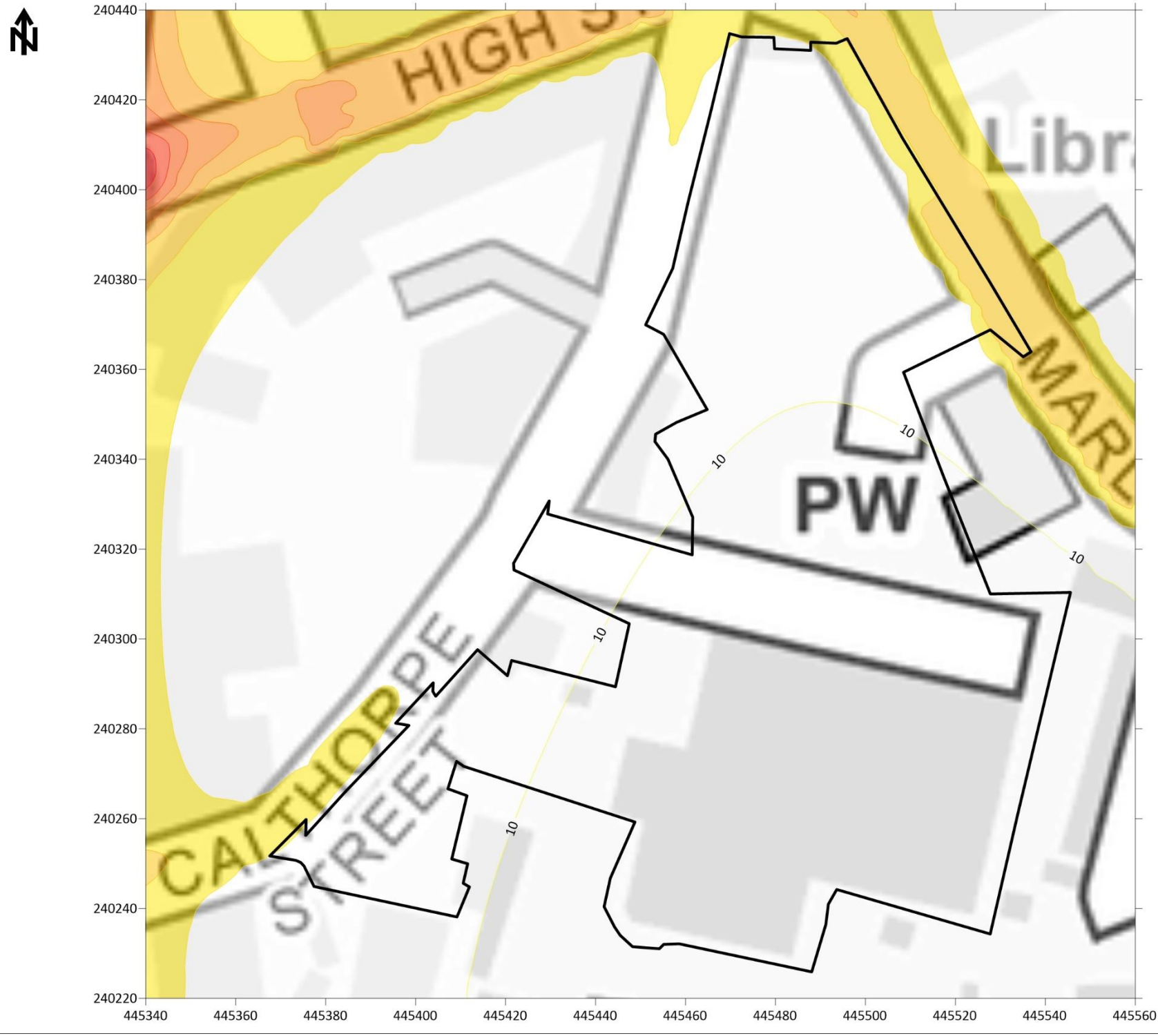

Legend

Site Boundary

13.5
13
12.5
12
11.5
11
10.5
10

Predicted Annual Mean $PM_{2.5}$ Concentration (µg/m³)

Title

Figure 9

Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m³)

Project

Calthorpe Street, Banbury, Oxford

Project Number

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APPENDIX C – ASSESSMENT INPUTS

The Proposed Development has the potential to introduce future site users to poor air quality. Dispersion modelling using ADMS Roads was therefore undertaken to predict pollutant concentrations across the site to consider site suitability for the proposed end-use.

The assessment was undertaken in accordance with the guidance contained within the DEFRA document LAQM.TG(22)[2] and the EPUK and IAQM guidance[4].

Dispersion Model

Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 5.0). ADMS-Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

The model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length; and
- Monin-Obukhov length.

Assessment Area

Ambient concentrations were predicted over the Proposed Development site and surrounding highway network. One Cartesian grid was included in the model over the area at approximately NGR: 445340, 240220 and 445560, 240440 at height of 1.5m to represent the proposed ground floor level for the 2028 opening year scenario.

Results were subsequently used to produce contour plots within the Surfer software package. Reference should be made to Figure 6 within Appendix B for a graphical representation of the verification inputs and operation phase DS extents, respectively.

Traffic Flow Data

Development flow traffic data and associated network distribution was provided by Calibro Consultants Ltd, the appointed Transport Consultants for the scheme, and indicated that a total flow generation of 104 on the local road network outside of the AQMA and result in net reductions at all roads within the AQMA as a result of the Purposed Development. Baseline traffic data for all road links were obtained from the transport consultant

Growth factors provided by the Trip End Model Presentation Program (TEMPRO) software package were utilised to allow for conversion from the obtained 20219 traffic flow to 2028 which was used to represent the opening year scenario. Vehicle speeds were estimated based on the free flow potential of each link and local speed limits. Road widths were estimated from aerial photography and UK highway design standards.

A summary of the traffic data used in the verification scenario is provided in Table C1.

Table C1: 2019 Verification Traffic Data

Road Link		Road Width (m)	Canyon Height	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)
L1	Calthorpe Street - south of Site Access	6.3	0	2,324	2.40	8.05
L2	Calthorpe Street - north of Site Access	6.8	0	1,409	4.64	32.19
L3	Calthorpe Street - south of High Street	5.8	0	1,409	4.64	8.05
L4	Marlborough Road to Calthorpe Street	6.2	0	2,675	1.06	8.05
L5	Marlborough Road from Calthorpe Street	3.6	0	2,675	1.06	8.05
L6	Marlborough Road - south of High Street	6.2	0	5,350	2.12	16.09
L7	Marlborough Road	15.8	9	5,350	2.12	32.19
L8	Marlborough Road - west of A4260	5.5	0	5,350	2.12	16.09
L9	George Street	12.52	0	5,795	5.70	16.09
L10	High Street	12.5	10	6,899	4.47	24.14
L11	High Street - east of A361	10	0	6,899	4.47	8.05
L12	B4035/A361 Roundabout	6.5	0	14,374	7.31	16.09
L13	Upper Windsor Street - south of Bridge Street	14.3	0	13,969	3.97	16.09
L14	Upper Windsor Street - north of George Street	11	0	13,969	3.97	16.09
L15	Upper Windsor Street - south of George Street	10	0	13,969	3.97	16.09
L16	Upper Windsor Street - by Swan Close Road south bound	6	0	6,984	1.98	16.09
L17	Upper Windsor Street - by Swan Close Road north bound	5	0	6,984	1.98	16.09
L18	Oxford Road - north of Upper Windsor Street	7.5	0	11,812	3.51	16.09
L19	A361 South Bar Street - north of Oxford Road	10.5	0	10,970	5.49	16.09
L20	A361 South Bar Street - north of Dashwood Road	10	0	10,970	5.49	32.19
L21	A361 South Bar Street - south of High Street	12.8	0	10,970	5.49	16.09
L22	A361 Horse Fair - north of High Street	14	0	14,080	5.38	16.09
L23	A361 Horse Fair	6.5	0	14,080	5.38	32.19
L24	North Bar Street - south of Castle Street	12	0	14,080	5.38	16.09
L25	North Bar Street - north of Castle Street	10	0	14,080	5.38	16.09
L26	North Bar Street - north of Cope Road	7	0	14,080	5.38	32.19
L27	Bloxham Road - west of Oxford Road	8	0	10,492	5.44	16.09
L28	Bloxham Road	7.5	0	10,492	5.44	32.19

Reference should be made to Figure 6 within Appendix B for a graphical representation of the road link locations used within the verification assessment. The road width, canyon height and mean vehicle speed shown in Table C1 remained the same for the 2028 scenarios.

A summary of the 2028 traffic data is shown in Table C2.

Table C2: 2028 Traffic Data

Road Link		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)
L1	Calthorpe Street - south of Site Access	2,536	2.48
L2	Calthorpe Street - north of Site Access	1,346	5.82
L3	Calthorpe Street - south of High Street	1,346	5.82
L4	Marlborough Road to Calthorpe Street	3,187	1.12
L5	Marlborough Road from Calthorpe Street	3,187	1.12
L6	Marlborough Road - south of High Street	6,373	2.25
L7	Marlborough Road	6,373	2.25
L8	Marlborough Road - west of A4260	6,373	2.25
L9	George Street	6,271	5.73
L10	High Street	7,036	4.77
L11	High Street - east of A361	7,036	4.77
L12	B4035/A361 Roundabout	15,403	7.46
L13	Upper Windsor Street - south of Bridge Street	15,218	3.97
L14	Upper Windsor Street - north of George Street	15,218	3.97
L15	Upper Windsor Street - south of George Street	15,218	3.97
L16	Upper Windsor Street - by Swan Close Road south bound	7,609	1.99
L17	Upper Windsor Street - by Swan Close Road north bound	7,609	1.99
L18	Oxford Road - north of Upper Windsor Street	12,740	3.55
L19	A361 South Bar Street - north of Oxford Road	11,764	5.58
L20	A361 South Bar Street - north of Dashwood Road	11,764	5.58
L21	A361 South Bar Street - south of High Street	11,764	5.58
L22	A361 Horse Fair - north of High Street	15,186	5.43
L23	A361 Horse Fair	15,186	5.43
L24	North Bar Street - south of Castle Street	15,186	5.43
L25	North Bar Street - north of Castle Street	15,186	5.43
L26	North Bar Street - north of Cope Road	15,186	5.43
L27	Bloxham Road - west of Oxford Road	11,569	5.38
L28	Bloxham Road	11,569	5.38

Reference should be made to Figure 6 within Appendix B for a graphical representation of the road link locations used within the operation phase assessment.

Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 11.0) released in November 2021, which incorporates updated COPERT 5.3 vehicle emissions factors for NO_x, PM_{10} and $PM_{2.5}$ and EURO 6 vehicle fleet sub-categories.

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO_2 concentrations using the NO_x to NO_2 Calculator (v.8.1) provided by DEFRA, which is the method detailed within LAQM.TG(22)[2].

Meteorological Data

Meteorological data used in this assessment was taken from Church Lawford meteorological station over the period 1st January 2019 to 31st December 2019 (inclusive).

Church Lawford meteorological station is located at approximate NGR: 445630, 273615 which is approximately 35km north of the Proposed Development. Although there is a large distance between the application site and Church Lawford the use of this data is considered to provide a reasonable representation of conditions at the development site.

All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 5 within Appendix B for a wind rose of utilised meteorological data.

Roughness Length

The specific roughness length (z_0) values used to represent conditions during the verification process, DS scenario, as well as conditions at the Church Lawford meteorological station are summarised in Table C3.

Table C3: Utilised Roughness Lengths

Scenario	Roughness Length (m)	ADMS Description
Verification, future year Scenarios	1	Cities/Woodlands
Church Lawford	0.3	Agricultural Area (Max)

These values of z_0 are considered appropriate for the morphology of the assessment area.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere within certain urban or rural contexts. The specific length values used to represent conditions during the verification process, DS scenario, as well as conditions at the Church Lawford are summarised in Table C4.

Table C4: Utilised Monin-Obukhov Lengths

Scenario	Monin-Obukhov Length (m)	ADMS Description
Verification, future year Scenarios	10	Small Town <10,000
Church Lawford	10	Small Town <10,000

This Monin-Obukhov value is considered appropriate for the morphology of the assessment area.

Background Concentrations

The 2028 annual mean background concentrations detailed in Table 4, was used in the dispersion modelling assessment to represent annual mean pollutant levels at the Proposed Development site.

Table C5 displays the specific background concentrations as predicted by DEFRA, utilised to represent the condition at the monitoring locations used within the verification process.

Table C5: Predicted Background Pollutant Concentrations for Monitoring Locations

Monitoring Location	DEFRA Grid Square	Pollutant	2028 Predicted Background Concentration (µg/m³)
5, 6, 7, 10 and 11, 12, 13	445500, 240500	NO_x	18.82
		NO_2	13.83

Verification

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and
- Uncertainties associated with monitoring data, including locations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

For the purpose of this assessment model verification was undertaken for 2019, using traffic data, meteorological data and monitoring results from this year.

Traffic data for bridge street was unavailable at the time of assessment, as such diffusion tube 3 has not been included within the verification. CDC undertakes periodic monitoring of NO_2 concentrations at 5 roadside monitoring location within the assessment extents. The road contribution to total NO_x concentration was calculated from the monitored NO_2 result for use in the verification process. This was undertaken following the methodology contained within DEFRA guidance LAQM.TG(22)[2]. The monitored annual mean NO_x concentration and calculated road NO_x concentration are summarised in Table C6.

Table C6: NO_x Concentrations

Site ID	Monitored Road NO_x Concentration (µg/m³)	Modelled Road NO_x Concentration (µg/m³)	% Difference ((Monitored - Modelled)/Monitored)) * 100
5	41.31	27.37	34
6	40.00	25.04	37
7	31.29	32.37	-3
10	42.83	28.75	33
11, 12, 13	50.18	16.53	67

According to LAQM.TG(22), no adjustment is necessary where the results of the model all lie within 10% of the monitored concentrations or provide systematic overpredictions (7). Subsequently, specific monitors have not been included within the calculation of the NO_x adjustment factor.

The monitored and modelled NO_x road contribution concentrations were graphed and the equation of the trend line based on the linear progression through zero was calculated, as shown in Graph 1

This indicated that a verification factor of **1.6936** was required to be applied to all NO_x modelling results, showing the model overestimated pollutant concentrations throughout the assessment extents.

An adjustment factor of 1 has been applied where modelled concentrations are observed within 10% of monitored NO_x concentrations, or in cases where systematic overpredictions occur. This method ensures that over adjustment is avoided at locations where the initial modelling provides suitable correlation to monitored concentrations.

Graph 1 is provided below.

Graph 1 - Verification Adjustment Factor

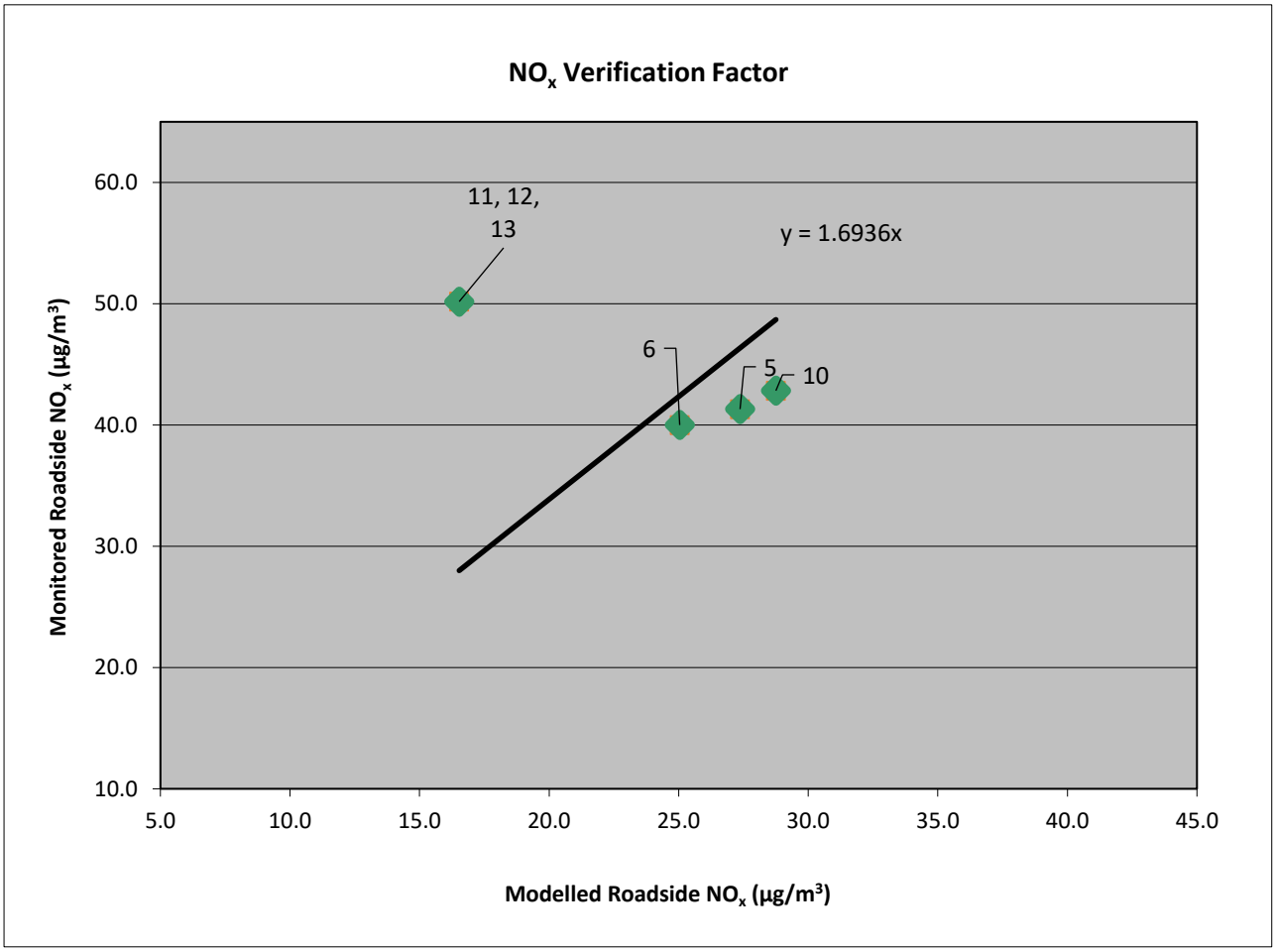


Table C7 presents the monitored annual mean NO_2 concentrations and the adjusted modelled total NO_2 concentration based on the above verification factor. Exceedances of the annual mean NO_2 AQO are highlighted in **bold**.

Table C7: NO_2 Concentrations

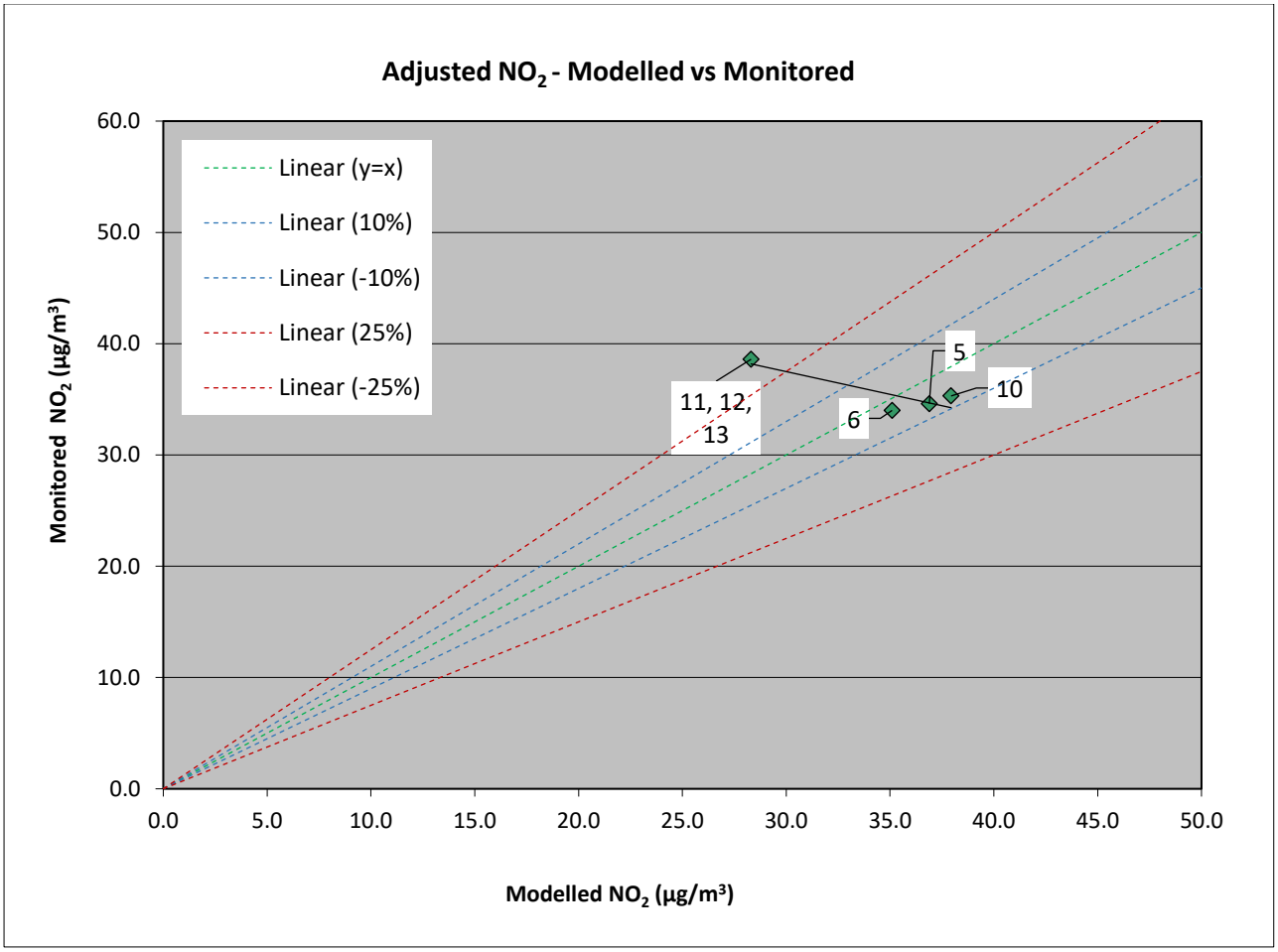
Site ID	Monitored Total NO_2 Concentration (µg/m³)	Adjusted Modelled Total NO_2 Concentration (µg/m³)	% Difference ((Monitored - Modelled)/Monitored)) * 100
5	34.60	36.89	-7%
6	34.00	35.10	-3%
7*	29.90	30.42	-2%
10	35.30	37.94	-7%
11, 12, 13	38.60	28.31	27%

* Adjustment factor of 1.0 applied

As demonstrated in Table C7, the percentage difference between modelled and monitored concentrations is deemed acceptable and is less than 25% in 4 cases, and less than 10% at 4 locations. This reduces uncertainties in the model predictions and provide a robust representation of pollutant concentrations in accordance with the guidance suggested in LAQM.TG(22)[2]. Although diffusion tube 7 falls outside of the 25% as a result of localised factors which are difficult to reproduce within the model, it has been included to ensure a worst case scenario.

A graphical representation of the adjusted NO_2 concentrations is provided within Graph 2.

Graph 2 – Modelled vs Monitored NO_2



As PM_{10} and $PM_{2.5}$ monitoring is not undertaken within the assessment extents, the NOx adjustment factor of 1.6936 was utilised to adjust model predictions of PM_{10} and $PM_{2.5}$ in accordance with the guidance provided within LAQM.TG(22)[2].

APPENDIX D – CONSTRUCTION PHASE METHODOLOGY

There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the methodology outlined within the Institute of Air Quality Management (IAQM) document 'Guidance on the Assessment of Dust from Demolition and Construction'[3].

Activities are divided into four types to reflect their different potential impacts. These are:

- Demolition
- Earthworks;
- Construction; and
- Trackout.

The potential for dust emissions was assessed for each activity that is likely to take place and considered three separate dust effects:

- Annoyance due to dust soiling;
- Harm to ecological receptors; and
- The risk of health effects due to a significant increase in exposure to PM_{10} and $PM_{2.5}$.

The assessment steps are detailed below.

Step 1

Step 1 screens the requirement for a more detailed assessment. Should human receptors be identified within 350m from the site boundary or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment should proceed to Step 2. Additionally, should ecological receptors be identified within 50m of the boundary site or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment should also proceed to Step 2.

Should sensitive receptors not be present within the relevant distances then negligible impacts would be expected and further assessment is not necessary.

Step 2

Step 2 assesses the risk of potential dust impacts. A site is allocated to a risk category based on two factors:

- The scale and nature of the works, which determines the magnitude of dust arising as: small, medium or large (Step 2A); and
- The sensitivity of the area to dust impacts, which can be defined as low, medium or high sensitivity (Step 2B).

The two factors are combined in Step 2C to determine the risk of dust impacts without mitigation applied. Step 2A defines the potential magnitude of dust emission through the construction phase. The relevant criteria are summarised in Table F1.

Table F1: Construction Dust - Magnitude of Emission

Magnitude	Activity	Criteria
Large	Demolition	Total building volume greater than 50,000m^3 Potentially dusty construction material (e.g. concrete) On-site crushing and screening Demolition activities greater than 20m above ground level
	Earthworks	Total site area greater than 10,000m^2 Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size)

Magnitude	Activity	Criteria
		More than 10 heavy earth moving vehicles active at any one time Formation of bunds greater than 8m in height More than 100,000 tonnes of material moved
	Construction	Total building volume greater than 100,000m^3 On site concrete batching Sandblasting
	Trackout	More than 50 Heavy Duty Vehicle (HDV) trips per day Potentially dusty surface material (e.g. high clay content) Unpaved road length greater than 100m
Medium	Demolition	Total building volume 20,000m^3 to 50,000m^3 Potentially dusty construction material Demolition activities 10m to 20m above ground level
	Earthworks	Total site area 2,500m^2 to 10,000m^2 Moderately dusty soil type (e.g. silt) 5 to 10 heavy earth moving vehicles active at any one time Formation of bunds 4m to 8m in height Total material moved 20,000 tonnes to 100,000 tonnes
	Construction	Total building volume 25,000m^3 to 100,000m^3 Potentially dusty construction material (e.g. concrete) On site concrete batching
	Trackout	10 to 50 HDV trips per day Moderately dusty surface material (e.g. high clay content) Unpaved road length 50m to 100m
Small	Demolition	Total building volume under 20,000m^3 Construction material with low potential for dust release (e.g. metal cladding or timber) Demolition activities less than 10m above ground level Demolition during wetter months
	Earthworks	Total site area less than 2,500m^2 Soil type with large grain size (e.g. sand) Less than 5 heavy earth moving vehicles active at any one time Formation of bunds less than 4m in height Total material moved less than 20,000 tonnes Earthworks during wetter months
	Construction	Total building volume less than 25,000m^3 Construction material with low potential for dust release (e.g. metal cladding or timber)
	Trackout	<10 HDV (3.5t) outward movements in any one day Surface material with low potential for dust release Unpaved road length <50m

Step 2B defines the sensitivity of the area around the development site for construction, earthworks and trackout. The factors influencing the sensitivity of the area are shown in Table F2.

Table F2: Examples of Factors Defining Sensitivity of an Area

Sensitivity	Examples	
	Human Receptors	Ecological Receptors
High	Users expect of high levels of amenity High aesthetic or value property People expected to be present continuously for extended periods of time	Internationally or nationally designated site e.g. Special Area of Conservation

Sensitivity	Examples	
	Human Receptors	Ecological Receptors
	Locations where members of the public are exposed over a time period relevant to the AQO for PM_{10} e.g. residential properties, hospitals, schools and residential care homes	
Medium	Users would expect to enjoy a reasonable level of amenity Aesthetics or value of their property could be diminished by soiling People or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land e.g. parks and places of work	Nationally designated site e.g. Sites of Special Scientific Interest
Low	Enjoyment of amenity would not reasonably be expected Property would not be expected to be diminished in appearance Transient exposure, where people would only be expected to be present for limited periods. e.g. public footpaths, playing fields, shopping streets, playing fields, farmland, footpaths, short term car park and roads	Locally designated site e.g. Local Nature Reserve

The guidance also provides the following factors to consider when determining the sensitivity of an area to potential dust impacts during the construction phase:

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and the receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which works will take place;
- Any conclusions drawn from local topography;
- Duration of the potential impact, as a receptor may become more sensitive over time; and
- Any known specific receptor sensitivities which go beyond the classifications given in the document.

These factors were considered in the undertaking of this assessment.

The sensitivity of the area to dust soiling effects on people and property is shown in Table F3.

Table F3: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		Less than 20	Less than 50	Less than 100	Less than 350
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 F4 outlines the sensitivity of the area to human health impacts.

Table F4: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			Less than 20	Less than 50	Less than 100	Less than 200	Less than 350
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 - 28µg/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 24µg/m^3	More than 100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
	Less than 24µg/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	Greater than 32µg/m^3	More than 10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	28 - 32µg/m^3	More than 10	Medium	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	24 - 28µg/m^3	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	Less than 24µg/m^3	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Low	-	More than 1	Low	Low	Low	Low	Low

Table F5 outlines the sensitivity of the area to ecological impacts.

Table F5: Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	Less than 20	Less than 50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Step 2C combines the dust emission magnitude with the sensitivity of the area to determine the risk of unmitigated impacts.

Table F6 outlines the risk category from demolition activities.

Table F6: Dust Risk Category from Demolition

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Medium
Medium	High	Medium	Low
Low	Medium	Low	Negligible

Table F7 outlines the risk category from earthworks and construction activities.

Table F7: Dust Risk Category from Earthworks and Construction

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table F8 outlines the risk category from trackout.

Table F8: Dust Risk Category from Trackout

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

Step 3

Step 3 requires the identification of site-specific mitigation measures within the IAQM guidance to reduce potential dust impacts based upon the relevant risk categories identified in Step 2. For sites with negligible risk mitigation measures beyond those required by legislation are not required. However, additional controls may be applied as part of good practice.

Step 4

Once the risk of dust impacts has been determined and the appropriate mitigation measures identified, the final step is to determine the significance of any residual impacts. For almost all construction activity, the aim should be to control effects through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'.

APPENDIX E – ASSESSORS CV

Lewis Ellison
Technical Director
MOcean, AMIEnvSc, MIAQM

KEY EXPERIENCE

Lewis is a Technical Director with specialist experience in the air quality sectors. His key capabilities include:

- Production of Air Quality Assessments to the Department for Environment, Food and Rural Affairs (DEFRA), Environment Agency and Environmental Protection UK (EPUK) methodologies for clients from the residential, retail and commercial sectors.
- Detailed dispersion modelling of road vehicle emissions using ADMS-Roads. Studies have included impact assessment of pollutant concentrations at various floor levels and assessment of suitability of development sites for proposed end-use.
- Assessment of dust impacts from construction sites to the Institute of Air Quality Management (IAQM) methodology.
- Assessment of Odour Impact from commercial and industrial processes in line with Environment Agency (EA) and IAQM methodologies and guidance
- Quantification of Ecological Impacts associated with Nitrogen and Acid Deposition from industrial processes
- Production of air quality mitigation strategies for developments throughout the UK.

SELECT PROJECTS SUMMARY

Permit Application Support

- Elliot Hire Salford
- Elliot Hire Wakefield
- Elliot Hire Scunthorpe

ES Chapters

- Lyle Park West, Newham – residential development in close proximity to an active industrial estate.
- Deansgate, Manchester – residential multistorey development in the centre of Manchester.
- Land West of Stevenage – 1350 residential unit development with the potential to negatively impact local air quality

Air Quality

- Goulton Street Hull – Outline planning permission for 7 industrial units within Hull
- Empire Cinema, Birmingham – Diffusion tube survey and air quality assessment for an assisted living accommodation
- Tirrell's Lane, Tenbury Wells – residential assessment in the village of Tenbury Wells.

Odour Assessments

- Gowanbank, Forfar – Odour survey to support a residential development in close proximity to Gowanbank recycling centre
- Squires Close, Pocklington – Odour risk assessment in support of a residential in close proximity to a sewage treatment works
- Hawthorn Fields, Rufforth - Odour risk assessment in support of a residential in close proximity to a waste water treatment works

Dust Assessment

- Liverpool Docks – Construction dust monitoring survey
- Lyle Park West – Dust impact assessment from adjacent concrete batching plant
- High Street, Burton – Construction dust risk assessment

London Experience

- Gurnell Leisure Centre – mixed use development including residential, sports and commercial land use
- Springfield Village Wandsworth – residential development and extension to the existing hospital building
- Evelyn House, Greenwich – residential apartment block

Monitoring & Surveying Experience

- Liverpool Waters – Frisbee Dust gauge monitoring
- Gownbank, Forfar – Field odour survey "sniff test"
- Empire Cinema Birmingham – Diffusion tube survey

QUALIFICATIONS

- Masters of Geological Oceanography
- Odour Acuity Certified Master of Science