Air Quality Assessment

Proposed Construction of a New McDonald’s Drive Thru Restaurant at

Ashgrove Road West, Aberdeen AB16 5EH

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ENVIRONMENTAL AND
SUSTAINABILITY CONSULTANTS

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Executive Summary

McDonalds Ltd (the 'Client') to carry out an air quality in connection with the proposed new McDonalds restaurant and Drive-Thru off Ashgrove Road West, Aberdeen (the 'Site').

Aberdeen City Council has undertaken extensive assessment is air quality across the district and as a result has declared three air quality management areas within the borough due to exceedances of the annual mean NO_2 UK objective limit. One of these AQMA incorporates the A92 North Anderson Drive which runs to the west of the Site. The development proposals have been reviewed against current air quality planning guidance published by the Institute of Air Quality Management (IAQM), which has identified a risk of significant effects from operational traffic indicating the need for more detailed assessment.

Encon Associates were commissioned by McDonalds Ltd (the 'Client') to carry out an air quality in connection with the proposed new McDonalds restaurant and Drive-Thru off Ashgrove Road West, Aberdeen.

It is inevitable that with any development, demolition and construction activities will cause some disturbance to those nearby. Dust arising from most construction activities tends to be of a coarse nature, which through dispersion by the wind can lead to soiling of property including windows, cars, external paintwork and laundry. However, as well as giving rise to annoyance due to soiling of surfaces from dust emissions, there is evidence of major construction activities causing increases in long term PM_{10} concentrations and in the number of days exceeding the short term PM_{10} objective of 50 μgm^{-3}.

The IAQM guidance on assessing impacts on air quality from construction activities and determining the likely significance has been used to determine the risk of impacts occurring during the construction of the development and to identify appropriate mitigation measures to be implemented on site to reduce dust emissions and associated impacts.

Due to the proximity of nearby residential receptors the Site is considered to have a medium risk of impacts with regards to dust soiling and PM_{10} concentrations. However, following the implementation of appropriate mitigation measures impacts associated with the construction of the development are likely to be insignificant.

The assessment has used detailed modelling to predict the impact of traffic generated by the operational development on local air quality. The assessment has predicted a negligible impact on NO_2, PM_{10} and $PM_{2.5}$ as a result of operational traffic. The overall impact of the development, based on professional judgement, is judged to be not significant.

The development proposals will meet the relevant polices set out within the Local Plan and does not pose a constraint to development of the Site for the proposed use.

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1.1 Introduction

Encon Associates were commissioned by McDonalds Ltd (the 'Client') to carry out an air quality in connection with the proposed new McDonalds restaurant and Drive-Thru off Ashgrove Road West, Aberdeen (the 'Site').

The Site falls within Aberdeen, which is one of the Scottish Unitary Authorities. Air quality within Aberdeen is generally good however, due to exceedances of the annual mean nitrogen dioxide (NO_2) objective limit the Council have declared three air quality management areas (AQMA) including one incorporating Anderson Drive which runs to the west of the Site.

The development proposals have been reviewed against current air quality planning guidance published by the Institute of Air Quality Management (IAQM), which has identified a risk of significant effects from operational traffic indicating the need for more detailed assessment.

This report addresses the impact of the proposed development on local air quality. Potential sources of emissions are identified and assessed in the context of existing air quality and emission sources and the nature and location of receptors.

A glossary of air quality terminology is provided in Appendix A.

1.2 Scope of Assessment

Initial traffic data provided by the transport consultants ADL Traffic showed a daily trip generation from the new restaurant of 2460 two-way vehicles.

Criteria set out within the air quality planning guidance provided by the Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)[1] indicates that significant impacts on local air quality are unlikely to occur where a development results in a change in light goods vehicles (LGV) of less than 100 per day in locations within or adjacent to an AQMA and more than 500 elsewhere. The data indicates that although a significant number of the trips generated by the new restaurant would be existing trips, diverting off the A92 (Anderson Drive), to the restaurant, and

[1] EPUK & IAQM (May 2017) Land-Use Planning and Development Control: Planning for Air Quality v.1.2.

back again, the proposals would result in an additional 304 trips travelling north and south along Anderson Drive. The trip generation data therefore exceeds the screening criteria and a detailed assessment of operational traffic has been carried out.

An assessment of air quality impacts associated with the construction of the proposed development has been undertaken following the methodology set out within the Institute of Air Quality Management (IAQM) guidance[2].

The full scope of the assessment has been agreed via email correspondence with Barbara Hill, Senior Authorisation Officer at Aberdeen City Council (ACC).

[2] IAQM (January 2014) Guidance on the Assessment of Dust from Demolition and Construction. Version 1.1

2 Site Description

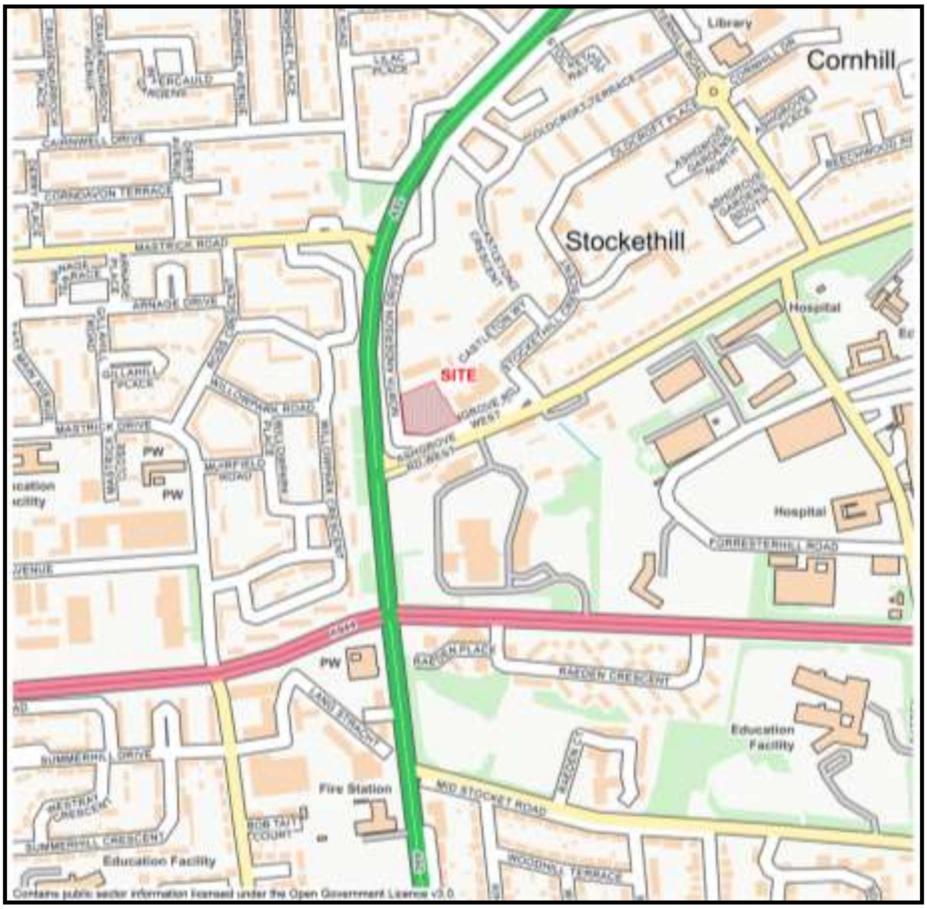
2.1 The Existing Site

The Site is the current location of the Rosehill Day Centre located on a parcel of land on the corner of Ashgrove Road West and North Anderson Drive. The Site is bounded to the west and south by Ashgrove Road West (minor road) and further to the west by North Anderson Drive A92 and further south by Ashgrove Road West A9011 (main road).

Land uses surrounding the Site include an employment building to the east and telephone exchange building to the north. Residential areas are located to the west of North Anderson Drive on Willowpark Crescent, further north beyond the telephone exchange at Woodhill Court and further north-east and east beyond the adjacent employment site on Castleton Way and Castleton Drive. To the south of Ashgrove Road West is Woodhill House occupied by ACC.

The location of the Site is shown in Figure 2.1.

Figure 2.1: Location of proposed development site



2.2 Proposed Development

The proposed application is for the construction of a new McDonalds restaurant with Drive-thru. The new building will include a 100-seated restaurant and commercial kitchen, with an additional external seating area to the east of the building. Parking for up to 51 vehicles (including 2 accessible bays and 2 reserve bays) will be located to the south of the building with the Drive-thru route traversing the building to the west and north exiting to the south onto Ashgrove Road West. Access to the Site will be via the same location on Ashgrove Road West.

An indicative site layout of the Site is shown in Figure 2.2.

Figure 2.2: Indicative Layout of Site

3 Policy Context

3.1 International Legislation and Policy

The EU Directive 2008/50/EC[3] on ambient air quality and cleaner air for Europe (the CAFE directive) sets out the ambient air quality standards for NO_2 and PM_{10}, to be achieved by 1st January 2010 and 2005 respectively. The Air Quality Standards Regulations 2010[4] implements the requirements of the Directive into UK legislation. The Directive contains a series of limit values for the protection of human health and critical levels for the protection of vegetation. These limit values are legally binding, and the UK may incur infringement action if it does not meet the required objective limits within the agreed time limits. The UK is currently exceeding the objective limits for NO_2 and PM_{10} within London and a number of other air quality zones within the UK.

3.2 National Legislation and Policy

3.2.1 The Air Quality Strategy

The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007[5], pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

The AQS sets standards and objectives for ten main air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3-butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), oxides of nitrogen (NO_x), particulate matter (PM_{10}, $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3) and polycyclic aromatic hydrocarbons (PAHs).

The air quality standards are long-term benchmarks for ambient pollutant concentrations which represent negligible or zero risk to health, based on medical and scientific evidence reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). These

[3] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe
[4] Air Quality Regulations 2010 – Statutory Instrument 2010 No. 1001
[5] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – July 2007

are general concentration limits, above which sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

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

For some pollutants, there is both a long-term (annual mean) standard and a short-term standard. In the case of NO_2, the short-term standard is for a 1-hour averaging period, whereas for PM_{10} it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road).

Of the pollutants included in the AQS, NO_2 and PM_{10} would be particularly relevant to this project as these are the primary pollutants associated with road traffic. The current statutory standards and objectives for NO_2 and PM_{10} in relation to human health are set out in Table 3.1.

The Scottish Government has also set objective limits for the smaller particulate fraction $PM_{2.6}$, as set out within the Air Quality (Scotland) Amendment Regulations 2016[6]. The objective for $PM_{2.5}$ is set out below in Table 3.1.

Table 3.1: Relevant Objectives set out in the Air Quality Strategy

Pollutant	Concentrations	Measured As	Date to be Achieved by
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times per year	1-hour mean	31 December 2005
	40 µg/m^3	Annual mean	31 December 2005
Particulate Matter (PM_{10})	50 µg/m^3 not to be exceeded more than 7 times per year	24-hour mean	31 December 2010
	18 µg/m^3	Annual mean	31 December 2010
Particulate Matter ($PM_{2.5}$)	10 µg/m^3	Annual Mean	31 December 2020

[6] The Air Quality (Scotland) Regulations 2016 – Statutory Instrument No. 162

The NAQOs apply to external air where there is relevant exposure to the public over the associated averaging periods within each objective. Guidance is provided within Local Air Quality Management Technical Guidance 2016 (LAQM.TG(16))[7] issued by the Defra for Local Authorities, on where the NAQOs apply as detailed in Table 3.2. The objectives do not apply in workplace locations, to internal air or where people are unlikely to be regularly exposed (i.e. centre of roadways).

It should be noted that the EU Limit Values are numerically the same as the NAQO values but differ in terms of compliance dates, locations where they apply and legal responsibility. The compliance date for the NO_2 Limit Values is 1 January 2010, which is five years later than the date for the NAQO.

The Limit Values are mandatory, whereas the NAQOs are policy objectives. Local authorities are not required to achieve them but have to work towards their achievement. In addition, the limit Values apply in all locations except where members of the public do not have access and there is no fixed habitation, on factory premises or at industrial installations, and on the carriageway/central reservation of roads except where there is normally pedestrian access.

[7] Defra (2016) Local Air Quality Management. Technical Guidance LAQM.TG(16)

Table 3.2: Locations Where Air Quality Objectives Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building Facades of residential properties, schools, hospitals, care home etc.	Building facades 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 facade), 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 (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend 1-hour or more. Any outdoor locations where the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.2.2 Local Air Quality Management

Local authorities are seen to play a particularly important role. Section 82 of the Environment Act 1995 requires every local authority to conduct a review of the air quality from time to time within the authority's area. LAQM.TG(16) and Scotland's LAQM Policy Guidance ((PG(S)(16))[8] describes a streamlined approach to the Local Air Quality Management (LAQM) regime, whereby every authority has to undertake and submit a single Annual Status Report/Annual Progress Report within its area, to identify whether the objectives have been or will be achieved at relevant locations by the applicable date. If the objectives are not being met, the authority must declare an Air Quality

[8] Scottish Government (2016) Local Air Quality management Policy Guidance PG(S) (16), March 2016

Management Area (section 83 of the Act) and prepare an action plan (section 84) which identifies measures that will be introduced in pursuit of the objectives.

3.2.3 National Air Quality Action Plan for Nitrogen Dioxide (NO_2) in the UK

The National Air Quality Plan[9] was written as a joint venture between the Defra and the Department for Transport (DfT) and aims to tackle roadside concentrations of NO_2 in the UK. It includes a number of measures such as those aimed at investing in Ultra Low Emission Vehicles (ULEVs) charging infrastructure, public transport and grants to help local authorities in improving air quality. The plan requires all local authorities (LAs) in England with areas expected not to meet the Limit Values by 2020 (known as ‘air quality hotspots’) to develop plans to bring concentrations within these values in “the shortest time possible”. These plans are to be reviewed by the government and suggestions included in the plan include actions such as utilising retrofitting technologies, changing road layout and encouraging public transport and ULEV use. Where these approaches are not considered sufficient, the LA may need to consider implementation of a Clean Air Zone (CAZ) which places restrictions on vehicle access to an area and may include charging certain (or all) vehicles or restrictions on the type of vehicle allowed to access an area.

3.2.4 Road to Zero Strategy

The ‘Road to Zero’ strategy[10] sets out the government’s plans to encourage zero emissions vehicles. These include the aim that by 2040 all new cars and vans will have zero tailpipe emissions and by 2050 almost every car will have zero emissions. Measures within the Strategy are aimed at encouraging the uptake of the cleanest vehicles and supporting electric charging infrastructure.

3.2.5 Clean Air Strategy

The Clean Air Strategy[11] sets out policies to lower national emissions of pollutants in order to reduce background pollution and human exposure. It aims to create a strong framework to tackle air

[9] Defra and DfT. (2017). UK plan for tackling roadside nitrogen dioxide concentrations. London: HMSO
[10] HM Government. (2018). Road to Zero Strategy. London: HMSO
[11] Defra. (2019). Clean Air Strategy. London: HMSO

pollution and to reduce the number of people living in locations with $PM_{2.5}$ concentrations exceeding 10 µg/m^3 by 50% by 2025.

3.2.6 Cleaner Air For Scotland

The Strategy sets out how the Scottish Government will continue to deliver air quality improvements across the country based on the recommendations arising from the Cleaner Air for Scotland (CAFS) review[12]. The Strategy sets out actions the Government will take to reduce emissions and improve air quality working with local authorities and other organisations to implement measures and actions that benefit air quality, inform future plans and policy making and undertake further research and monitoring of emissions.

3.2.7 Control of Dust and Particulates Associated with Construction

Section 79 of the Environmental Protection Act (1990)[13] states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Statutory nuisance is defined as:

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

Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

In the context of the proposed development, the main potential for nuisance of this nature would arise during the construction phase - potential sources being the clearance, earthworks, construction and landscaping processes.

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

[12] Cleaner Air for Scotland: Independent review – www.gov.scot
[13] Secretary of State, The Environment Act 1990 HMSO

3.3 Planning Policy

3.3.1 National Planning Policy

The most recent Scottish Planning Policy (SPP) was published in December 2020 but was withdrawn due to a legal challenge in August 2021. The 2014 SPP[14] is therefore the current planning policy for Scotland and sets out the Scottish Governments planning policies for Scotland and how these are expected to be applied. A revised SPP was published in December 2020 but.

One of the core principles of the SPP is “a presumption in favour of development that contributes to sustainable development. The planning system should support economically, environmentally and socially sustainable places by enabling development that balances the costs and benefits of a proposal over the longer term. The aim is to achieve the right development in the right place; it is not to allow development at any cost”.

It goes on by saying that policies and decisions should be guided by a number of principles including “avoiding over-development, protecting the amenity of new and existing development and considering the implications of development for water, air and soil quality.

The Scottish Government has also published Planning Advice Notes (PANS) of which PAN 51 ‘Planning, Environmental Protection and Regulation’[15] and PAN 75 ‘Planning for Transport’[16] make reference to air quality.

PAN 51 provides government guidance on pollution control for local authorities when drawing up their development plans and making decisions on individual planning applications. Of particular relevance to the proposed development, as it is a large scale proposal located close to an Air Quality Management Area, is the statement in section 62 which states: “In AQMAs or adjacent to them, air quality is likely to be a material consideration for large scale proposals or if they are to be occupied by sensitive groups such as the elderly or young children or are likely to have cumulative effects. This does not mean that all such applications should be refused even if they are likely to

[14] The Scottish Government (2014) Scottish Planning Policy June 2014

[15] Scottish Executive Development Department (2005) Planning Advice Note 51 Planning, Environmental Protection and Regulation, August 2005

[16] Scottish Executive Development Department (2006) Planning Advice Note 51 Planning, Environmental Protection and Regulation, October 2006

affect local air quality, but it may mean that conditions have to be applied to mitigate adverse effects. Generally, it may be necessary to consider whether a development could lead to the designation of a new AQMA or if granting permission could conflict with an Air Quality Action Plan. "
PAN 75 focuses on the promotion of sustainable transport solutions associated with new developments (e.g. provision of a maximum number of parking spaces, use of travel plans).
Paragraph 15 of Planning Advice Note 75 highlights that transport associated with a development has the potential to impact on air quality and that this should be considered in terms of air quality objectives and AQMAS.

3.3.2 Aberdeen Local Development Plan 2017

The Aberdeen Local Development Plan 2017[17] sets out the framework for growth and development across the district, setting out policies to guide development and meet the aims and objectives of the Plan.

In dealing with air quality the Plan sets out the following:

Policy T4: Air Quality states that '*Development proposals which may have a detrimental impact on air quality will not be permitted unless measures to mitigate the impact of air pollutants are proposed and agreed with the Planning Authority. Planning applications for such [proposals should be accompanied by an assessment of the likely impact of development on air quality and any mitigation measures proposed*.

The policy goes on to say that '*the relevant Supplementary Guidance Air Quality, detailed below sets out the likely =circumstances in which applications must submit an assessment of the potential impact of particular types of development on existing and future air quality, particularly in and around Air Quality Management Areas. It also provides guidance on the process of air quality assessment and how mitigation measures will be assessed and implemented'*.

[17] Aberdeen City Council, Local Development Plan 2017

3.3.3 Aberdeen Air Quality Supplementary Guidance

The Aberdeen Air Quality Supplementary Guidance (SG)[18] has been produced to support Policy T4 of the Local Development Plan providing guidance on when and how developments should be assessed for air quality effects and details of the approach that should be taken to mitigate emissions where these are found to be significant.

The guidance has been used to inform this assessment.

3.4 Air Quality Guidance

3.4.1 DEFRA Technical Guidance

Local authorities are seen to play a particularly important role. Section 82 of the Environment Act 1995 requires every local authority to conduct a review of the air quality from time to time within the authority's area. The recently released DEFRA technical guidance, LAQM.TG(16), describes a new streamlined approach to the Local Air Quality Management (LAQM) regime, whereby every authority has to undertake and submit a single Annual Status Report/Annual Progress Report within its area, to identify whether the objectives have been or will be achieved at relevant locations by the applicable date. If the objectives are not being met, the authority must declare an Air Quality Management Area (section 83 of the Act) and prepare an action plan (section 84) which identifies measures that will be introduced in pursuit of the objectives.

3.4.2 IAQM Land Use Planning and Development Control: Planning for Air Quality

Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) have published joint guidance on the assessment of air quality impacts for planning purpose. This includes information on when an air quality assessment is required, what should be included in an assessment and criteria for assessing the significance of any impacts. The scope of the operational impact and exposure assessment within this report are based on the guidance set out in this document.

[18] Aberdeen City Council, Supplementary Guidance: Air Quality

3.4.3 IAQM Guidance on the Assessment of Dust from Demolition and Construction

Guidance produced by the IAQM on assessing impacts from construction and demolition activities includes a methodology for identifying the risk magnitude of potential dust sources associated with demolition, construction, earthworks and trackout. This is then used to identify the level of mitigation necessary in order for the impacts to be not significant.

4 Methodology

4.1 Construction Phase

4.1.1 Construction Traffic

During construction of the proposed development, lorries will require access to the Site to deliver and remove materials; earthmoving plant and other mobile machinery will work on site and generators and cranes will also be in operation. These machines produce exhaust emissions; of particular concern are emissions of NO_2 and PM_{10}.

It is anticipated that during the construction phase there would be no more than 10-15 heavy duty vehicles (HDV) accessing the Site in any given day. The criteria set out in the IAQM air quality planning guidance indicates that significant impacts on air quality are unlikely to occur where a development results in less than 25 HDV movements per day within an AQMA and less than 100 per day elsewhere. It is therefore anticipated that construction traffic generated by the proposed development would result in a negligible impact on local NO_2 and PM_{10} concentrations and has not been considered any further in this assessment

4.1.2 Construction/Fugitive Dust

Construction phase activities associated with the Proposed Development may result in the generation of fugitive dust emissions (i.e. dust emissions generated by site-specific activities that disperse beyond the construction site boundaries).

If transported beyond the site boundary, dust can have an adverse impact on local air quality. The IAQM has published a guidance document for the assessment of demolition and construction phase impacts[19].The guidance considers the potential for dust nuisance and impacts to human health and ecosystems to occur due to activities carried out during the following stages of construction:

- Demolition (removal of existing structures).
- Earthworks (soil-stripping, ground-levelling, excavation and landscaping).
- Construction (activities involved in the provision of a new structure); and

[19] IAQM (June 2016) Guidance on the assessment of dust from demolition and construction Version 1.1

- Trackout (the transport of dust and dirt from the construction site onto the public road network where it may be deposited and then re-suspended by vehicles using the network).

A qualitative assessment of air quality impacts due to the release of fugitive dust and particulates (PM_{10}) during the construction phase was undertaken in accordance with the methodology detailed in the IAQM guidance.

The assessment takes into account the nature and scale of the activities undertaken for each source and the sensitivity of the area to an increase in dust and PM_{10} levels, thus enabling a level of risk to be assigned. Risks are described in terms of there being a low, medium or high risk of dust impacts.

Once the level of risk has been ascertained, then site specific mitigation proportionate to the level of risk is identified, and the significance of residual effects determined.

A summary of the IAQM assessment methodology is provided in Appendix B.

4.2 Operational Phase

4.2.1 Traffic Emissions

Introduction

The prediction of air quality at the Site has been undertaken using the ADMS Roads dispersion model (Version 5.0.0.1, released March 2020, updated September 2020). This is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

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

The model has been used to predict road specific concentrations of oxides of nitrogen (NO_x), PM_{10} and $PM_{2.5}$. The predicted concentrations of NO_x have been converted to NO_2 using the LAQM calculator available on the Defra air quality website version 8.1, published in August 2020[20].

Emissions Data

The model uses traffic flow data and vehicle related emission factors to predict road specific concentrations of oxides of nitrogen (NO_x) and particulate matter (PM_{10} and $PM_{2.5}$) at selected receptors.

The assessment has predicted air quality during 2019 for model verification. The emission factors released by Defra in November 2021, provided in the emissions factor toolkit EFT2021_v11[21] have been used to predict traffic related emissions of PM and NO_x.

Emission factors and background data used in the prediction of future air quality concentrations predict a gradual decline in pollution levels over time due to improved emissions from new vehicles and the gradual renewal of the vehicle fleet. In recent years the Defra emission factors published within the Emission Factor Toolkits (EFT) have been found to predict lower NO_x concentrations in future years compared to concentrations measures at roadside locations across the UK. However, research carried out by Air Quality Consultants Ltd (AQC) has now shown that emissions of NO_x from vehicles within the recently released EFT are now matching concentrations recorded at roadside locations between 2013 to 2019. The report [22] concludes that '*the EFT is now unlikely to over-state the rate at which NOx emissions decline into the future at an 'average' site in the UK. Indeed, the balance of evidence suggests that, on average, NOx concentrations are likely to decline more quickly in the future than predicted by the EFT'*. This has removed the need for the use of any sensitivity tests for future year scenarios. Relevant future year emission factors have therefore been used to predict the impact of the development in the 2023, the anticipated first full year of operation.

Traffic Data

Traffic data for use in the assessment has been provided by ADL.

[20] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/
[21] https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html
[22] https://www.aqconsultants.co.uk/news/march-2020/defra%E2%80%99s-emission-factor-toolkit-now-matching-measu

Initial trip generation data was provided as Annual Average Daily Traffic (AADT) and then screened against the following criteria set out in the IAQM air quality planning guidance:

- A change in LDV of 100 vehicles or more per day within or adjacent to an AQMA, a change of 500 or more elsewhere;
- A change in HDV of 25 vehicles or more per day within or adjacent to an AQMA, a change of 100 or more elsewhere.

The daily trips of 2460 vehicles associated with the operational restaurant exceed the above criteria indicating the need for a detailed assessment of operational traffic. Further screening of the change additional trips using the A92 (taking into account the fact that the majority of trips associated with the operational development would be existing trips diverting off and back onto the A92) showed that the above criteria is also predicted to be exceeded within the AQMA, with an increase in vehicle movement of 304 per day north and south of Ashgrove Road West.

AADT for the A92 and Ashgrove Road West for use in the modelling assessment have also been provided by ADL for the following scenarios:

- 2019 Base Scenario (for model verification and baseline assessment)
- 2023 Do-minimum Scenario (future base flows taking into account growth in the area from other committed developments)
- 2023 Do-Something Scenario (including proposed development)

A summary of the traffic data is provided in Appendix C.

Background Concentrations

The ADMS model predicts concentrations arising as a result of vehicle emissions. It is necessary to add an estimate of local background concentrations to obtain the total concentration for comparison against the air quality objectives.

Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been taken from the Defra background maps[23]. The data has been calibrated against locally monitored background concentrations to derive an adjustment factor that has subsequently been applied to the Defra background data. Details of the calibration are provided in Appendix D. The adjusted background data used in the modelling assessment is provided in Table 5.5.

The 2019 background data has been used for the future 2023 assessment scenario, providing a cautious predicting of future concentrations.

Model Outputs and processing

For the 2019 base year and 2023 future year scenarios the ADMS Model has predicted traffic related annual mean emissions of oxides of nitrogen (NO_x) and PM at existing sensitive receptors located adjacent to those road links where the development would exceed the IAQM screening criteria.

The predicted concentrations of NO_x have been converted to NO_2 using the LAQM calculator (Version 8.1, released August 2020) available on the Defra air quality website[24].

Relevant background concentrations have subsequently been added to the model outputs to provide the total concentrations across the Site.

Analysis of long-term monitoring data[25] suggests that if the annual mean NO_2 concentration is less than 60 μg/m^3 then the one-hour mean NO_2 objective is unlikely to be exceeded where road transport is the main source of pollution. Therefore, in this assessment the annual mean concentration has been used to screen whether the one-hour mean objective is likely to be achieved as recommended within LAQM.TG(16). Similar to NO_2, an annual mean PM_{10} concentrations below 22.5 μg/m^3 is used to screen whether the 24-hour PM_{10} mean objective is likely to be achieved, the approach also recommended within LAQM.TG(16).

[23] https://uk-air.defra.gov.uk/data/laqm-background-home
[24] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/
[25] D Laxen and B Marner: Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites (July 2003).

4.2.2 Verification of Model results

It is recommended that the model results are compared with measured data to determine whether the model results need adjusting to more accurately reflect local air quality. This process is known as verification.

LAQM.TG(16) recommends that model predictions should be within 25% (preferably 10%) of monitored concentrations for the model to be predicting with any degree of accuracy. Also, the guidance recommends that any adjustment factors applied to model results should be calculated based on verification using monitoring sites in a similar location i.e. roadside, intermediate or background sites.

To verify the model results, the ADMS model has been used to predict NO_x concentrations at local monitoring site DT60 on North Anderson Drive.

Data within the model (i.e. traffic speeds and road widths) have been adjusted to represent the conditions at each monitoring sites. The locations of the monitoring sites have also been adjusted to represent to correct distance from the roadside as detailed within the ACC Air Quality Annual Progress Report (APR)[26] and visual review on Google Earth.

Further details on the verification and calculation of adjustment factors are provided in Appendix D. Details of the approach taken for PM_{10} and $PM_{2.5}$ are also set out in Appendix E.

4.2.3 Model Uncertainty

There are many components that contribute to the uncertainty of predicted concentrations. The model used in the assessment is dependent upon the traffic data that is used within it and which will have inherent uncertainties associated with it. There is also the additional uncertainty as the model simplified real-world conditions into a series of algorithms.

As detailed in the previous section there has also been some disparity between national road transport emission projections and measures annual mean concentrations of NO_2, although the

[26] Aberdeen City Council Annual Progress Report 2021, June 2021

most recent emissions data has been shown to be predicting within good agreement of monitored data, thus reducing this uncertainty.

The modelling assessment has been based on 2023 emission factors with the resulting predicted concentrations added to 2019 background data to predict the future year assessment scenarios. The use of 2019 background data is considered to represent a worst-case assumption.

Furthermore, the modelled NO_2 concentrations have been verified against 2019 monitoring data. This is considered to provide an appropriately conservative and robust assessment taking into account the uncertainties regarding future vehicle emissions and the fact that the most recently release emissions data has been shown to better represent real-world emissions and future reductions in tailpipe emissions.

4.3 Selection of Receptors

4.3.1 Construction Phase Receptors

The IAQM assessment is undertaken where there are:

- human receptors within 350m of the site boundary or within 50m of the route(s) used by construction vehicles on the public highway;
- human receptors up to 500m from the site entrance(s);
- ecological receptors within 50m of the site boundary, or within 50m of the route(s) used by construction vehicles on the public highway; and
- ecological receptors up to 500m from the site entrance(s).

It is within these distances that the impacts of dust soiling and increased particulate matter in the ambient air will have the greatest impact on local air quality at sensitive receptors.

4.3.2 Operational Phase Receptors

As set out in Table 3.2, LAQM.TG(16) describes in detail typical locations where consideration should be given to pollutants defined in the Regulations. Generally, the guidance suggests that all locations ‘where members of the public are regularly present’ should be considered. At such locations, members of the public would be exposed to pollution over the time that they are present, and the most suitable averaging period of the pollutant needs to be used for assessment purposes.

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

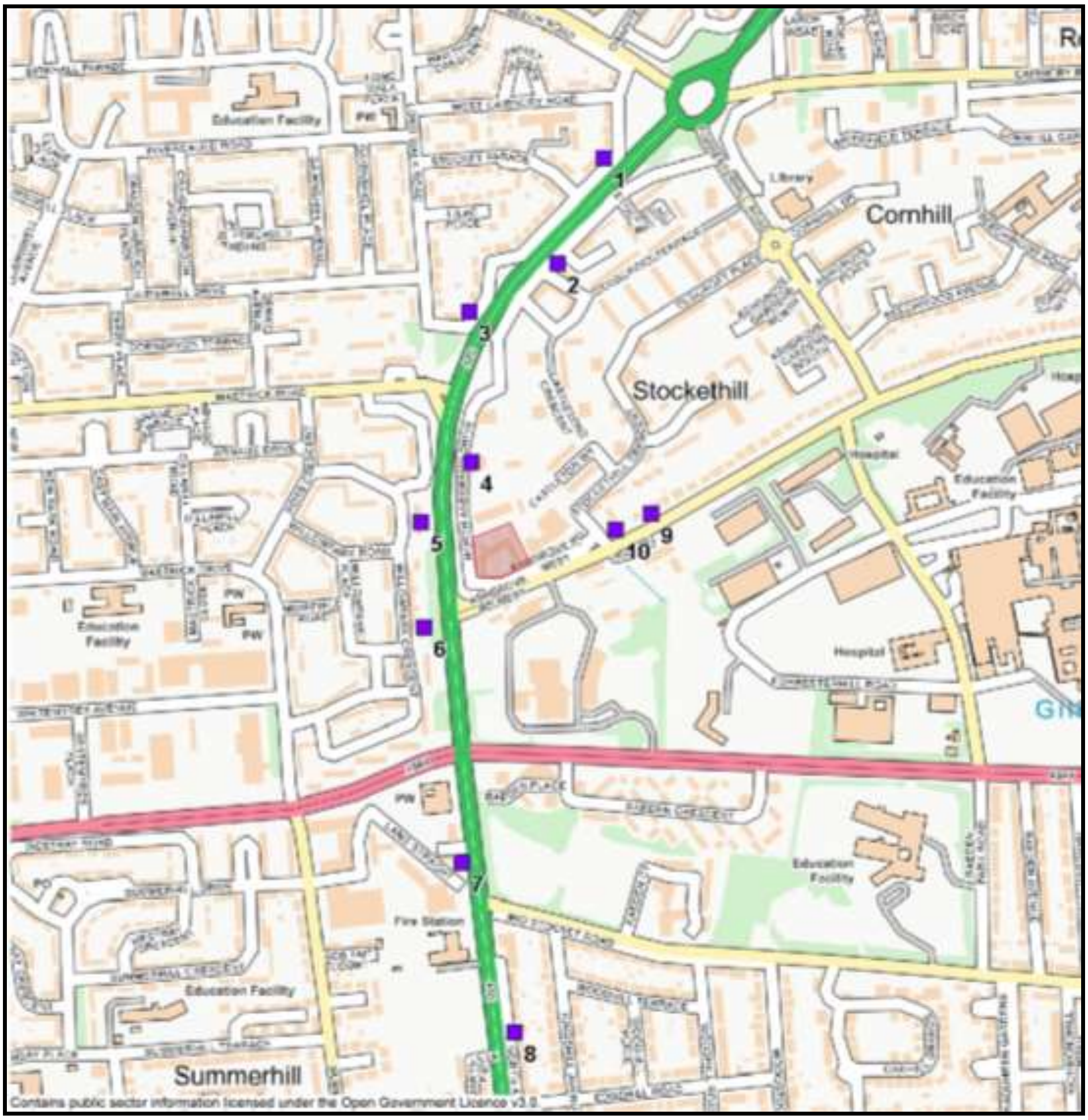
For the completion of this assessment, air quality has been predicted at a number of sensitive receptors (residential houses, schools, hospitals etc) adjacent to North Anderson Drive and Ashgrove Road West. Each receptor has been selected to represent worst-case exposure to local traffic emissions. The details of each receptor are set out in Table 4.1 and their locations shown in Figure 4.1.

Table 4.1: Receptors Used in Modelling

Receptor Number	Receptor Location	OS Grid Reference	Receptor Height (M)
1	245 North Anderson Drive	391240, 807663	1.5
2	59 Stickethill Way	391177, 807518	1.5
3	187 North Anderson Drive	391055, 807451	1.5
4	Woodland Court	391058, 807244	1.5
5	119 North Anderson Drive	390989, 807161	1.5
6	83 North Anderson Drive	390993, 807015	1.5
7	Midstocket View	391045, 806690	1.5
8	54 North Anderson Drive	391118, 806456	4.5
9	160 North Anderson Drive	391306, 807173	1.5

Receptor Number	Receptor Location	OS Grid Reference	Receptor Height (M)
10	2 Castleton Drive	391257, 807150	1.5

Figure 4.1: Location of Monitoring Sites



4.4 Significance Criteria

4.4.1 Construction Phase

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

4.4.2 Operational Phase

Guidance issued by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) relates to Air Quality considerations within the planning process and sets criterion which identify the need for an Air Quality Assessment, the type of Air Quality assessment required, and the significance of any predicted impact.

The guidance suggests expressing the magnitude of incremental change in concentrations as a proportion of an Air Quality Assessment Level (AQAL) such as the air quality objectives set out in Table 3.1. The significance of impact is then identified based on the incremental change in the context of the new total concentrations and its relationship with the assessment criteria, noting whether the impact is adverse or beneficial based on a positive or negative change in concentrations. The criteria suggested for assigning significance is set out in Table 4.2 below.

Table 4.2: Impact Descriptors for Individual Receptors

Long-term average concentration at receptor in assessment year	% Change in concentrations relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Minor	Moderate
76-94% of AQAL	Negligible	Minor	Moderate	Moderate
95-102% of AQAL	Minor	Moderate	Moderate	Major
103-109% of AQAL	Moderate	Moderate	Major	Major
110% of AQAL	Moderate	Major	Major	Major
AQAL – Air Quality Assessment Level which in this assessment refers to the Air Quality Objectives set out in Table 3.1				

In assessing the significance of effects, the following have also been taken into considerations:

The percentage change in concentration should be rounded to a whole number

- The table should only be used with annual mean concentrations

- The descriptors are for individual receptors only: overall significance should be based on professional judgment
- When defining the concentrations as a percentage of the AQAL use the 'without scheme' concentration where there is a decrease in pollutant concentrations and the 'with scheme' concentrations for an increase
- The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value i.e. well below, the degree of harm is likely to be small. As exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL
- It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year, it is impossible to define the new total concentrations without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

5 Baseline Assessment

5.1 Aberdeen Review and Assessment of Air Quality

ACC has completed a number of detailed assessments of air quality in the district which has identified exceedances of the annual mean NO_2 objective and resulted in the declaration of three AQMAs. Two of the AQMA, the City Centre AQMA and Wellington Road AQMA, are over 3 km from the Site and therefore not of relevance to this assessment. However, the Anderson Road AQMA has been declared due to exceedances of the NO_2 objective adjacent to the A92 and covers Anderson Drive and adjoining properties between Malcolm Road to the north and Holborn Street to the south. The location of the AQMA in relation to the Site is presented in Appendix F.

5.2 RC Air Quality Monitoring

5.2.1 NO_2 Concentrations

In 2019, ACC operated six automatic monitoring sites and an extensive network of passive diffusion tubes recording NO_2 concentrations across the city. A number of these sites are located adjacent to the A92, although only one within reasonable proximity to the Site. Those of most relevance to this assessment are set out in Table 5.1, along with details of the relevant background sites. Their locations are shown in Figure 5.1.

Diffusion tubes are a passive form of monitoring, which, due to their relative in-expense, allow for a much greater spatial coverage than with automatic monitoring sites. Diffusion tubes are acknowledged as a less accurate method of monitoring ambient air pollutants than automatic monitors, with diffusion tubes over or under estimating concentrations by as much as 30 %. To allow the results to be reliably compared with the AQ Objectives, the data should be bias corrected using factors calculated from a co-location site where both diffusion tubes and an automatic monitor are located in the same location. The data provided in Table 5.1 has been adjusted by ACC using appropriately derived adjustment factors.

The monitoring data presented in Table 5.1, shows annual mean NO_2 concentrations to be below the objective limit of 40 $\mu g/m^3$ at all sites since 2016 with the exception of Site DT8 which recorded exceedances of the objective between 2016 and 2018. Concentrations at this location decline to just below the objective in 2019.

The data shows an overall downward trend in concentrations during the monitoring period at all the monitoring locations.

Table 5.1: NO_2 Diffusion Tube Monitoring Results 2015-2019 (µg/m³)

Site	Site Type	Year				
		2016	2017	2018	2019	2020[1]
CM1 – Errol Place	UB	23	21	22	20	14
CM4 – Anderson Drive	R	22	21	19	17	12
DT8 – 107 Anderson Drive	R	**54**	**48**	**48**	39	31
DT45 – 111 Anderson Drive	R	30.6	25.2	24	21	16
DT60 – Anderson Drive/Beech Rd	R	32.9	32.4	31	27	20
DT62 – 35 Chestnut Row	UB	14.4	14.0	12	11	8
DT64 – 102 Picktillum Place	UB	16.9	17.2	17.	14	11

UB – Urban Background, R - Roadside

Data taken from ACC 2021 Air Quality Annual Progress Report (ASR)

Data in bold shows an exceedance of the annual mean objective

[1] data has been presented for 2020, however due to the restrictions imposed during the Covid 19 pandemic, resulting in significant reductions in vehicle movements, a significant reduction in air quality was recorded at the majority of locations across the UK. For this reason 2020 data has not been used to inform the baseline assessment.

Short-term NO_2 concentrations have been recorded at the two automatic monitoring sites CM1 and CM4. At both locations there has been no breach of the 1-hour objective of 200 µg/m^3 (with no more than 18 exceedances within any given year).

Diffusion tubes cannot monitor short-term NO_2 concentrations, however, research[27] has concluded that exceedences of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m^3. Based on monitoring data presented in Table 5.1, it is unlikely that the short-term objective is being exceeded.

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

PM Concentrations

ACC monitor PM_{10} concentrations at the CM1 and CM4 automatic monitoring sites and $PM_{2.5}$ at CM1. Monitoring data for PM_{10} are set out in Table 5.2, and for $PM_{2.5}$ in Table 5.5. The location of the sites are shown in Figure 5.1.

The data set out in Table 5.2 shows annual mean PM_{10} concentrations below the annual mean objective of 18 µg/m^3 during 2017 through to 2019. The data indicates no overall downward or upward trend in concentrations during the monitoring period.

Exceedences of the 24-hour objective limit have been recorded at both sites however, the objective allows for up to 7 exceedences of the limit in any given year, therefore the objective has been met during all monitoring years.

Table 5.2: PM_{10} Concentrations Measured at CM1 and CM4 Automatic Monitoring Sites

Site	Site Type	Parameter	Year				
			2016	**2017**	**2018**	**2019**	**2020[1]**
CM1	UB	Annual Mean (µg/m^3)	12	11	14	14	11
		Days > 50 µg/m^3	0	0	1	1	0
CM4	R	Annual Mean (µg/m^3)	12	12	14	13	9
		Days > 50 µg/m^3	0	0	0	3	0

UB – Urban Background, R - Roadside

Data taken from ACC 2021 Air Quality Annual Progress Report (ASR)

Data in bold shows an exceedance of the annual mean objective

[1] data has been presented for 2020, however due to the restrictions imposed during the Covid 19 pandemic, resulting in significant reductions in vehicle movements, a significant reduction in air quality was recorded at the majority of locations across the UK. For this reason 2020 data has not been used to inform the baseline assessment.

Data presented in Table 5.3 shows that annual mean $PM_{2.5}$ concentrations have met the objective limit of 10 µg/m^3 during all monitoring years presented. The data shows little change in concentrations between 2017 and 2019.

Table 5.3: Annual Mean $PM_{2.5}$ Concentrations Measured at CM1 Automatic Site

Site	Classification	Year				
		2016	2017	2018	2019	2020[1]
CM1	UB	**5**	6	7	7	5

UB – Urban Background, R - Roadside

Data taken from ACC 2021 Air Quality Annual Progress Report (ASR)

Data in bold shows an exceedance of the annual mean objective

[1] data has been presented for 2020, however due to the restrictions imposed during the Covid 19 pandemic, resulting in significant reductions in vehicle movements, a significant reduction in air quality was recorded at the majority of locations across the UK. For this reason 2020 data has not been used to inform the baseline assessment..

Figure 5.1: Location of NO_2 Monitoring Sites

5.3 Predicted Baseline Concentrations

Pollutant concentrations predicted as part of the detailed modelling exercise in 2019 and the future 2023 Do Minimum scenario are set out in Table 5.4.

The data shows that predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations are meeting the relevant objective limits set out in Table 3.1 across the study area (Figure 4.1).

As annual mean NO_2 concentrations are predicted to be below 60 µg/m^3, concentrations are also meeting the short-term objective limits for both pollutants.

Annual mean PM_{10} concentrations are also predicted to be below 22.5 µg/m^3, therefore the 24-hour PM_{10} objective is also being met at all receptor locations.

The data shows little change in PM concentrations between 2019 and 2023. In relation to NO_2, concentrations are predicted to decline between the two assessment years due to predicted improvements in vehicle emissions and an increase in low emission vehicles within the vehicle fleet.

Table 5.4: Predicted Baseline Air Quality

Receptor	Predicted Baseline Air Quality					
	2019 Baseline			2023 Do Minimum		
	Annual mean NO_2 (µg/m^3)	Annual mean PM_{10} (µg/m^3)	Annual mean $PM_{2.5}$ (µg/m^3)	Annual mean NO_2 (µg/m^3)	Annual mean PM_{10} (µg/m^3)	Annual mean $PM_{2.5}$ (µg/m^3)
1	21.0	16.3	8.9	19.6	16.3	8.8
2	22.3	16.6	9.0	20.5	16.6	9.0
3	21.6	16.4	8.9	19.8	16.4	8.9
4	21.3	16.3	8.9	19.6	16.3	8.9
5	15.3	12.0	7.6	13.8	12.0	7.6
6	14.7	11.8	7.5	13.3	11.8	7.5
7	21.0	13.0	8.1	18.6	13.0	8.0
8	19.6	12.7	7.9	17.4	12.7	7.9
9	20.3	16.1	8.7	19.0	16.1	8.7
10	20.3	16.1	8.7	19.0	16.1	8.7

5.4 Background Data

Additional information on estimated background pollutant concentrations has been obtained from the Defra background maps provided on the UK-AIR, the Air Quality Information Resource. Estimated air pollution concentrations for oxides of nitrogen (NO_x), NO_2, PM_{10} and $PM_{2.5}$ have been extracted from the 2018 background pollution maps for the UK, which were published in August 2020[28]. These maps are available in 1 km x 1 km grid squares and provide an estimate of concentrations between 2018 and 2030. The average concentrations for the grid square representing the study area have been extracted for the 2019 base year. The data is provided in Table 5.5.

Table 5.5: Annual Mean Background Air Pollution Concentrations

Location (OS Grid Square)	Annual mean concentrations (µgm^{-3})					
	2019			2023		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
391500, 806500	13.2	11.3	7.1	11.4	13.1	6.8
390500, 807500	10.3	10.9	7.0	8.8	12.7	6.8
391500, 807500	16.5	15.3	8.3	14.7	14.6	7.8

The data indicates that estimated background concentrations are currently meeting the NO_2, PM_{10} and $PM_{2.5}$ objectives in the study area.

5.5 Air Quality at the Development Site

The proposed development would not provide any residential accommodation. Due to the transient nature of users of such commercial sites, the annual mean and 24-hour objective limits do not apply. However, the shorter-term objective limits such as the 1-hour NO_2 objective are considered relevant to the Site. Exposure at the Site should therefore be considered in relation to the 1-hour NO_2 objective but not in relation to the PM objective limits.

Local monitoring of annual mean NO_2 concentrations (Table 5.1) has shown that roadside annual mean concentrations in the vicinity of the Site are well below the objective limit of 40 µg/m^3. It is

[28] https://uk-air.defra.gov.uk/data/laq11.7m-background-home12.8

therefore considered unlikely, based on professional judgement, that concentrations at the Site would exceed 60 µg/m^3. Concentrations at the Site are therefore expected to be meeting the 1-hour objective limit for NO_2. The impact of the proposals in terms of new exposure are therefore considered to be negligible.

6 Construction Assessment

6.1 Assessing the Risk of Dust Effects

6.1.1 Site and Surroundings

A summary of the proposed development is provided in Section 2 of this report.

There are residential properties located to the west, east and south-east of the Site, within 350 m of the Site boundary. An assessment of construction related impacts in relation to human receptors is therefore considered necessary.

Significant impacts on ecologically sensitive receptors are unlikely to occur beyond 50 m from any construction activities. A review of data held on the Defra MAGIC website[29] shows no sites designated as important for wildlife within 50 m of the Site therefore impacts on ecological receptors has not been considered any further within this assessment.

A review of background data published by Defra within the 2019 background maps, indicates background concentrations at the Site in the region of 11-15 µg/m^3, at 83% of the annual mean objective. The CM4 roadside monitoring site indicates roadside concentrations in the area of approximately 11-14 µg/m^3, making the surrounding area of medium sensitivity to human health impacts.

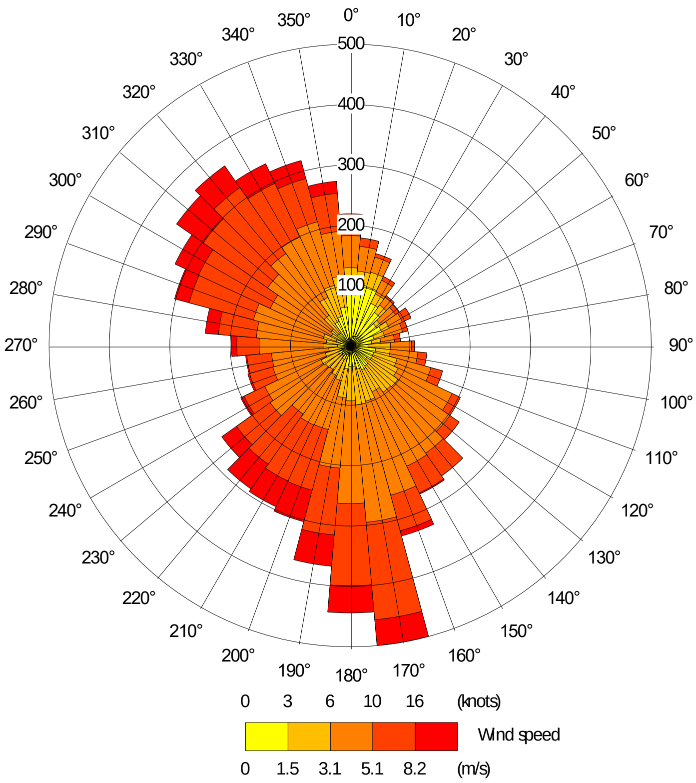
The precise behaviour of the dust, its residence time in the atmosphere, and the distance it may travel before being deposited would depend upon a number of factors. These include wind direction and strength, local topography and the presence of intervening structures (buildings, etc.) that may intercept dust before it reaches sensitive locations. Furthermore, dust would be naturally suppressed by rainfall.

A windrose from the Dyce Meteorological Station for 2019 is provided below in Figure 6.1, which shows that the prevailing wind is from the south/south-east and the north-west. Receptors located to the north/north-west and south-east of the Site are therefore most at risk of experiencing impacts. There are no high sensitivity receptors located to the south-east, although the short-term car park

[29] http://magic.defra.gov.uk/

associated with Council buildings and Ambulance service is located to the south-east on the opposite d=side of Ashgrove Road West. There are no sensitive receptors located immediately to the north/north-west.

Figure 6.1: Windrose from Dyce Meteorological Site (2019)



6.1.2 Risk Assessment of Dust Impacts

Defining the Dust Emission Magnitude

With reference to the criteria detailed in Appendix B, the dust emission magnitude for each of the categories demolition, earthworks, construction and trackout have been determined. These have been summarised in Table 6.1.

Table 6.1: Dust Emission Magnitude for each Activity

Activity	Criteria	Magnitude
Demolition	Existing building with a volume of approx. 7,000 m^3 of brick and concrete construction	Small
Earthworks	Site area approx. 4,000 m^2, approx. 4-5 HDV on site	Medium
Construction	Total build volume <25,000 m^3, concrete and brick construction materials including large area of surface level parking and roadway, high potential for dust generation	Medium
Trackout	10 -50 HDV per day	Medium

Sensitivity of Surrounding Area

Using the criteria set out in Tables B1 to B3, Appendix B, the sensitivity of the surrounding area to impacts from dust emissions has been determined and are set out in Table 6.2.

Dust Soiling

There are no residential properties within 20 m of the Site, the nearest being residential properties on North Anderson Drive, approximately 70 m to the west of the Site boundary. In addition, the short-term car park associated with adjacent commercial property to the east and those to the south are of medium sensitivity to dust effects. The overall sensitivity of the surrounding area in relation to dust soiling effects is therefore considered to be medium.

It is expected that there will be between 10 – 15 HDV (>3.5t) movements per day during the construction phase which will travel to and from the Site along the A92 via Ashgrove Road West. As a general guide, significant impacts from trackout may occur up to 500 m from large sites, 250 m from medium sites and 50 m from small sites, as measured from the site exit. Residential properties on Castleton Drive are within 250 m of the site access and within 20m of the roadside and are of high sensitivity to dust effects, although there are less than 10 properties within 20 m of the roadside. Furthermore, the adjacent car park areas immediately adjacent to Ashgrove Road West would be of medium sensitivity to dust effects. The sensitivity of the area to dust soiling effects from trackout is therefore considered to be medium.

PM_{10} Effects

As previously discussed, annual mean PM_{10} concentrations in the vicinity of the Site are expected to be between 11-14 µg/m^3. Based on the proximity of sensitive receptors to the site boundary and the local concentrations of PM_{10} the sensitivity of the surrounding area is considered to be medium with regards human health impacts.

Table 6.2: Sensitivity of Surrounding Area

Source	Dust Soiling	Human health
Demolition	Medium	Medium
Earthworks	Medium	Medium
Construction	Medium	Medium
Trackout	Medium	Medium

Defining the Risk of Impacts

The dust emission magnitude as set out in Table 6.1 is combined with the sensitivity of the area (Table 6.2) to determine the risk of both dust soiling and human health impacts, assuming no mitigation measures applied at site. The risk of impacts associated with each activity is provided in Table 6.3 below and has been used to identify site-specific mitigation measures, which are discussed in Section 6.2 and set out in Appendix G.

Table 6.3: Summary of Risk Effects to Define Site Specific Mitigation

Source	Dust Soiling	Human health
Demolition	Medium Risk	Medium Risk
Earthworks	Medium Risk	Medium Risk
Construction	Medium Risk	Medium Risk
Trackout	Medium Risk	Medium Risk

6.2 Determining Appropriate Mitigation

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

An overall medium risk of impacts is predicted at adjacent receptors during construction of the proposed development. Appropriate mitigation measures for the Site have been identified following the IAQM guidance and based on the risk effects presented in Table 6.3. It is recommended that the measures set out in Appendix G are incorporated into a DMP and approved by ACC prior to commencement of any work on site.

Based on the risk effects identified during each of the four types of activities and following implementation of the recommended mitigation measures, the significance of residual impacts during construction of the proposed development will be **negligible.**

7 Operational Impacts

7.1 Model Results

Annual mean NO_2 concentrations predicted at the selected receptor locations are provided in Table 7.1, while annual mean PM_{10} and $PM_{2.5}$ are provided in Tables 7.2 and 7.3, respectively.

Table 7.1: Predicted Annual Mean NO_2 Concentrations (µg/m^3)

Receptor	2023 Do Minimum	2023 Do Something	Change in NO_2 due to Development (as % of the AQAL)	Significance of Impact
1	19.6	19.7	0	Negligible
2	20.5	20.6	0	Negligible
3	19.8	19.8	0	Negligible
4	19.6	19.6	0	Negligible
5	13.8	13.8	0	Negligible
6	13.3	13.4	0	Negligible
7	18.6	18.6	0	Negligible
8	17.4	17.4	0	Negligible
9	19.0	19.0	0	Negligible
10	19.0	19.3	1	Negligible

Table 7.2: Predicted Annual Mean PM_{10} Concentrations (µg/m^3)

Receptor	2023 Do Minimum	2023 Do Something	Change in PM_{10} due to Development (as % of the AQAL)	Significance of Impact
1	16.3	16.3	0	Negligible
2	16.6	16.6	0	Negligible
3	16.4	16.4	0	Negligible
4	16.3	16.3	0	Negligible
5	12.0	12.0	0	Negligible
6	11.8	11.8	0	Negligible
7	13.0	13.0	0	Negligible
8	12.7	12.7	0	Negligible

Receptor	2023 Do Minimum	2023 Do Something	Change in PM_{10} due to Development (as % of the AQAL)	Significance of Impact
9	16.1	16.1	0	Negligible
10	16.1	16.2	0	Negligible

Table 7.3: Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m^3)

Receptor	2023 Do Minimum	2023 Do Something	Change in $PM_{2.5}$ due to Development (as % of the AQAL)	Significance of Impact
1	8.8	8.8	0	Negligible
2	9.0	9.0	0	Negligible
3	8.9	8.9	0	Negligible
4	8.9	8.9	0	Negligible
5	7.6	7.6	0	Negligible
6	7.5	7.5	0	Negligible
7	8.0	8.1	0	Negligible
8	7.9	7.9	0	Negligible
9	8.7	8.7	0	Negligible
10	8.7	8.8	0	Negligible

7.1.1 NO_2 Concentrations

The data set out in Table 7.1 shows that the model is predicting annual mean NO_2 concentrations below the objective limit at all the selected receptor locations.

As concentrations are predicted to be less than 60 µg/m^3, concentrations are also meeting the 1-hour objective at all receptor locations.

The model is predicting a change in annual mean NO_2 concentrations of no more than 0.1 µg/m^3 at the selected receptors. This equates to less than 1% of the AQAL which is considered to be a negligible impact the criteria set out in Table 4.2.

7.1.2 PM_{10} Concentrations

The model is predicting annual mean PM_{10} concentrations below the objective limit at all receptor locations (Table 7.2) under both future year assessment scenarios.

Based on the annual mean concentrations the number of days exceeding the short-term PM_{10} concentration is less than 7, therefore the 24-hour objective is being met at all receptors.

The modelling assessment is predicting a change in PM_{10} concentrations of no more than 0.1 $\mu g/m^3$ as a result of the operational vehicle movements. The impact of the development on local PM_{10} is therefore judged to be negligible.

7.1.3 $PM_{2.5}$ Concentrations

The modelling assessment has predicted annual mean $PM_{2.5}$ concentrations below the objective limit at all receptor locations under the DM and DS scenarios.

The modelling assessment is predicting a change in $PM_{2.5}$ concentrations of no more than 0.1 $\mu g/m^3$ as a result of the operational vehicle movements. The impact of the development on local $PM_{2.5}$ is therefore judged to be negligible.

7.2 Determining Appropriate Mitigation

The assessment has predicted a negligible impact on local air quality as a result of operational traffic associated with the development. No mitigation of operational traffic is therefore considered necessary.

8 Conclusion

Encon Associates were commissioned by McDonalds Ltd (the ‘Client’) to carry out an air quality in connection with the proposed new McDonalds restaurant and Drive-Thru off Ashgrove Road West, Aberdeen.

It is inevitable that with any development, demolition and construction activities will cause some disturbance to those nearby. Dust arising from most construction activities tends to be of a coarse nature, which through dispersion by the wind can lead to soiling of property including windows, cars, external paintwork and laundry. However, as well as giving rise to annoyance due to soiling of surfaces from dust emissions, there is evidence of major construction activities causing increases in long term PM_{10} concentrations and in the number of days exceeding the short term PM_{10} objective of 50 μgm^{-3}.

The IAQM guidance on assessing impacts on air quality from construction activities and determining the likely significance has been used to determine the risk of impacts occurring during the construction of the development and to identify appropriate mitigation measures to be implemented on site to reduce dust emissions and associated impacts.

Due to the proximity of nearby residential receptors the Site is considered to have a medium risk of impacts with regards to dust soiling and PM_{10} concentrations. However, following the implementation of appropriate mitigation measures impacts associated with the construction of the development are likely to be insignificant.

The assessment has used detailed modelling to predict the impact of traffic generated by the operational development on local air quality. The assessment has predicted a negligible impact on NO_2, PM_{10} and $PM_{2.5}$ as a result of operational traffic. The overall impact of the development, based on professional judgement, is judged to be not significant.

The development proposals will meet the relevant polices set out within the Local Plan and does not pose a constraint to development of the Site for the proposed use.

Appendix A

Glossary of Terminology

Term	Definition
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedences within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
DEFRA	Department for Environment, Food and Rural Affairs.
Exceedance	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O_3	Ozone.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
μgm^{-3} micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of $1ug/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the

Term	Definition
	closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

Appendix B
IAQM Construction Dust Assessment Procedure

In order to assess the potential impacts, the activities on construction sites are divided into four categories. These are:

- demolition (removal of existing structures).
- earthworks (soil-stripping, ground-levelling, excavation and landscaping).
- construction (activities involved in the provision of a new structure); and
- trackout (the transport of dust and dirt from the construction site onto the public road network where it may be deposited and then re-suspended by vehicles using the network).

For each activity, the risk of dust annoyance, health and ecological impact is determined using three risk categories: low, medium and high risk. The risk category may be different for each of the four activities. The risk magnitude identified for each of the construction activities is then compared to the number of sensitive receptors in the near vicinity of the site in order to determine the risks posed by the construction activities to these receptors.

Step 1: Screen the Need for an Assessment

The first step is to screen the requirement for a more detailed assessment. An assessment is required where there is:

- a ‘human receptor’ within 350m of the boundary of the site or 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s); and/or
- an ‘ecological receptor’ within 50m of the boundary of the site; or 50m of the route(s) used by the construction vehicles on the public highway, up to 500m from the site entrance(s).

Step 2A: Define the Potential Dust Emission Magnitude

This is based on the scale of the anticipated works and the proximity of nearby receptors. The risk is classified as small, medium or large for each of the four categories.

Demolition: The potential dust emission classes for demolition are:

- Large: Total building volume >50,000m^3, potentially dusty construction material (e.g. Concrete), on site crushing and screening, demolition activities >20m above ground level.
- Medium: total building volume 20,000m^3 – 50,000m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- Small: total building volume <20,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

Earthworks: This involves excavating material, haulage, tipping and stockpiling. The potential dust emission classes for earthworks are:

- Large: Total site area >10,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes;
- Medium: Total site area 2,500 m^2 – 10,000m^2, moderately dusty soil (e.g. silt), 5 – 10 heavy earth moving vehicles active at any one time, formation of bunds 4m – 8m in height, total material moved 20,000 tonnes- 100,000 tonnes; and
- Small: Total site area <2,500m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <20,000 tonnes, earthworks during wetter months.

Construction: The important issues here when determining the potential dust emission magnitude include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build. The categories are:

- Large: Total building volume >100,000m^3, on site concrete batching, sandblasting.
- Medium: Total building volume 25,000m^3 – 100,000m^3, potentially dusty construction material (e.g. concrete), on site concrete batching; and
- Small: Total building volume <25,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Trackout: The risk of impacts occurring during trackout is predominantly dependent on the number of vehicles accessing the Site on a daily basis. However, vehicle size and speed, the duration of activities and local geology are also factors which are used to determine the emission class of the Site as a result of trackout. The categories are:

- Large: >50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100m.
- Medium: 10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content, unpaved road length 50-100m; and
- Small: <10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length >50m.

Step 2B: Defining the Sensitivity of the Area

The sensitivity of the area is defined for dust soiling, human health (PM_{10}) and ecological receptors. The sensitivity of the area takes into account the following factors:

- the specific sensitivities of receptors in the area.
- the proximity and number of receptors.
- in the case of PM_{10}, the local background concentration; and
- site specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

Table B1 is used to define the sensitivity of different types of receptors to dust soiling, health effects and ecological effects.

Based on the sensitivities assigned to the different receptors surrounding the site and numbers of receptors within certain distances of the site, a sensitivity classification can be defined for each. Tables B2 to B4 indicate the criteria used to determine the sensitivity of the area to dust soiling, human health and ecological impacts.

Table B1: Examples of Factors Defining Sensitivity of an Area			
Sensitivity of Area	**Dust Soiling**	**Human Receptors**	**Ecological Receptors**
High	Users can reasonably expect enjoyment of a high level of amenity The appearance, aesthetics or value of their property would be diminished by soiling' The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. E.g. dwellings, museums and other important collections, medium and long term car parks and car showrooms.	10 – 100 dwellings within 20 m of site. Local PM_{10} concentrations close to the objective (e.g. annual mean 36 -40 μg/m^3). E.g. residential properties, hospitals, schools and residential care homes.	Locations with an international or national designation and the designated features may be affected by dust soiling. Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red List for Great Britain. E.g. A Special Area of Conservation (SAC).
Medium	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home. The appearance, aesthetics or value of their property could be diminished by soiling The 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.	Less than 10 receptors within 20 m. Local PM_{10} concentrations below the objective (e.g. annual mean 30-36 μg/m^3). E.g. office and shop workers but will generally not include workers occupationally exposed to PM_{10} as protection is covered by the Health and Safety at Work legislation.	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown. Locations with a national designation where the features may be affected by dust deposition E.g. A Site of Special Scientific Interest (SSSI) with dust sensitive features.
Low	The enjoyment of amenity would not reasonably be expected. Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling. There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the	Locations where human exposure is transient. No receptors within 20 m. Local PM_{10} concentrations well below the objectives (less than 75%). E.g. public footpaths, playing fields, parks and shopping streets.	Locations with a local designation where the features may be affected by dust deposition. E.g. Local Nature Reserve with dust sensitive features.

Table B1: Examples of Factors Defining Sensitivity of an Area			
Sensitivity of Area	**Dust Soiling**	**Human Receptors**	**Ecological Receptors**
	land. E.g. playing fields, farmland unless commercially sensitive horticultural, footpaths, short lived car [parks and roads.		

Table B2: Sensitivity of the Area to Dust Soiling on People and Property					
Receptor Sensitivity	**Number of Receptors**	**Distance from the Source (m)**			
		<20	**<50**	**<100**	**<350**
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table B3: Sensitivity of the Area to Human Health Impacts							
Receptor Sensitivity	**Annual Mean PM_{10} Concentration**	**Number of Receptors**	**Distance from Source (m)**				
			<20	**<50**	**<100**	**<200**	**<350**
High	>32 μg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 μg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 μg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 μg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 μg/m³	>10	High	Medium	Low	Low	Low

Table B3: Sensitivity of the Area to Human Health Impacts							
Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from Source (m)				
			<20	<50	<100	<200	<350
		1-10	Medium	Low	Low	Low	Low
	28-32 μg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 μg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 μg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table B4: Sensitivity of the Area to Ecological Impacts		
Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Define the Risk of Impacts

The final step is to combine the dust emission magnitude determined in step 2A with the sensitivity of the area determined in step 2B to determine the risk of impacts with no mitigation applied. Tables B5 to B7 indicate the method used to assign the level of risk for each construction activity. The identified level of risk is then used to determine measures for inclusion within a site-specific Construction Management Plan (CMP) aimed at reducing dust emissions and hence reducing the impact of the construction phase on nearby receptors. The mitigation measures are drawn from detailed mitigation set out within the IAQM guidance document.

Table B5: Risk of Dust Impacts from Demolition			
Sensitivity of Area	**Large**	**Medium**	**Small**
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table B6: Risk of Dust Impacts from Earthworks/ Construction			
Sensitivity of Area	**Large**	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table B7: Risk of Dust Impacts from Trackout			
Sensitivity of Area	**Large**	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Appendix C
Traffic Data used in ADMS Modelling

Table C1: Traffic Data used in ADMS Roads Dispersion Model

Link Name	Speed (kph)	% HDV	AADT		
			2019 Base	2023 Do Minimum[1]	2023 Do Something[1]
1 – Ashgrove Road West (site Access)	48 (38 at junction)	0.8	654	666	3216
2 – Ashgrove West (A9011)	48 (38 at junction)	1.1	12563	13128	15340
3 – A92 South of Ashgrove Road West	64 (56 at junction)	4.5	27908	29163	29467
4 – Ashgrove Road West (east of Site)	48 (38 at junction)	1.1	12563	13128	13196
5 – A92 North of Ashgrove Road West	64 (56 at junction)	4.5	27908	29163	29163

Appendix D
Calibration of Defra Background Data

To ensure that annual mean background concentrations used in the assessment reflect real-world concentrations as accurately as possible a calibration exercise has been carried out. Monitored data measured at local background diffusion tube monitoring site DT60 (North Anderson Drive) have been compared against Defra predictions at the same location to provide a calibration factor. This calculation of the calibration factor is shown in Table D1.

Table D1: Background Calibration of NO_2

Parameter	Monitoring Site		
	CM1	**DT62**	**DT64**
Measured Concentration (µg/m^3)	20	11	14
Data Capture (%)			
Mapped Concentration (µg/m^3)	16.5	14.1	15.4
Calibration Factor	1.21	0.78	0.91
Average Calibration Factor	0.97		

Comparison of the measures and mapped data shows that the Defra concentrations are lower than monitoring data suggests for the study area. The mapped background NO_2 data has therefore been adjusted by the calculated calibration factor for the purposes of this assessment.

The same approach has been taken to adjust the Defra mapped background PM_{10} and $PM_{2.5}$ data. Details of the calibration factor calculation is set out in Tables D2 and D3.

Table D2: Background Calibration of PM_{10}

Parameter	Monitoring Site
	CM1
Measured Concentration (µg/m^3)	14
Data Capture (%)	
Mapped Concentration (µg/m^3)	9.7
Calibration Factor	1.4

Table D2: Background Calibration of $PM_{2.5}$

Parameter	Monitoring Site
	CM1
Measured Concentration (µg/m^3)	7
Data Capture (%)	
Mapped Concentration (µg/m^3)	5.9
Calibration Factor	1.2

Appendix E
Roads Modelling Verification

NO_2 Concentrations

Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions. The model has been run to predict annual mean road-NO_x concentrations at monitoring site DT60 located adjacent to North Anderson Drive A92 (full details are provided in Table 5.1).

The model is under-predicting concentrations at this monitoring location. An adjustment factor has therefore been calculated following the methodology given below to apply to concentrations predicted by the ADMS model.

The model output of road-NO_x (i.e. the component of total NO_x coming from road traffic) has been compared with the 'measured' road-NO_x (Figure E1). The 'measured' road NO_x has been calculated from the measured NO_2 concentrations, by first converting the measured NO_2 into an equivalent measured NO_x using the NO_x from NO_2 DEFRA calculator, then subtracting the background value.

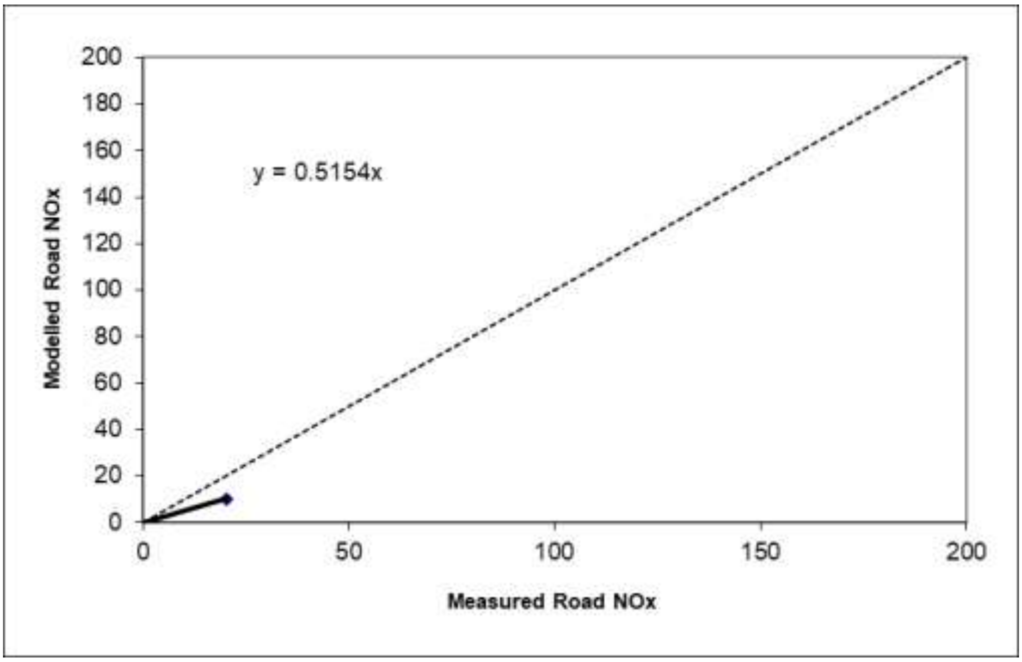


Figure E1: Comparison of Modelled Road NO_x to 'Measured' Road NO_x

A primary adjustment factor was then determined as the ratio between the measured road-NO_x contribution and the model derived road-NO_x contribution, forced through zero (1/0.5154 = 1.94). This factor was then applied to the modelled road-NO_x concentration for each monitoring location to provide an adjusted modelled road-NO_x concentration. The background concentration was then added to these concentrations to determine the adjusted total modelled NO_x concentration.

The NO_2- road contribution to the total annual mean NO_2 concentration was then determined using the Defra NO_x:NO_2 calculator tool.

The total NO_2 concentration was then determined by adding the background NO_2 concentration to this calculated road contribution. Figure E2 shows the adjusted modelled total NO_2 vs monitored NO_2. There is good agreement, between measured and predicted concentrations, thus a secondary adjustment factor is not required.

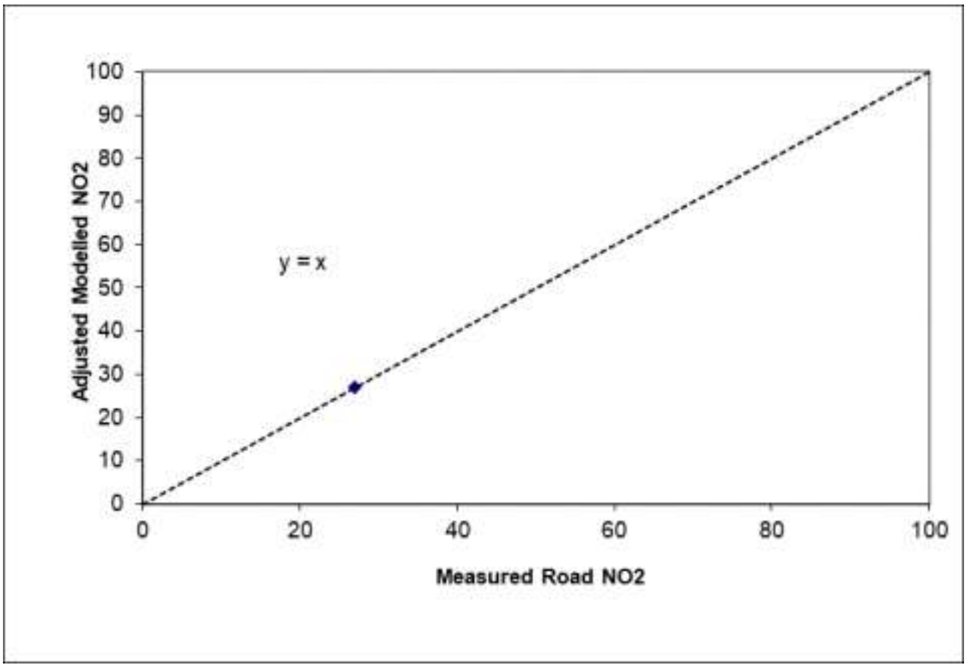


Figure E2: Comparison of Modelled NO_2 with Measured NO_2 before Secondary Adjustment.

Further review of the verification process was undertaken to determine the uncertainty of the model results and subsequent adjusted model results. The Root Mean Square Error (RMSE) was calculated for both the unadjusted and adjusted model results. LAQM.TG(16) recommends that the RMSE should be within 10% of the air quality objective, which equates to 4 µg/m^3 for NO_2.

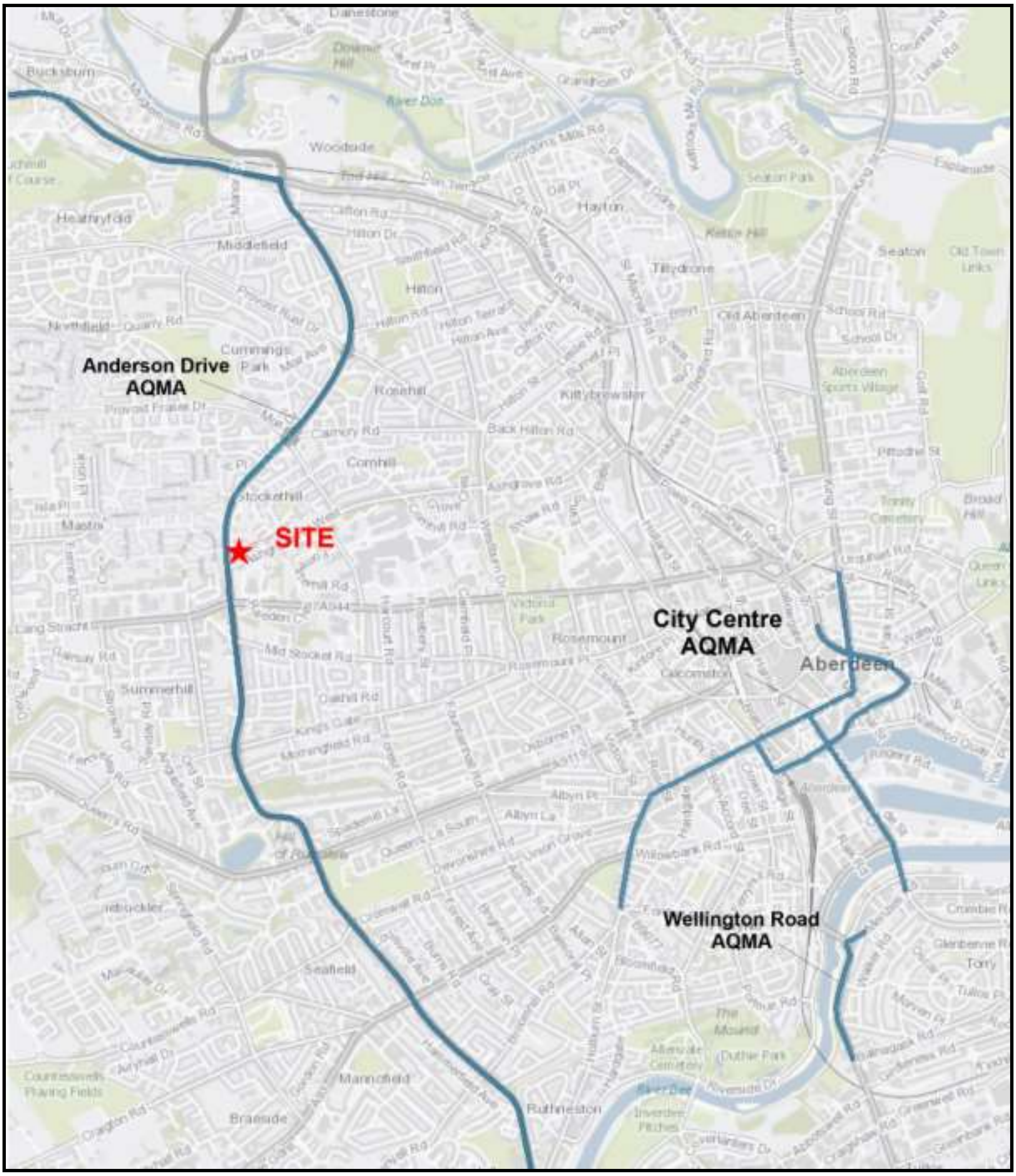
The RMSE of the unadjusted results was calculated as 5 µg/m^3. However, following adjustment using both the primary and secondary adjustment factors set out above the RMSE was reduced to 0 µg/m^3, below the preferred 4 µg/m^3.

The adjustment factor of 1.94 has been applied to the modelled NO_x-road concentrations predicted at all receptor locations. The predicted NO_2-road concentrations, calculated using the NO_x-NO_2 converter tool, have subsequently been added to background NO_2 concentrations to provide the final predicted annual mean NO_2 concentrations at each receptor.

PM Concentrations

The approach undertaken above determines the road increment of NO_x concentrations by subtracting the background concentrations from total roadside measurements. This works well for NO_x due to the large difference between roadside and background concentrations with a large proportion of roadside concentrations being contributed by tailpipe emissions. This is not the same for PM_{10} and $PM_{2.5}$ which are dominated by non-road sources, even at roadside locations. Due to the dominance of non-road sources, the influence of local road concentrations can often be smaller than the uncertainty in background mapped concentrations. It is not therefore considered appropriate to calculate the annual mean road-increment of PM_{10} and $PM_{2.5}$ concentrations by subtracting background concentrations. This is more significant where an assessment is reliant on the Defra background mapped data rather than locally monitored background data. Therefore, the approach used for model adjustment for processing predicted NO_x and NO_2 concentrations is not considered appropriate for PM_{10} and $PM_{2.5}$. Furthermore, there is little evidence that suggests that the EFT-based models have consistently under-predicted roadside PM_{10} and $PM_{2.5}$. Predicted PM concentrations have not therefore been adjusted.

Appendix F
Location of AQMA[30]



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[30] https://uk-air.defra.gov.uk/aqma/maps/

Appendix G
Construction Mitigation Measures

It is recommended that the following measures are incorporated into a DMP and approved by ACC prior to commencement of any work on site. The measures set out below summaries the measures set out within the IAQM guidance

This guidance should be read in conjunction with this report to obtain full details of all the measures that should be applied on site.

- display the name and contact details of the person accountable for air quality and dust issues on the site boundary (i.e. the environment manager/engineer or site manager);
- display the head or regional office contact information on the site boundary;
- record all dust and air quality complaints, identify cause, take appropriate measures to reduce emissions in a timely manner and record the measures taken;
- make the complaints log available to the local authority when asked;
- record any exceptional incidents that cause dust and/or air emissions, either on- or off- site and the action taken to resolve the situation in the log book;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results and make inspection log available to ACC when asked;
- increase frequency of site inspection by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged periods of dry or windy conditions;
- plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles;
- fully enclose site or specific operations where there is a high potential for dust production;
- avoid site runoff of water or mud;

- keep the site fencing, barriers and scaffolding clean using wet methods;
- remove material that have a potential to produce dust form 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;
- ensure all vehicles switch off engines when stationary - no idling vehicles;
- avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable;
- produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials;
- only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction e.g. suitable local exhaust ventilation systems;
- ensure an adequate water supply on site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- use enclosed chutes and conveyors and covered skips;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate;
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods;
- avoid bonfires and burning of waste materials;
- ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- use water-assisted dust sweepers on the access and local roads, to remove, as necessary, any material tracked out of the site;
- avoid dry sweeping of large areas;

- ensure vehicles entering and leaving the site are covered to prevent the escape of materials during transport.
- Inspect on-site haul roads for integrity and instigate necessary repairs to the surfaces 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 reasonable practicable;
- ensure vehicles entering and leaving the site are covered to prevent the escape of materials during transport.

Desirable Measures

- undertake daily on-site and off-site inspection, where receptors 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, windows sills within 100m of site boundary, with cleaning provided if necessary;
- implement a travel plan that supports and encourages sustainable travel;
- re-vegetate earthworks and exposed areas/soil stockpiles to stablise 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;
- 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 or overfilling during delivery;

- avoid scabbling where possible;
- for smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust;