BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

ENVIRONMENT

HB (SOUTH CALDECOTE)

SOUTH CALDECOTTE

Air Quality Assessment

NTS2682

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HB (SOUTH CALDECOTTE)

SOUTH CALDECOTTE

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Notice

EXECUTIVE SUMMARY

BWB Consulting was appointed by HB (South Caldecotte) Limited to undertake an air quality assessment for a proposed commercial park located north of the A4146 / A5 roundabout, South Caldecotte, Milton Keynes.

The proposed development site is located within the administrative area of Milton Keynes Council and lies adjacent to the junction of the A5 and V10 Brickhill Street. The proposed development site is not located in an Air Quality Management Area.

A qualitative construction phase dust assessment was undertaken in accordance with Institute of Air Quality Management guidance and measures were recommended for inclusion in a Dust Management Plan to minimise emissions during construction activities. With the implementation of these mitigation measures the impact of construction phase dust emissions was considered to be 'not significant' in accordance with IAQM guidance.

A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified existing receptor locations. Road traffic emissions were modelled using the dispersion model ADMS-Roads and concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) were predicted at identified sensitive receptor locations. The modelling assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance. The development was not predicted to result in any new exceedances of the relevant air quality objectives and the impact of the development on local air quality was predicted to be 'negligible' in accordance with IAQM and EPUK guidance[13].

CONTENTS

FIGURES

APPENDICES

1. INTRODUCTION

Appointment & Background

1.1 BWB Consulting was appointed by HB (South Caldecotte) to undertake an air quality assessment for a proposed commercial development at land off V10 Brickhill Street ('the Site').

1.2 The assessment considers construction phase dust impacts and operational phase road traffic emissions. A qualitative construction phase dust assessment was undertaken in accordance with relevant guidance. A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified receptor locations.

1.3 This report is necessarily technical in nature, so to assist the reader, a glossary of air quality terminology can be found in **Appendix A**.

Site Setting

1.4 The Site is located off the V10 Brickhill Street and is located within the administrative area of Milton Keynes Council (MKC). **Figure 1.1** details the location of the proposed development. The site currently comprises agricultural land and a residential dwelling with associated outbuildings that are understood to be demolished as part of the development proposals.

1.5 The Site is bounded to the North by a railway line with offices and Caldecotte Lake beyond. To the East is V10 Brickhill Street with agricultural land and a small number of residential dwellings beyond. The junction of the A5 and V10 Brickhill Street is located to the South, with a small number of retail premises beyond, whilst to the West is more agricultural land and a retail outlet with a small number of residential dwellings beyond.

1.6 Principal air pollution sources in the vicinity of the development are likely to comprise road traffic emissions, particularly the A5 which runs along the southwestern boundary of the Site. The Site is not located in an Air Quality Management Area (AQMA); the nearest AQMA is more than 16km southwest of the Site in Dunstable town centre, declared by Central Bedfordshire Council for exceedances of the annual mean nitrogen dioxide (NO_2) air quality objective.

Proposed Development

1.7 The proposed development comprises 2,596,350sq.ft of commercial space.

1.8 The proposed development masterplan is detailed in **Appendix B**.

Figure 1.1: Site Location

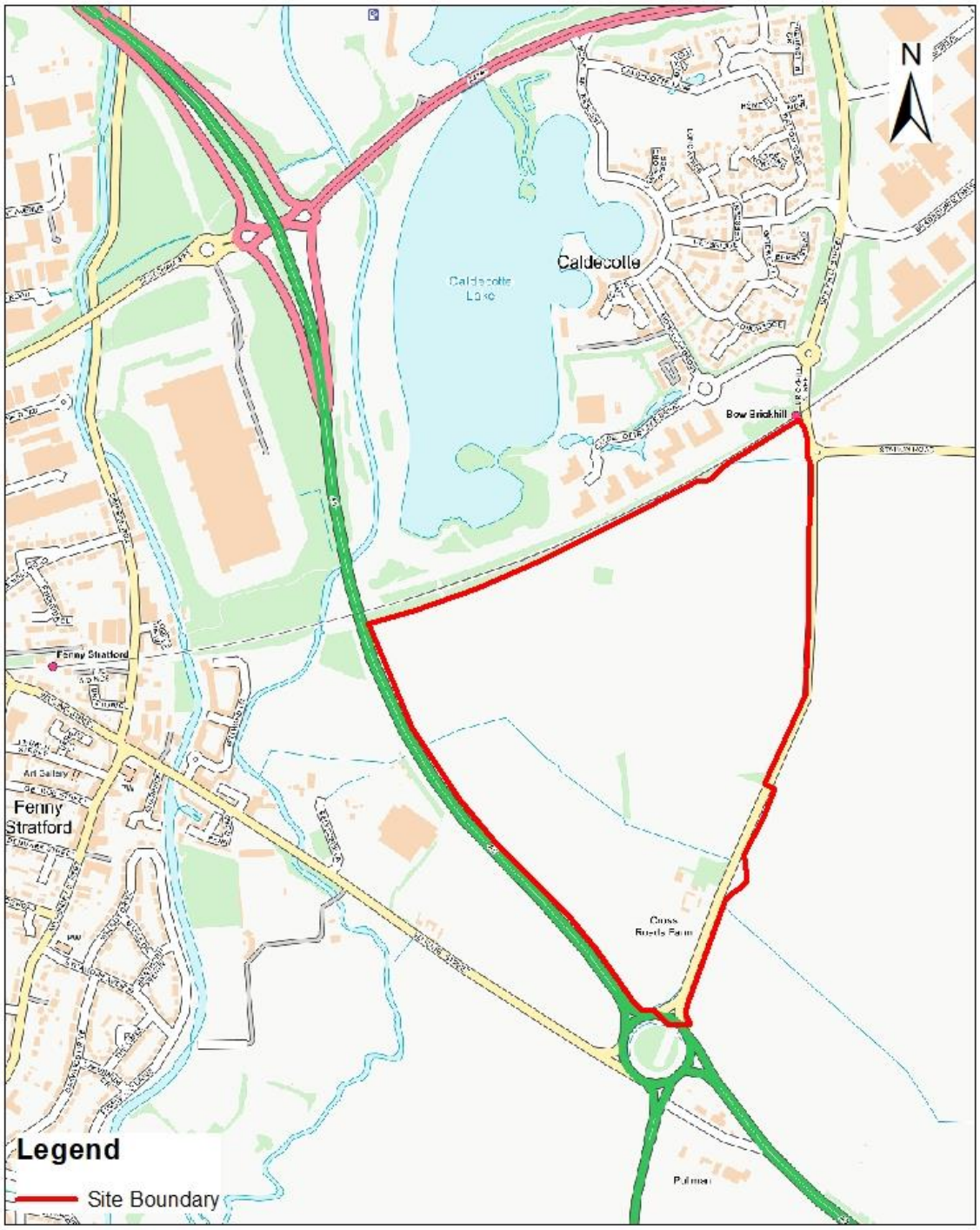

Figure 1 Site Location

Drawn by: FH
Date: 29/11/2018

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2. LEGISLATION AND PLANNING POLICY

National Legislation and Planning Policy

The UK Air Quality Strategy

2.1 European Union (EU) legislation forms the basis of air quality policy and legislation in the UK. The EU 2008 ambient Air Quality Directive[1] sets limits for ambient concentrations of air pollutants including nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). The air quality standards and objectives are prescribed through the Air Quality (England) Regulations 2000[2], as amended, for the purpose of the Local Air Quality Management Framework.

2.2 The UK Government are required under the Environment Act 1995[3] to produce a national Air Quality Strategy (AQS). The AQS was first published in 1997[4] and was most recently reviewed and updated in 2007[5]. The AQS provides an overview of the Government's ambient air quality policy and sets out the air quality standards and objectives to be achieved and measures to improve air quality.

2.3 Part IV of the Environment Act[3] requires local authorities in the UK to review local air quality within their administrative area and, if relevant air quality standards and objectives are likely to be exceeded, designate Air Quality Management Areas (AQMAs). Following the designation of an AQMA, local authorities are required to publish an Air Quality Action Plan (AQAP) detailing measures to be taken to improve local air quality and work towards meeting the relevant air quality standards and objectives.

National Planning Policy Framework

2.4 The National Planning Policy Framework (NPPF)[6] was published in July 2018 and sets out the Government's planning policies for England and how these are expected to be applied.

2.5 With regard to assessing cumulative effects the NPPF[6] states:

> *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development.*
>
> *[…]"*

[1] European Parliament (2008) Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe
[2] HMSO (2000) Statutory Instrument 2000 No. 928, The Air Quality (England) Regulations 2000 (as amended), London: HMSO
[3] HMSO (1995) The Environment Act 1995, London: TSO
[4] Department of the Environment (DoE) (1997) The UK National Air Quality Strategy, London: HMSO
[5] Department of the Environment, Food and Rural Affairs (Defra) (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, London: HMSO
[6] Ministry of Housing, Communities & Local Government (2018) National Planning Policy Framework, HMSO London

The NPPF[6] recognises air quality within Section 15: Conserving and enhancing the natural environment, and states that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

[…]

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

[…]

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development.

[…]

Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.Planning Practice Guidance".

2.6 The Planning Practice Guidance (PPG) for air quality[7] was updated in 2014 and provides guiding principles on how the planning process can take account of the impacts of new development on air quality.

2.7 The PPG[7] sets out the role of Local Plans with regard to air quality and when air quality could be relevant to a planning decision stating that:

"Whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality

[7] Department for Communities and Local Government (2014) Planning Practice Guidance Air Quality

is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife).

[…]

When deciding whether air quality is relevant to a planning application, considerations could include whether the development would:

- *Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate Heavy Goods Vehicle flows over a period of a year or more.*

- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area.*

- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.*

- *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations.*

- *Affect biodiversity. In particular, this is likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites."*

2.8 The PPG provides guidance regarding what should be included within an air quality assessment. Examples of potential air quality mitigation measures are also provided.

Local Planning Policy

Milton Keynes Core Strategy

2.9 The Milton Keynes Core Strategy[8] contains the strategic policies and sets the framework for future detailed policies and Neighbourhood Plans in the Milton Keynes area. Contained within the Core Strategy are policies relating to air quality.

2.10 Policy CS12 – Developing Successful Neighbourhoods states:

"New developments and major redevelopments must be designed to support sustainable lifestyles for all. This will include:

[…]

4. Appropriately locating development to maintain and improve current flood risk and air quality standards.

[…]"

Milton Keynes Local Plan

2.11 The Milton Keynes Local Plan[9] was adopted in 2005 and works alongside the Milton Keynes Core Strategy to make up the development plan for Milton Keynes. Contained in the Local Plan are policies relating to air quality.

2.12 Policy E9 states:

"Planning permission will be granted for industrial uses within employment areas if all of the following criteria are met:

[…]

li) adequate controls are proposed to deal with air pollution…

[…]"

2.13 The above policies were taken into consideration throughout the undertaking of the assessment.

[8] Milton Keynes Council (2013) Core Strategy
[9] Milton Keynes Council (2005) Local Plan

3. METHODOLOGY

Consultation with Milton Keynes Council

3.1 Consultation was undertaken with the Environmental Protection Department at MKC, in which the proposed assessment methodology was provided via email and a response was received on 06/11/2018[10].

3.2 The agreed assessment methodology is detailed below:

- Construction Phase - A construction phase assessment was undertaken and relevant measures to mitigate construction phase dust emissions were recommended. The assessment was undertaken in accordance with guidance provided by the Institute of Air Quality Management (IAQM)[11].
- Operational Phase – A detailed operational phase road traffic emissions assessment was undertaken to consider the impact of development-generated traffic on local air quality and predict pollutant concentrations at the proposed development site. The dispersion model ADMS-Roads was used to model concentrations of oxides of nitrogen (NOx) and particulate matter (PM_{10} and $PM_{2.5}$) at identified existing receptor locations for both without and with development scenarios. The change in pollutant concentrations as a result of development-generated traffic was then calculated. The assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance (LAQM.TG16)[12]. Full details of the methodology used in the assessment as agreed with MKC is provided in paragraph 3.11 of this report.

Construction Phase Assessment

3.3 An assessment of the potential impacts arising from the construction of the proposed development was undertaken in accordance with IAQM Guidance[13]. The full assessment methodology is not reproduced within this report but a summary of the assessment steps are provided below:

- Step 1 – screen the requirement for a more detailed assessment. No assessment is required if there are no receptors within a certain distance of the works;
- Step 2 – assess the risk of dust impacts separately for each of the four activities considered (demolition, earthworks, construction and trackout).
    - Step 2A – determine the potential dust emission magnitude for each of the four activities;
    - Step 2B – determine the sensitivity of the area;
    - Step 2C – determine the risk of dust impacts by combining the findings of steps 2A and 2B.
- Step 3 – determine the site-specific mitigation for each of the four activities; and
- Step 4 – examine the residual effects and determine significance.

[10] Consultation issued by email to the Milton Keynes Environmental Health Department, on 31/05/2018 and a response was received on 06/11/2018.
[11] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London
[12] Defra (2016) Local Air Quality Management Technical Guidance (LAQM.TG16), London: Defra
[13] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London

Road Traffic Emissions – Air Dispersion Modelling

3.4 The air dispersion model ADMS-Roads, version 4.1.1.0 was utilised in the assessment to predict concentrations of NOx, PM_{10} and $PM_{2.5}$ at existing receptor locations.

3.5 The assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance[14] and Institute of Air Quality Management and Environmental Protection UK guidance[15].

Assessment Scenarios and Traffic Data

3.6 The following scenarios were considered in the air dispersion modelling:

- Scenario 1: 2017 Base Year;
- Scenario 2: 2023 Opening Year 'without development'; and
- Scenario 3: 2023 Opening Year 'with development'.

3.7 Traffic data were obtained from BWB, the Transport Consultants for the project. 24-hour Annual Average Daily Traffic Data (AADT) and Heavy Duty Vehicle (HDV) proportions were provided for the following roads for use in the assessment:

- A5;
- A4146;
- V10 Brickhill Street;
- Watling Street;
- Station Road;
- Caldecotte Lake Drive; and
- Bletcham Way.

3.8 In addition, traffic data for the A5 London Road was obtained from the Department for Transport for use in the verification of the ADMS-Roads model.

3.9 Consideration was given to the speeds at which vehicles are likely to travel within the study area. Free-flowing traffic conditions were modelled at speeds provided by the Transport Consultants. Queuing sections, including roundabout junctions, were modelled in accordance with Defra guidance[12].

3.10 Traffic data used in the air dispersion modelling are provided in **Appendix C.**

ADMS-Roads Model Inputs

3.11 The following model inputs were utilised in the assessment:

[14] Defra (2016) Local Air Quality Management Technical Guidance (LAQM.TG16), London: Defra
[15] Institute of Air Quality Management and Environmental Protection UK (2017) Land-Use Planning & Development Control: Planning for Air Quality, v1.2, London

- Emission Factors – emission factors were utilised from the Defra Emission Factor Toolkit[16], version 8.0.1, for the years of assessment (2017 and 2023.
- Conversion of oxides of nitrogen – concentrations of NOx were predicted using the ADMS-Roads dispersion model. These concentrations were converted to nitrogen dioxide (NO_2) using the Defra NOx to NO_2 calculator[17], version 6.1.
- Meteorological Data – hourly sequential meteorological data for the base year of assessment (2017) were obtained for the Manchester recording station. This is the closest, most representation recording station to the proposed development site. The wind rose for 2017 is provided in **Appendix D**.
- Surface roughness – a surface roughness of 0.5 was utilised in the dispersion model. This is representative of the suburban conditions of the study area.
- Monin-Obukhov length (MO) – a MO of 30 was utilised in the dispersion model. This is representative of the mixed urban and industrial conditions of the study area.
- Background pollutant concentrations – background concentrations of NO_2, PM_{10} and $PM_{2.5}$ for the study area were obtained from the pollutant concentrations maps[18] provided by Defra as a 1km x 1km grid of the UK, for the years of assessment (2017 and 2023).
- Model verification – model verification was undertaken using Central Bedfordshire Council (CBC) monitoring data as there were no MKC monitoring locations within the study area representative of conditions within the study area. This approach was agreed with MKC. Full details of the verification procedure are provided in **Appendix E**.
- Calculation of short term PM_{10} concentrations – the following calculation, as detailed in Defra guidance[14], was utilised to calculate the number of exceedance of the 24-hour mean PM_{10} air quality objective:

$$\text{Number of 24-Hour Mean Exceedance} = -18.5 + 0.00145 * \text{Annual Mean}^3 + (206 / \text{Annual Mean})$$

- The IAQM released a position statement in July 2018[19] regarding dealing with the uncertainty in vehicle NOx emissions within air quality assessments. This recommends that sensitivity analyses be undertaken and professional judgement be applied to consider the scenario where NOx emissions do not reduce as rapidly as shown by the EFT. As such a sensitivity analysis was undertaken and emission factors, NOx to NO_2 calcutor inputs and background concentrations were kept at base year (2017) levels. Details of the sensitivity analysis are provided in **Appendix F**.

Assessment Criteria

3.12 Predicted pollutant concentrations were compared to the relevant air quality objectives. The current relevant air quality standards and objectives are detailed in **Table 3.1.**

[16] Defra (2018) Emission Factor Toolkit [https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html]
[17] Defra (2018) NOx to NO_2 Calculator [https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc]
[18] Defra (2018) background pollutant concentration maps [https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015]
[19] Institute of Air Quality Management (2018) Position Statement: Dealing with Uncertainty in Vehicle NOx Emissions within Air Quality Assessments, Version 1.1

Table 3.1: Air Quality Standards and Objectives (England)

Pollutant	Averaging Period	Air Quality Objective (µg.m^{-3})	Date to Achieve by
NO_2	Annual Mean	40	31 December 2005
	1-hour mean not to be exceeded more than 18 times per year	200	31 December 2005
PM_{10}	Annual Mean	40	31 December 2004
	24-hour mean not to be exceeded more than 35 times per year	50	31 December 2004
$PM_{2.5}$	Annual mean target (15% cut in annual mean (urban background exposure)	25	2010 - 2020

3.13 Guidance is provided by the Institute of Air Quality Management and Environmental Protection UK[15] to determine the significance of the impact of development-generated road traffic emissions on local air quality. The impact descriptors at receptor locations are detailed in **Table 3.2.** These impact descriptors consider the predicted magnitude of change in pollutant concentrations and the concentration in relation to the relevant air quality objectives.

Table 3.2: Impact Descriptors for Individual Receptors

Long Term Average Concentration at Receptor in Assessment Year	% Change in Concentration Relative to Air Quality Assessment Level (AQAL)			
	1%	2 – 5%	6 – 10%	>10%
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 – 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 – 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Note: Figures rounded up to the nearest whole number, therefore any value less than 1% after rounding (effectively less than 0.5%) will be described as negligible.

4. BASELINE CONDITIONS

Local Air Quality Management

4.1 The proposed development is not located within, or in close proximity to, an AQMA.

Local Air Quality Monitoring

Nitrogen Dioxide

4.2 MKC undertakes monitoring within its administrative boundary using a network of automatic monitoring locations and diffusion tubes, however none are located within the study area. The closest monitoring location to the proposed development site is located in Bletchley, 1.7km southwest of the Site.

4.3 Bias adjusted NO_2 monitoring results, for the locations in the vicinity of the proposed development site, are detailed in **Table 4.1.**

Table 4.1: MKC NO_2 Monitoring Data in 2013 – 2017

Location	Grid Reference		Site Type[20]	Monitored Annual Average Concentration ($\mu g.m^{-3}$)				
				2013	2014	2015	2016	2017
WER - 97 Water Eaton Road, Bletchley	487395	233174	R	-	-	-	-	20.9

4.4 Monitored concentrations in 2017 were below the annual mean air quality objective for NO_2 of 40µg.m-3 at the nearest monitoring location to the Site. Monitoring was not undertaken at this site prior to 2017 and therefore, there is not sufficient data to derive a trend.

Particulate Matter (PM_{10})

4.5 Concentrations of PM_{10} are monitored at the two automatic analysers in the administrative area of MKC, however none are located within the study area. Monitored concentrations of PM_{10} at both automatic analysers were below the annual and daily mean objectives for 2017.

Particulate Matter ($PM_{2.5}$)

4.6 MKC do not monitor $PM_{2.5}$ concentrations in their administrative area.

[20] Site Types: R = Roadside, UB =- Urban Background, UT = Urban Traffic

Background Pollutant Concentrations

4.7 No background air quality monitoring is undertaken by MKC within the study area.

4.8 Background pollutant concentrations were therefore obtained from the latest Defra background concentration maps[18], which are provided for the UK as a 1km x 1km grid network. The latest maps are based on 2015 monitoring and meteorological data. Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ were obtained for the grid squares covering the study area for the years of assessment (2017 and 2023). The background concentrations used in the assessment are detailed in **Table 4.2.**

Table 4.2: Background Pollutant Concentrations used in the Assessment

Pollutant	Grid Square	Receptors	Concentration (µg.m^{-3})	
			2017	2023
NO_2	489500, 233500	R1	11.6	9.0
PM_{10}			14.1	13.7
$PM_{2.5}$			9.3	8.9
NO_2	490500, 232500	R2	10.0	7.8
PM_{10}			12.8	12.3
$PM_{2.5}$			8.6	8.2
NO_2	488500, 235500	R4	12.7	9.9
PM_{10}			13.1	12.6
$PM_{2.5}$			8.8	8.4
NO_2	489500, 235000	R3, R5, R6	12.3	9.6
PM_{10}			13.2	12.7
$PM_{2.5}$			8.9	8.5
NO_2	489500, 234500	R7, R8	10.7	8.4
PM_{10}			13.2	12.8
$PM_{2.5}$			8.8	8.4
NO_2	516500, 249500	MD3, N20 (verification only)	11.1	-
PM_{10}			15.6	-
$PM_{2.5}$			10.8	-

4.9 2017 and 2023 background concentrations are below the relevant annual mean air quality objectives for NO_2, PM_{10} and $PM_{2.5}$.

5. CONSTRUCTION PHASE ASSESSMENT

5.1 The construction phase of the proposed development will involve a number of activities which have the potential to impact on local air quality. These include emissions of dust generated through demolition, excavation, construction, earthworks and trackout activities, exhaust pollutant emissions from construction traffic on the local highways network, and exhaust emissions from non-road mobile machinery (NRMM) within the construction site itself.

5.2 The location of sensitive receptors in relation to construction activities will affect the potential for such construction activities to cause dust soiling, nuisance and local air quality impacts. Meteorological conditions and the use of control measures will also contribute to the effects experienced.

Step 1: Screen the Need for a Detailed Assessment

5.3 Step 1 of the IAQM guidance[13] involves a screening assessment to consider whether a more detailed construction phase dust assessment is required.

5.4 In accordance with the guidance, a detailed assessment is required if:

- Human receptors are located within 350m of the boundary of the site or 50m of routes used by construction vehicles on the public highways, up to 500m from the site entrances; or
- Ecological receptors are located within 50m of the boundary of the site or 50m of routes used by construction vehicles on the public highways, up to 500m from the site entrances.

5.5 From a review of the Multi Agency Geographic Information for the Countryside (MAGIC) website[21], no ecological designations were identified within 50m of the proposed development and therefore, the ecological effects from construction phase activities were not considered further. However human receptors are located within 350m of the site boundary, with the closest of these receptors located off Brickhill Street. A construction phase assessment was therefore undertaken.

Step 2: Assess the Risk of Dust Impacts

Step 2A: Define the Potential Dust Emission Magnitude

5.6 The dust emission magnitudes for the construction activities were defined using the criteria detailed in the IAQM guidance[13]. These criteria and the dust emission magnitude defined for the proposed development are detailed in **Table 5.1**.

[21] Defra, Multi Agency Geographic Information for the Countryside (MAGIC) [http://magic.defra.gov.uk/]

Table 5.1: Dust Emission Magnitude Criteria and Definition

Activity	IAQM Dust Emission Magnitude	IAQM Dust Emission Magnitude Criteria	Project Defined Dust Emission Magnitude
Demolition	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.	Small: Total building volume to be demolished <20,000m^3
	Medium	Total building volume 20,000m^3 – 50,000m^3, potentially dusty construction material, demolition activities 10 - 20m above ground level.	
	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	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.	Large: Total site area significantly larger than 10,000m^2
	Medium	Total site area 2,500m^2 – 10,000m^2, moderately dusty soil type (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.	
	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 <4m in height, total material moved <20,000 tonnes, earthworks during wetter months.	
Construction	Large	Total building volume >100,000m^3, on site concrete batching, sandblasting.	Large: Volume of buildings significantly larger than 100,000m^3
	Medium	Total building volume 25,000m^3 – 100,000m^3, potentially dusty construction material (e.g. concrete), on site concrete batching.	
	Small	Total building volume <25,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).	
Trackout	Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m.	Large: >50 outward movements per day are likely, over an unpaved road length of >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 50m – 100m.	
	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: Define the Sensitivity of the Area

5.7 The sensitivity of the study area takes into account the specific receptors in the vicinity of the site, the proximity and number of those receptors, the local background concentration of PM_{10} and site-specific factors. The assessment requires the determination of the sensitivity of the area for the purposes of dust soiling, human health and ecological impacts and these are presented in **Table 5.2**.

Table 5.2: Determination of the Sensitivity of the Area

Potential Impact	Justification	Sensitivity			
		Demolition	Earthworks	Construction	Trackout
Dust Soiling	There are <10 highly sensitive receptors and 10-100 medium sensitive receptors within 50m of the proposed development.	Low	Low	Low	Low
Human Health	There are <10 highly sensitive receptors and 10-100 medium sensitivity receptors within 50m of the proposed development. The 2017 background concentration of PM_{10} is less than 24µg.m^{-3}.	Low	Low	Low	Low

Step 2C: Define the Risk of Impacts

5.8 The dust emission magnitude determined in Step 2A is then combined with the sensitivity of the area determined in Step 2B to define the risk of dust impacts with no mitigation applied. The results of this assessment are detailed in **Table 5.2.**

Table 5.3: Summary Dust Risk Table to Define Site Specific Risk

Activity	Step 2A: Dust Emission Magnitude	Step 2B: Sensitivity of the Area	Step 2C: Risk of Dust Impacts
Dust Soiling Effects on People and Property			
Demolition	Small	Low	Negligible
Earthworks	Large	Low	Low Risk

Activity	Step 2A: Dust Emission Magnitude	Step 2B: Sensitivity of the Area	Step 2C: Risk of Dust Impacts
Construction	Large	Low	Low Risk
Trackout	Large	Low	Low Risk
Human Health Impacts			
Demolition	Small	Low	Negligible
Earthworks	Large	Low	Low Risk
Construction	Large	Low	Low Risk
Trackout	Large	Low	Low Risk

Step 3: Site-Specific Mitigation

5.9 The risk of dust impacts defined in Step 2C is used to determine the measures required to mitigate construction phase dust impacts. The mitigation measures are detailed in **Section 7** of this report.

Step 4: Determine Significant Effects

5.10 In accordance with IAQM guidance[13], with the implementation of the mitigation measures detailed in **Section 7**, the residual impacts from the construction phase are considered to be 'not significant'.

6. OPERATIONAL PHASE ROAD TRAFFIC EMISSIONS ASSESSMENT

Existing Receptor Locations

6.1 Existing receptor locations were identified within close proximity of the road links detailed in paragraph 3.7 and considered in the operational phase road traffic emissions assessment. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at the identified existing receptor locations for the assessment scenarios detailed in paragraph 3.6. Where possible the closest receptors to those road links were considered, as these receptors are likely to experience the greatest change in pollutant concentrations as a result of the proposed development. Receptors heights were modelled at 1.5m.

6.2 The existing receptor locations are detailed in **Table 6.1** and **Figure 6.1.**

Table 6.1: Existing Sensitive Receptor Locations

Receptor	Grid Reference		Details
	X	Y	
R1	489401.1	233406.6	McDonalds outdoor seating (short term receptor only)
R2	490162.8	232999.4	Farmhouse A5
R3	489538.0	235672.8	Cook Close
R4	488334.6	235553.4	Simpson Road (short term receptor only)
R5	489573.0	235707.8	Cook Close
R6	489616.0	235589.4	Tredlington Grove
R7	489594.7	234944.6	Long Mile
R8	489651.8	234733.5	Station Road

Figure 6.1: Existing Receptor Locations

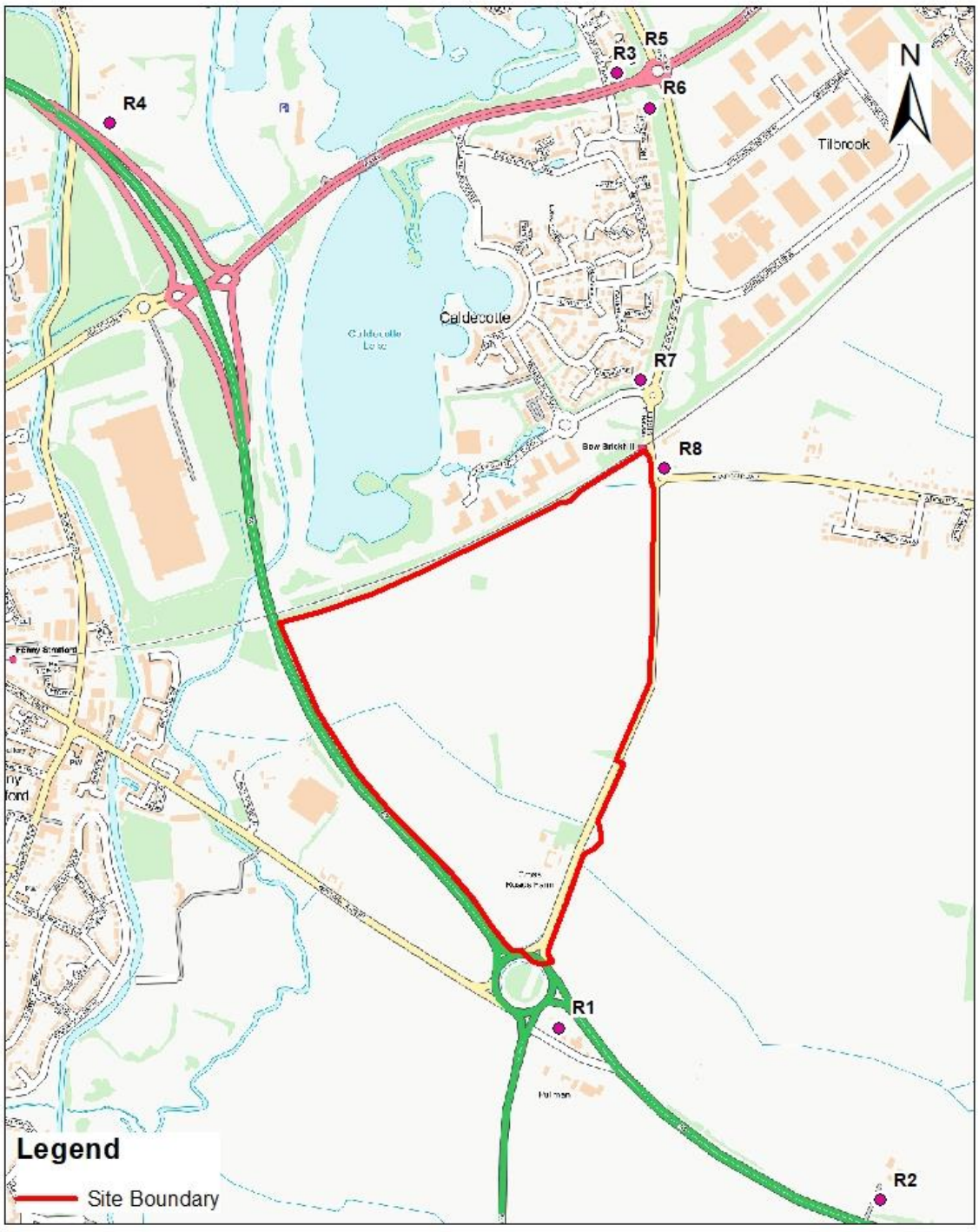

Figure 2 Existing Receptors

Drawn by: FH
Date: 29/11/2018

BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

Baseline Assessment

6.3 Pollutant concentrations were predicted at the identified existing sensitive receptor locations using the dispersion model ADMS-Roads. Predicted pollutant concentrations for Scenario 1: 2017 Base Year and Scenario 2: 2023 Opening Year 'without development' are detailed in **Table 6.3.**

Table 6.3: Predicted Annual Mean Pollutant Concentrations for Scenario 1: 2017 Base Year and Scenario 2: 2023 Opening Year Without Development at Existing Receptor Locations

Receptor	Scenario 1: 2017 Base Year (µg.m^{-3})			Scenario 2: 2023 Opening Year Without Development (µg.m^{-3})		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	16.7	15.0	9.8	12.2	14.5	9.4
R2	13.7	13.4	9.0	10.2	12.9	8.5
R3	13.7	13.4	9.1	10.4	13.0	8.6
R4	16.1	13.6	9.1	12.1	13.2	8.7
R5	14.1	13.5	9.1	10.7	13.1	8.7
R6	14.9	13.6	9.2	11.2	13.2	8.7
R7	14.7	13.9	9.2	10.9	13.4	8.8
R8	22.7	15.2	10.0	15.9	14.7	9.5

6.4 The baseline assessment for Scenario 1 and Scenario 2 indicates that predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ are below the respective annual mean air quality objectives at receptors considered.

6.5 With regard to short term air quality objectives for NO_2 and PM_{10}, the predicted annual mean NO_2 concentrations are less than 60µg.m-^{3} and therefore in accordance with Defra guidance[12] it may be assumed that exceedance of the 1-hour mean objective are unlikely. The calculation detailed in paragraph 3.11 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

Impact Assessment

6.6 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at identified existing receptor locations for Scenario 3: 2023 Opening Year with development, to consider the impact of development-generated vehicles on local air quality.

6.7 Predicted pollutant concentrations are detailed in **Tables 6.4**, **6.5** and **6.6** for NO_2, PM_{10} and $PM_{2.5}$ respectively together with Scenario 2: 2023 Opening Year without development concentrations for comparison purposes. The predicted change in pollutant concentrations resulting from development-generated traffic, and the associated impact are also provided.

Table 6.4: Predicted Annual Mean NO_2 Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted NO_2 Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2023 Without Development	Scenario 3: 2023 With Development	Change	
R1	12.2	12.4	+0.2	Negligible
R2	10.2	10.3	+0.1	Negligible
R3	10.4	10.5	+0.1	Negligible
R4	12.1	12.2	+0.1	Negligible
R5	10.7	10.8	+0.1	Negligible
R6	11.2	11.3	+0.1	Negligible
R7	10.9	11.0	+0.1	Negligible
R8	15.9	16.3	+0.4	Negligible

Table 6.5: Predicted Annual Mean PM_{10} Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted PM_{10} Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2023 Without Development	Scenario 3: 2023 With Development	Change	
R1	14.5	14.6	+0.1	Negligible
R2	12.9	13.0	0.0	Negligible
R3	13.0	13.0	0.0	Negligible
R4	13.2	13.2	0.0	Negligible
R5	13.1	13.1	0.0	Negligible
R6	13.2	13.2	0.0	Negligible
R7	13.4	13.5	0.0	Negligible
R8	14.7	14.9	+0.1	Negligible

Table 6.6: Predicted Annual Mean $PM_{2.5}$ Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted $PM_{2.5}$ Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2023 Without Development	Scenario 3: 2023 With Development	Change	
R1	9.4	9.4	0.0	Negligible
R2	8.5	8.5	0.0	Negligible
R3	8.6	8.6	0.0	Negligible
R4	8.7	8.7	0.0	Negligible
R5	8.7	8.7	0.0	Negligible
R6	8.7	8.7	0.0	Negligible
R7	8.8	8.8	0.0	Negligible
R8	9.5	9.6	+0.1	Negligible

6.8 The predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for Scenario 2: 2023 Opening Year without development and Scenario 3: 2023 Opening Year with development are below the relevant annual mean air quality objectives at all receptors.

6.9 The proposed development does not lead to any additional exceedances of the annual mean air quality objectives.

6.10 Predicted changes in NO_2, PM_{10} and $PM_{2.5}$ concentrations are less than 0.5% of the relevant annual mean air quality objectives at all receptors with the exception of R8 where the change in annual mean NO_2 concentration is 1% of the objective. The annual mean objective predicted at R8 in Scenario 3 was 16.3µg/m^3 which is equal to 41% of the annual mean objective and therefore, the predicted impact of the proposed development at R8 was negligible. The impact of the proposed development on annual mean pollutant concentrations at all receptors was considered to be negligible in accordance with IAQM and EPUK guidance[13].

6.11 With regard to short term air quality objectives for NO_2 and PM_{10}, the predicted annual mean NO_2 concentrations are less than 60µg.m-^{3} and therefore in accordance with Defra guidance[12] it may be assumed that exceedance of the 1-hour mean objective are unlikely.

6.12 With regard to short term air quality objectives for PM_{10} at the existing receptor locations, the calculation detailed in paragraph 3.11 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

Impact Significance Summary

6.13 Relevant guidance and legislation and professional judgement was utilised to determine the significance of the air quality assessment. The air quality assessment was supervised by a full member of the Institute of Air Quality Management. A summary of the impact significance and justification of this are provided below.

6.14 The impact of the proposed development on air quality is considered to be 'insignificant':

- Consideration was given to local planning policy[89] and the development proposals are considered to be in accordance with this policy with regard to air quality.
- Existing concentrations of NO_2, PM_{10} and $PM_{2.5}$ in the study area are predicted to be below the relevant air quality objectives.
- The air quality assessment undertaken utilised robust model inputs including slowing traffic sections at junctions, appropriate meteorological data and surface roughness and cumulative traffic flows.
- The impact of development-generated road traffic on local air quality is defined as negligible in accordance with IAQM and EPUK guidance[15].
- In addition, a sensitivity analysis was undertaken and provided in **Appendix F** considering the conservative scenario of NOx concentrations not decreasing from baseline levels in line with projected emission factors. The findings of this sensitivity analysis also predict the impact of development-generated road traffic on local air quality as negligible in accordance with IAQM and EPUK guidance[15].

7. MITIGATION

Construction Phase Assessment

Step 3: Site-specific Mitigation

7.1 The risk of dust impacts, defined in Step 2C of the assessment, are used to determine the mitigation measures required to minimise the emission of dust during construction phase activities. The IAQM guidance[13] provides details of highly recommended and desirable mitigation measures which are commensurate with the risk of dust impacts defined in Step 2C for construction, earthworks and track out activities. Where the mitigation measures are general in nature, the highest risk category was applied in accordance with the guidance[13]. The highest risk category identified was 'Low Risk' and the recommended mitigation taken from the IAQM guidance13 is detailed in **Table 7.1** and **Table 7.2**.

Table 7.1: Mitigation Measures for a Low Risk Site

Category	Mitigation Measures	
	Highly Recommended	**Desirable**
Communication	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site manager. Display the head or regional office contact information.	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site.
	Display the head or regional office contact information.	
Site Management	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner and record the measures taken.	None
	Make the complaints log available to the local authority when asked.	
	Record any exceptional incidents that cause and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.	
Monitoring	Carry out regular site inspections to monitor compliance with the DMP, record inspections results, and make an inspection log available to the local authority when asked.	Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of the site boundary, with
	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and	

	during prolonged dry or windy conditions.	cleaning to be provided as necessary.
Preparing and maintaining the site	Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extended period.
		Keep site fencing, barriers and scaffolding clean using wet methods.
	Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.	Remove materials that have a potential to produce dust from site as soon as possible. Unless being re-used on site. If they are being re-used on-site cover as described below.
	Avoid site runoff of water or mud.	Cover, seed or fence stockpiles to prevent wind whipping.
Operating vehicle / machinery and sustainable travel	Ensure all vehicles switch off engines when stationary – no idling vehicles.	Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas .
	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	Ensure equipment is readily available on site to clean and dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	None
	Ensure an adequate water supply on site for effective dust/particulate matter suppression/mitigation, using non-portable water where possible and appropriate.	
	Use enclose 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.	
Waste Management	Avoid bonfires and burning of waste materials.	None

Table 7.2: Mitigation Measures Specific to Construction and Trackout

Category	Mitigation Measures	
	Highly Recommended	Desirable
Construction (Low Risk Site)	None	Avoid scabbling (roughening of concrete surfaces) if possible.
		Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
Trackout (Low Risk Site)	None	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any materials tracked out of the site. This may require the sweeper being continuously in use.
		Avoid dry sweeping of large areas.
		Ensure vehicles entering and leaving the sites are covered to prevent escape of materials during transport.
		Record all inspections of haul routes and any subsequent action in a site log book.
		Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

Road Traffic Emissions

7.2 The development will result in minimal increases in pollutant concentrations and no new exceedances of the relevant air quality objectives are predicted. No mitigation measures are therefore required to minimise development-generated road traffic emissions.

8. CONCLUSIONS

8.1 An air quality impact assessment was undertaken for the proposed commercial development at V10 Brickhill Street in South Caldecotte.

8.2 A qualitative construction phase assessment was undertaken and measures were recommended for inclusion in a DMP to minimise emissions during construction activities. With the implementation of these mitigation measures the impact of construction phase dust emissions is considered to be 'not significant' in accordance with IAQM guidance[13].

8.3 A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified existing receptor locations. Road traffic emissions were modelled using the dispersion model ADMS-Roads and concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at identified sensitive receptor locations. The modelling assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance[14]. The development was not predicted to result in any new exceedances of the relevant air quality objectives and the impact of the development on local air quality was predicted to be 'negligible' in accordance with IAQM and EPUK guidance[15].

APPENDICES

APPENDIX A: GLOSSARY OF TERMS

Term	Definition
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances 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).
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 two years, which is useful for pollutants that have higher concentrations during the winter months.
AQAP	Air Quality Action Plan.
AQMA	Air Quality Management Area.
AQS	Air Quality Strategy.
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.
HDV	Heavy Duty Vehicles, (HGVs + buses)
HGV	Heavy Goods Vehicles.
IAQM	Institute of Air Quality Management.
LAQM	Local Air Quality Management.
LDV	Light Duty Vehicles (motorbikes, cars, vans and small trucks)
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.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
micrograms per cubic metre ($\mu g.m^{-3}$)	A measure of concentration in terms of mass per unit volume. A concentration of $1\mu g.m^{-3}$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UK-AIR	UK Air Information Resource – A source of air quality information provided by Defra.
UKAQS	United Kingdom Air Quality Strategy.

APPENDIX B: PROPOSED DEVELOPMENT MASTERPLAN

Ref:

Site	GIA (ft²)	NDA (ac)	Plot Density (%)
Unit 1	473,200	27.13	51.2
Unit 2	615,400	21.2	52.1
Unit 3	369,708	15.87	53.5
Unit 4	254,200	10.68	54.7
Unit 5	61,400	3.47	40.7
Unit 6 (office)	10,400	1.22	19.7
Unit 7	53,700	4.33	28.5
Unit 8	49,800	2.87	39.9
Unit 9	164,800	8.39	45.2
Unit 10	278,500	12.24	52.3
Total	**2,331,108**	**107.40**	49.9
	Total	**139.9**	

Revisions:

P1: 07/06/19 kbl Masterplan updated, drawing number P005 updated to PAS 1192 standard.
P2: 24/06/19 kbl Client / team comments.
P3: 27/06/19 kbl Client comments.
P4: 02/07/19 kbl Redline updated.
P5: 04/07/19 kbl Redline updated.

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South Caldecotte

Drawing Name:
Indicative Masterplan 23

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APPENDIX C: TRAFFIC DATA UTILISED IN THE AIR QUALITY ASSESSMENT

Traffic Data Utilised in the Air Dispersion Modelling Assessment

Road Link	Speed	Scenario 1: 2017 Base/Verification Year		Scenario 2: 2023 Opening Year without development		Scenario 3: 2023 Opening Year without development	
	kph	24 hour AADT Total Flow	HDV Flow	24 hour AADT Total Flow	HDV Flow	24 hour AADT Total Flow	HDV Flow
1 – V10 Brickhill South of Site	97	13644	650	14885	709	21323	2298
1 queue – V10 Brickhill South of Site junction with Kelly's Corner roundabout	97	13644	650	14885	709	21323	2298
2 – A5 South of Kelly's Corner roundabout	97	23557	1159	25701	1265	26910	1456
2 queue – A5 South of Kelly's Corner roundabout junction with roundabout	87	23557	1159	25701	1265	26910	1456
3 – A4146	97	25537	1402	27861	1530	28503	1784
3 queue – A4146 junction with Kelly's Corner roundabout	77	25537	1402	27861	1530	28503	1784
4 – Watling Street	48	403	13	439	14	617	46
4 queue – Watling Street junction with Kelly's Corner roundabout	38	403	13	439	14	617	46
7 – A5 North of Kelly's Kitchen roundabout	97	41961	1401	45780	1529	47804	2040

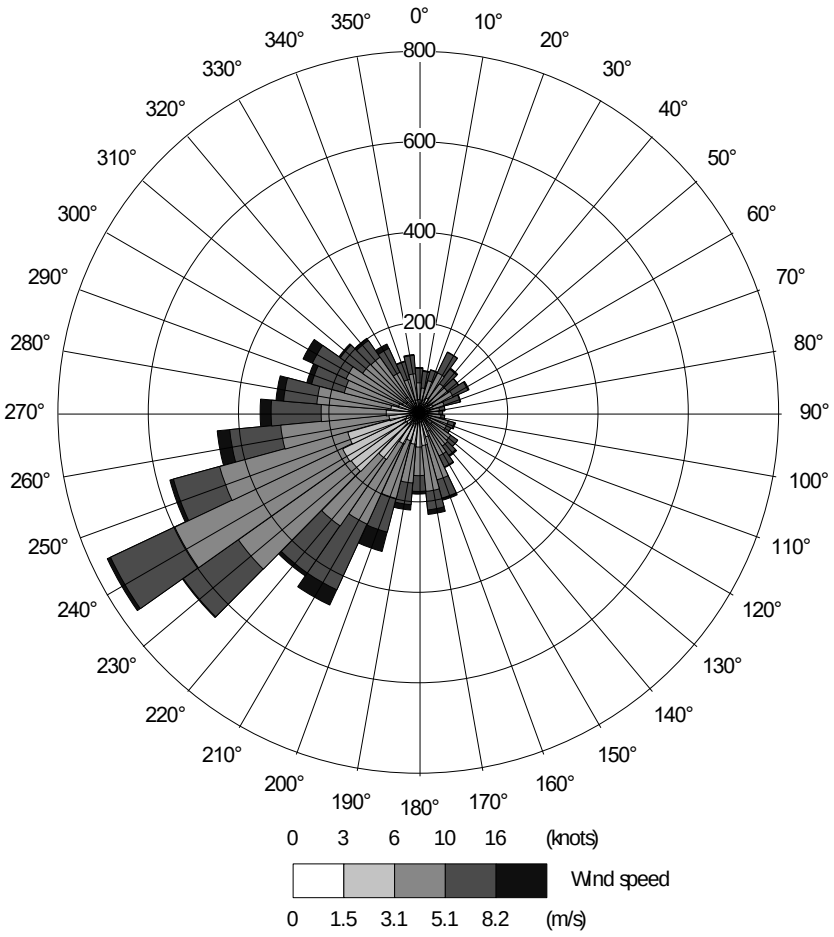
7 queue – A5 North of Kelly's Kitchen roundabout junction with roundabout	87	41961	1401	45780	1529	47804	2040
5WIDE – A5 North of Caldecotte roundabout (wide section)	97	40310	1310	43978	1429	45910	1906
5 – A5 North of Caldecotte roundabout	97	40310	1310	43978	1429	45910	1906
8 – Bletcham Way West of Walton Park roundabout	97	417	210	455	229	497	264
8 queue – Bletcham Way West of Walton Park roundabout junction with roundabout	87	417	210	455	229	497	264
9 – V10 Brickhill Street North of Walton Park roundabout	64	2334	59	2546	64	2635	73
9queue – V10 Brickhill Street North of Walton Park roundabout junction with roundabout	54	2334	59	2546	64	2635	73
10 -Bletcham Way East of Walton Park roundabout	97	21847	1168	23835	1274	24754	1465
10 queue – Bletcham Way East of Walton Park roundabout junction with roundabout	87	21847	1168	23835	1274	24754	1465
11 – V10 Brickhill Street North of Tilbrook roundabout (northern section)	97	24598	1436	26836	1567	27885	1802
11queue – V10 Brickhill North of Tilbrook roundabout junction with Walton Park roundabout	87	24598	1436	26836	1567	27885	1802
11south – V10 Brickhill North of Tilbrook roundabout (southern section)	97	24598	1436	26836	1567	27885	1802

11south queue – V10 Brickhill Street North of Tilbrook roundabout junction roundabout	87	24598	1436	26836	1567	27885	1802
12 – Caldecotte Lake Drive	48	232	0	253	0	261	0
12 queue – Caldecotte Lake Drive junction with Tilbrook roundabout	38	232	0	253	0	261	0
11EXTRA – V10 Brickhill Street South of Tilbrook roundabout	64	24598	1436	26836	1567	27885	1802
11EXTRAtop queue – V10 Brickhill Street South of Tilbrook roundabout junction with Tilbrook roundabout	54	24598	1436	26836	1567	27885	1802
11EXTRAbottom queue – V10 Brickhill Street South of Tilbrook roundabout junction with Station Road	54	24598	1436	26836	1567	27885	1802
13 – Station Road	64	1692	71	1847	78	1916	90
13 queue – Station Road junction with V10 Brickhill Street	54	1692	71	1847	78	1916	90
1top – V10 Brickhill Street North of Site	97	13644	650	14885	709	16011	956
1top queue – V10 Brickhill Street North of Site junction with Station Road	77	13644	650	14885	709	16011	956
Walton Park Roundabout	64	12299	718	13418	784	13943	901
Tilbrook Roundabout	48	16476	957	17975	1045	18677	1201

Station Road roundabout	40	13311	719	14523	785	15271	949
Kelly's Kitchen roundabout	80	21020	925	22933	1009	25031	1525
A1 – Sandy (verification only)	80	35984	3119	-	-	-	-
A1 – Sandy junction with Carter Road (verification only)	70	35984	3119	-	-	-	-
A1 – Sandy North of junction with Carter Road (verification only)	80	35984	3119	-	-	-	-
A1 – Sandy South (verification only)	70	35984	3119	-	-	-	-

APPENDIX D: WIND ROSE FOR 2017 FOR BEDFORD METEOROLOGICAL RECORDING STATION

Meteorological data for 2017 Base Year scenario for the Bedford recording station was obtained for use in the air dispersion modelling assessment. The wind rose for 2017 is detailed below and illustrates a predominant wind direction from the southwest.



APPENDIX E: MODEL VERIFICATION

Whilst ADMS-Roads is widely validated for use in this type of assessment, model verification for the area around the Site will not have been included. To determine model performance at a local level, a comparison of modelled results with monitored results in the study area was done in accordance with the methodology provided by Defra[14]. This process of verification aims to minimise modelling uncertainty by correcting modelled results by an adjustment factor to give greater confidence to the results.

Due to a lack of monitoring locations in the MKC administrative area, model verification was undertaken using monitoring locations from the neighbouring Central Bedfordshire Council. This approach was agreed with the EHO at MKC. The model was run for Scenario 1: 2017 Verification Year to predict the 2017 annual mean road contributions of NOx at a number of monitoring locations in the town of Sandy, Central Bedfordshire, which was considered to be the most representative of conditions in the study area. The model NOx outputs at these locations were compared to the 2017 monitored concentrations to provide adjustment factors. **Table E1** presents the verification process for NOx.

PM_{10} and $PM_{2.5}$ monitoring is undertaken at the MD3 automatic analyser which was used in verification however the data capture for these pollutants was less than 75% and therefore, unsuitable for use, in accordance with Defra guidance[12]. The NOx verification factor was therefore used to verify modelled PM_{10} and $PM_{2.5}$ concentrations.

Table E1: NOx Verification Process

Model Verification Steps	MD3 (Auto)	N25
2017 monitored total NO_2 ($\mu g.m^{-3}$)	34.0	36.8
2017 background NO_2 concentration ($\mu g.m^{-3}$)	11.1	10.8
Monitored road contribution NOx ($\mu g.m^{-3}$)	46.3	53.1
Modelled road contribution NOx ($\mu g.m^{-3}$)	28.9	28.6
Ratio of monitored road NOx to modelled road NOx	1.6	1.9
Adjustment factor for modelled road contribution NOx	**1.7298**	
Adjusted modelled road contribution NOx ($\mu g.m^{-3}$)	50.0	49.4
Modelled total NO_2 concentration ($\mu g.m^{-3}$)	35.6	35.1
Monitored total NO_2 concentration ($\mu g.m^{-3}$)	34.0	36.8
% difference between modelled and monitored total NO_2	+4.6	-4.7

** Road-NOx component, determined from NOx to NO_2 calculator*

A road-NOx factor of **1.7298** was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero. This factor was then applied to the modelled road-NOx concentration at each receptor,

before conversion to NO_2 concentrations using the NO_x to NO_2 calculator[17] provided by Defra and the adjusted NO_2 background concentration.

APPENDIX F: SENSITIVITY ANALYSIS

SENSITIVITY ANALYSIS

A sensitivity analysis was undertaken to consider a scenario where pollutant background concentrations do not decrease with future years. Therefore base year (2017) background concentrations, NOx to NO_2 calculator inputs and emission factors were utilised for the 2023 Opening Year without and with development scenarios. The results of the assessment for the existing receptor locations identified are provided in **Table F1**, **F2** and **F3**.

Table F1: Predicted Annual Mean NO_2 Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted NO_2 Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 4: 2023 Without Development	Scenario 4: 2023 With Development	Change	
R1	17.1	17.6	+0.4	Negligible
R2	14.1	14.3	+0.2	Negligible
R3	13.9	14.0	+0.1	Negligible
R4	16.4	16.6	+0.2	Negligible
R5	14.3	14.4	+0.1	Negligible
R6	15.1	15.3	+0.2	Negligible
R7	15.1	15.4	+0.3	Negligible
R8	23.7	24.7	+1.0	Negligible

Table F2: Predicted Annual Mean PM_{10} Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted PM_{10} Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 4: 2023 Without Development	Scenario 5: 2023 With Development	Change	
R1	15.1	15.1	+0.1	Negligible
R2	13.4	13.5	0.0	Negligible
R3	13.5	13.5	0.0	Negligible
R4	13.7	13.7	0.0	Negligible
R5	13.5	13.5	0.0	Negligible
R6	13.7	13.7	0.0	Negligible
R7	13.9	14.0	0.0	Negligible
R8	15.4	15.5	+0.2	Negligible

Table F3: Predicted Annual Mean $PM_{2.5}$ Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted $PM_{2.5}$ Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 4: 2023 Without Development	Scenario 5: 2023 With Development	Change	
R1	9.9	9.9	0.0	Negligible
R2	9.0	9.0	0.0	Negligible
R3	9.1	9.1	0.0	Negligible
R4	9.2	9.2	0.0	Negligible
R5	9.1	9.1	0.0	Negligible
R6	9.2	9.2	0.0	Negligible
R7	9.3	9.3	0.0	Negligible
R8	10.1	10.2	+0.1	Negligible

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