BRUNSWICK RIVERSIDE
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CAMBRIDGE

AIR QUALITY ASSESSMENT REPORT

SPRING 2009

Berkeley HOMES

Brunswick Site, Cambridge
Air Quality Assessment

Berkeley Homes

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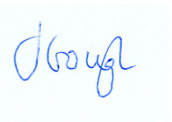
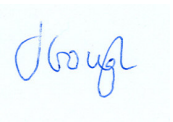
Signature				
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Preface

This report prepared by WSP Environmental on behalf of Berkeley Homes has been compiled in support of contemporaneous planning applications for the comprehensive redevelopment of the former Cambridge Regional College City Centre Campus – "The Brunswick Site", together with land to the south west currently known as Brunswick House, 61 - 69 Newmarket Road, Cambridge (known as the Rear and Front Sites respectively).

The information contained within this report relates to the redevelopment of the combined sites to provide 205 Residential Units, up to 256 Student Rooms (in lieu of Affordable Housing), Café, Public Open Spaces (including a new public thoroughfare through the site) and associated works. This document should be read in conjunction with both the Detailed Planning Applications and Conservation Area Consents for the Rear & Front Sites respectively. These applications have, in agreement with officers from Cambridge City Council's Planning Department, been submitted contemporaneously and will be considered jointly by the Council in due course.

Where necessary, specific reference has been made within this report to matters which relate solely to either of the applications for the purpose of ensuring that each application may be considered independently should the need arise.

It remains the applicant's firm intention that both the Rear & Front Sites are redeveloped comprehensively in the event that the respective applications are approved simultaneously.

Contents

1 Introduction

1.1 LOCAL AIR QUALITY ASSESSMENT

1.1.1 WSP Environmental Ltd (WSPE) has been commissioned to carry out an assessment of the potential air quality impacts arising from the proposed residential led mixed-use development of the Brunswick Site, Cambridge to include 205 residential units, up to 256 student rooms (in lieu of affordable housing), Café, public open spaces (including a new public thoroughfare through the site) and associated works.

1.1.2 This report presents the findings of an assessment of the potential air quality impacts of the proposed development during both the construction and operational phases. For both phases the type, source and significance of potential impacts are identified, and the measures that should be employed to suitably minimise these impacts are described.

1.1.3 This report has assessed the impact of the combined development (both the rear and front sites) simultaneously. The results presented and the conclusions drawn within this report are considered as worst case should the two applications be considered separately.

1.1.4 Section 5 of this report contains details of comments made by Daniel Bayles (Environmental Health Officer at Cambridge City Council) regarding the air quality assessment undertaken for the previous application for the development of the site. WSPE's response to these comments is also provided.

2 Relevant legislation and guidance

2.1 THE EUROPEAN AIR QUALITY FRAMEWORK DIRECTIVE AND DAUGHTER DIRECTIVES

2.1.1 The European Air Quality Framework Directive (Directive 96/62/EC) establishes a strategic framework for setting Europe-wide limit values for twelve pollutants. The pollutants are sulphur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter smaller than 10 micrometres (µm) in aerodynamic diameter (PM_{10}), lead (Pb), carbon monoxide (CO), benzene (C_6H_6), ozone (O_3), polycyclic aromatic hydrocarbons (PAHs), cadmium (Cd), arsenic (As), nickel (Ni) and mercury (Hg).

2.1.2 Limit values for each pollutant are established by a series of Daughter Directives and based on recommendations made by the World Health Organisation (WHO). Legally binding limit values for Member States to achieve have already been set for SO_2, NO_2, nitrogen oxides (NO_x), PM_{10}, Pb, CO and C_6H_6. The European Commission is currently working on proposals for the remaining pollutants identified in the Air Quality Framework Directive.

2.1.3 The new Air Quality Directive 2008/50/EC came into force on the 11th June 2008. This new directive merged four existing Directives and one Council Decision into a single Directive on air quality. It also sets new standards and target dates for reducing concentrations of fine particles. Under the new Directive Member States are required to reduce exposure to $PM_{2.5}$ in urban areas by an average of 20% by 2020 based on 2010 levels, and obliges them to reduce exposure levels below 20ug/m^3 by 2015 in these areas.

2.2 AIR QUALITY STRATEGY FOR ENGLAND, SCOTLAND, WALES & NORTHERN IRELAND

2.2.1 The Government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007[1]. 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.

2.2.2 The AQS sets standards and objectives for nine main air pollutants to protect health, vegetation and ecosystems. These are C_6H_6, 1,3-butadiene (C_4H_6), CO, Pb, NO_2, PM_{10}, SO_2, O_3, and PAHs.

2.2.3 The air quality standards are concentration limits 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 Organization (WHO). Above these limits sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

2.2.4 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.

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2) – July 2007.

2.2.5 For some pollutants, (e.g. NO_2), 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, for example temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road.

2.2.6 The AQS published in 2007 replaces the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (January 2000) and Addendum (February 2003). The majority of objectives set out in the previous version of the AQS have been retained; however, the provisional objectives previously proposed for PM_{10} have been replaced in England, Wales and Northern Ireland with a new framework for considering the effects of a finer group of particles known as '$PM_{2.5}$'. The introduction of this framework is based on increasing evidence that this size of particles can be more closely associated with observed adverse health affects than PM_{10}. For $PM_{2.5}$ the objectives will take the form of a limit value ('backstop objective') and an 'exposure reduction' target. Although a target for $PM_{2.5}$ is included in the AQS, there is currently no requirement for local authorities to assess this pollutant as part of their statutory obligations, and there is insufficient information available regarding local background levels to enable accurate assessment at this time.

2.2.7 Of the pollutants included in the AQS, NO_2 and PM_{10} will be particularly relevant to this assessment as road traffic is a major source and concentrations of these pollutants tend to be close to air quality objectives in urban locations such as the proposed development site. Local authorities undertaking review and assessments of air quality are finding that, where road traffic is the dominant source of air pollution, the objectives for these pollutants are likely to be the most difficult to achieve. It is also generally considered that, where concentrations of NO_2 and PM_{10} meet their respective objectives, and there are no other local sources of air pollution, such as from industrial processes, objectives for the other pollutants included the regulations will also be achieved.

2.3 AIR QUALITY (ENGLAND) REGULATIONS

2.3.1 Many of the objectives in the AQS have been made statutory in England with the *Air Quality (England) Regulations 2000*[2] and the *Air Quality (England) (Amendment) Regulations 2002*[3] for the purpose of Local Air Quality Management (LAQM). The standards and objectives for each pollutant in the AQS and the Regulations are given in **Appendix A**.

2.4 THE ENVIRONMENTAL PROTECTION ACT 1990 - CONTROL OF DUST AND PARTICULATES ASSOCIATED WITH CONSTRUCTION

2.4.1 Section 79 of the *Environmental Protection Act 1990* states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Definitions of statutory nuisance relevant to dust and particles are:

- 'Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance', and
- 'any accumulation or deposit which is prejudicial to health or a nuisance'.

[2] The Air Quality (England) Regulations 2000 - Statutory Instrument 2000 No.928

[3] The Air Quality (England) (Amendment) Regulations 2002 - Statutory Instrument 2002 No.3043

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

2.4.3 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.

Best Practice Guidance for Control of Dust and Emissions from Construction Sites

2.4.4 The Greater London Authority and London Councils have produced guidance on the control of dust and emissions from demolition and construction[4], which sets out the approach to minimising the impact of demolition and construction works in London based on prevention, suppression and containment. Although the document has been produced for application in London, Cambridge City Council has advised that it considers the approach set out in the guidance document to dust issues to be best practice and recommends that developers refer to it when considering preventing and minimising the impacts of the construction phase of a development on local air quality.

2.5 LOCAL AIR QUALITY MANAGEMENT (LAQM)

2.5.1 Under Part IV of the *Environment Act 1995*, local authorities must review and document local air quality within their area by way of staged appraisals and respond accordingly, with the aim of meeting the air quality objectives by the years defined in the Regulations. Where the objectives of the Air Quality Regulations are not likely to be achieved by the objective year, an authority is required to designate an Air Quality Management Area (AQMA). For each AQMA the local authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

2.5.2 An overview of the Review and Assessment process, explaining the terminology used (e.g. Stage and Round) in the context of LAQM is provided in **Appendix B**.

2.5.3 The Department for Environment, Food and Rural Affairs (DEFRA) has published technical guidance for use by local authorities in their review and assessment work[5]. This guidance, referred to in this report as LAQM.TG(03), has been used where appropriate in the assessment presented herein.

Cambridge City Council's review and assessment of air quality

2.5.4 Cambridge City Council (CCC) has completed the first, second and third rounds of the review and assessment process. As a result of the work undertaken during the first round, the area of land within the inner ring road of the City was declared as an Air Quality Management Area (AQMA) due to current and predicted exceedences of the AQS objectives for annual average NO_2 concentrations. The measured and predicted exceedences of the air quality standard mainly related to areas close to roads (traffic emissions). The third round of review and assessment reports that the AQMA should be kept in place as exceedences were still being predicted at 14 sites within the AQMA. The proposed development site is located within the AQMA, albeit in an area with low potential to exceed the air quality objectives.

[4] Greater London Authority and London Councils The control of dust and emissions from construction and demolition Best Practice Guidance (November 2006)

[5] Department for Environment, Food and Rural Affairs (DEFRA): *Part IV The Environment Act 1995 Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(03)* (Feb 2003).

2.6 NATIONAL PLANNING POLICY

Planning Policy Statement 1 (PPS1): Delivering Sustainable Development

2.6.1 This policy guidance sets out objectives for the planning system regarding air quality. In particular it states that policies 'should take account of environmental issues such as air quality and pollution'. PPS1 also contains guidance on general principles for pollution issues; which include:

- Significant adverse impacts on the environment should be avoided and alternative options should be pursued. Mitigatory measures can be used;
- The polluter pays principle should be employed; and
- The causes and impacts of pollution should both be addressed.

Planning Policy Statement 23 (PPS23): Planning and Pollution Control

2.6.2 Policy guidance for local planning authorities (in England only) regarding local air quality and new development is provided in PPS23[6]. PPS23 advises on the policies and practices that should be taken into account by those involved in the planning of any development that has the potential to cause pollution.

2.6.3 With regard to emissions to air, and specifically local air quality management, Appendix 1G of Annex 1 in PPS23 states that *'any air quality consideration that relates to land use and its development is capable of being a material planning consideration'.* This is most likely to be the case in situations where the proposed development could produce an exceedence of the AQS objectives and result in an AQMA designation, or where development is proposed in an AQMA, or where a proposed development renders a Local Authority's AQAP unworkable. PPS23 also re-iterates that the presence of an AQMA should not result in the sterilisation of a site from development.

2.7 LOCAL PLANNING POLICY

Cambridge City Council Local Plan (adopted July 2006)

2.7.1 The CCC Local Plan sets out policies and proposals for the future development and land use for Cambridge until 2016. Policy 4/14 Air Quality Management Areas states:

> *'Development within or adjacent to an AQMA will only be permitted if:*
> *a) it would have no adverse effect upon air quality within the AQMA, or*
> *b) air quality levels within the AQMA would not have a significant adverse effect on the proposed use/users.'*

Cambridge and Peterborough Structure Plan (adopted October 2003)

2.7.2 The Cambridge and Peterborough Structure Plan sets the strategic framework for land use planning in Cambridgeshire and Peterborough up to 2016. While now expired, Policy P7/8 – Safe and Healthy Air, Land and Water stated:

> *'New development will be located and designed to minimise and where possible avoid air, land, and water pollution. Individual and cumulative impacts of development will be taken into account in the consideration of proposals and developers will be expected to take appropriate avoidance and mitigation measures.*

[6] Communities and Local Government: *Planning Policy Statement 23: Planning and Pollution Control* (Oct 2004).

Local Planning Authorities should resist proposals that will adversely affect air quality in Air Quality Management Areas'

3 Scope and methodology

3.1 SCOPE

3.1.1 The scope of the assessment has been determined in the following way:

- consultation with the Environmental Health Department of CCC to discuss the availability of monitoring data, the assessment methodology to be applied and obtain a copy of their latest review and assessment report;
- review of air quality data for the area surrounding the site, including data from the UK Air Quality Archive (UKAQA)[7] and the Environment Agency[8];
- desk study to confirm the location of nearby areas that may be sensitive to changes in local air quality; and
- review of the traffic flow data provided by WSP Development and Transportation (WSP D&T), which has been used as an input to the air quality assessment.

3.2 METHODOLOGY

Construction phase

3.2.1 During the construction phase, activities undertaken on the application site may cause dust and particulate matter to be emitted to the atmosphere.

3.2.2 Dust comprises particles typically in the size range 1-75 micrometres (µm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials. The larger dust particles fall out of the atmosphere quickly after initial release and therefore tend to be deposited in close proximity (10 to 20 metres) to the source of emission. Dust therefore, is unlikely to cause long-term or widespread changes to local air quality; however, its deposition on property and cars can cause 'soiling' and discolouration. This may result in complaints of nuisance through amenity loss or perceived damage caused, which is usually temporary.

3.2.3 The smaller particles of dust (typically less than 10µm in aerodynamic diameter) are known as particulate matter (PM_{10}) and represent only a small proportion of total dust released. As these particles are at the smaller end of the size range of dust particles they remain suspended in the atmosphere for a longer period of time than the larger dust particles, and can therefore be transported by wind over a wider area (up to around 200m away from the source). PM_{10} is small enough to be drawn into the lungs during breathing, which in sensitive members of the public could cause an adverse reaction. As a result of this potential impact on health, standards and objectives for PM_{10} are defined in the AQS and Regulations.

3.2.4 A qualitative assessment of the potential impacts due to the generation and dispersion of dust and PM_{10} during the construction phase has been undertaken using information in guidance documents produced by the following organisations:

- Building Research Establishment (BRE)[9];
- Quality of Urban Air Review Group (QUARG)[10]; and

[7] http://www.airquality.co.uk

[8] http://www.environment-agency.gov.uk

[9] Kukadia, V., Upton, S. L. and Hall, D. J.; *Control of dust from Construction and Demolition Activities.* BRE (Feb 2003).

3.2.5 As there are no formal assessment criteria for dust and PM_{10} generation and dispersion during construction, the significance of impacts associated with this phase of the proposed development has been determined qualitatively by:

- identifying the construction activities associated with the proposed development which could generate dust and PM_{10} and their likely duration;
- identifying sensitive receptors (e.g. schools, residential properties) within 100m of the construction site boundary; and
- the prevailing wind direction.

3.2.6 Exhaust emissions from construction vehicles will have an impact on local air quality both on site and adjacent to the routes used by these vehicles to access the site. As information on the number of vehicles associated with construction phase is not available, a qualitative assessment of their impact on local air quality has been undertaken by considering:

- the level of construction traffic likely to be generated by this phase of the development;
- the number and distance of sensitive receptors in the vicinity of the site and along the likely routes to be used by construction vehicles; and
- the likely duration of the construction phase and the nature of the construction activities undertaken.

Operational phase

Road Traffic Emissions

3.2.7 Once construction has been completed the traffic generated by the development will have an effect on local pollution concentrations, both on and around the proposed development site. The main pollutants of concern for road traffic are generally considered to be NO_2, PM_{10}, CO and C_6H_6. Of these pollutants, emissions of NO_2 and PM_{10} are most likely to result in exceedences of the relevant air quality standards or objectives in urban areas. Indeed, CCC has declared the area within the inner ring road as an AQMA due to predicted exceedences of the objective for NO_2. This air quality assessment will therefore only consider concentrations of NO_2 and PM_{10}.

3.2.8 For the prediction of impacts due to emissions arising from road traffic during operation, the air pollutant dispersion model Breeze Roads has been used. This 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. More details on Breeze Roads can be found in **Appendix C**.

3.2.9 Meteorological data, such as wind speed and direction, is used by the model to determine pollutant transportation and levels of dilution by the wind. Meteorological data used in the model was obtained from the Met Office observing station at Cambridge. This station is considered to provide data representative of the conditions at the proposed development site. The meteorological data used for this assessment was from 2006, a windrose is provided in **Appendix D**.

3.2.10 For the assessment, seven scenarios were modelled. These scenarios are as follows:

[10] Quality of Urban Air Review Group: *Airborne Particulate Matter in the United Kingdom – Third Report of the Quality of Urban Air Review Group.* Prepared for the Department of the Environment (May 1996).

- 2006 “model verification”;
- 2008 “baseline”;
- 2010 “future baseline”;
- 2011 “without development”;
- 2011 “with development”;
- 2013 “without development”; and
- 2013 “with development”.

3.2.11 2013 is the year in which the development is anticipated to be completed and fully occupied. 2011 is the year where the development will be partially complete and occupied. 2010, is the year in which the EU objectives for NO_2 should be achieved.

3.2.12 A summary of the traffic data and pollutant emission factors used in the assessment can be found in **Appendix E**. It includes details of Annual Average Hourly Traffic flows (AAHT), average vehicle speeds and the percentage of Heavy Goods Vehicles (HGVs) for the local road network in all assessment years considered. The traffic data presented for the 2008 baseline flows is based on 2008 survey data and therefore includes traffic associated with the current use of the site. The 2010 future baseline flows exclude the flows from the existing college use (ceasing in 2009), but includes for growth of traffic flows due to development schemes in the wider area impacting roads in the vicinity of the development site.

3.2.13 The “without development” traffic data for 2011, which is included to provide an indication of the impact of the development at a stage of partial completion, utilises the 2010 baseline flow data (2011 emission factors and background concentrations used to develop the model input). For the “with development” scenario, the traffic generated by the fully completed and occupied development has been used to provide a conservative approach.

3.2.14 The 2013 “without development” traffic data includes growth for the development in the wider areas and committed developments (agreed with CCC) in the immediate area but does not include traffic generated by the proposed development. For the “with development” scenario, the traffic data also includes the traffic generated by the proposed development when fully complete and operational.

3.2.15 Modelled annual mean NO_x and PM_{10} concentrations were converted to annual mean NO_2 concentrations and the number of 24-hour mean PM_{10} exceedences per year were determined for direct comparison with the AQS objectives using the methods given in LAQM.TG(03) and the updated NO_x to NO_2 equation for locations outside Greater London published by Air Quality Consultants[11].

3.2.16 LAQM.TG(03) does not provide a method for the conversion of annual mean NO_2 concentrations to 1-hour mean NO_2 concentrations. However, research[12] has concluded that exceedences of the 1-hour mean objective are unlikely to occur where annual mean concentrations do not exceed 60µg/m^3.

3.2.17 To complete the assessment a number of ‘receptors’ were identified at which pollution concentrations were predicted. The locations of the assessment receptors are shown on **Figure 1**.

[11] Air Quality Consultants (AQC): *Deriving NO2 from NOx for Air Quality Assessments of Roads - Updated to 2006.* (March 2007).

[12] 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).

3.2.18 Quantitative assessments of the impacts on local air quality from road traffic emissions associated with the operation of the development have been completed against the current statutory standards and objectives for NO_2 and PM_{10} set out in **Appendix A**.

Model validation and verification

3.2.19 The Breeze Roads dispersion model has been widely validated for this type of assessment and is considered to be fit for purpose. The model is also listed in Government guidance document LAQM.TG3(00) – Review and Assessment: Selection and Use of Dispersion Models[13].

3.2.20 Model validation undertaken by the software developer will not have included validation in the vicinity of the development considered in this assessment. It is therefore necessary to perform a comparison of modelled results with local monitoring data at relevant locations. This process of verification attempts to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

3.2.21 Suitable local monitoring data for the purpose of verification is available for concentrations of NO_2 and PM_{10} at the locations shown in **Table 1** below.

TABLE 1 Local monitoring data sources suitable for model verification

Location	Distance from the proposed development	2006 measured concentrations		OS grid reference
		NO_2	PM_{10}	
Newmarket Road (continuous monitor)	200m	31µg/m^3	22µg/m^3	546317, 258900
Newmarket Road (diffusion tube)	100m	43µg/m^3	N/A	546195, 258867
East Road (diffusion tube)	460m	34µg/m^3	N/A	545908, 258439

3.2.22 Model verification for the continuous monitor has been undertaken following the methodology specified in LAQM.TG(03), using the monitoring data shown in the table above and traffic flow information for the main roads adjacent to these sites.

3.2.23 The average verification factor for NO_2 of 6.32 obtained during this process for the three locations has been applied to the modelling results given in **Appendix F** and the details of the verification calculations are shown in **Appendix G**. It was not possible to use the PM_{10} monitoring data from the Newmarket Road site due to the monitored concentration being lower than the estimated background concentration (from the UKAQA). This would have resulted in a negative verification factor. Therefore, the modelling results for PM_{10} have been adjusted using the NO_2 verification factor to provide a more robust approach.

Emissions from Energy Production

3.2.24 One of the options to reduce CO_2 emissions associated with the proposed development, is to install a total of 453m^2 solar hot water panels in combination with a 6kWe/17kWth Gas Combined Heat and Power (CHP) Plant. The use of the CHP Plant, in combination with other energy generation options will reduce carbon emissions from the proposed development by up to as much as 26.6% over a building with compliant

[13] Review and Assessment: Selection and Use of Dispersion Models; Part IV The Environment Act 1995 Local Air Quality Management LAQM.TG(00) May 2000.

building regulations. The gas-fired unit will incorporate technology to reduce NO_x emissions (low-NO_x burners) and have very low particle emissions. These units are therefore considered appropriate for use in the AQMA.

3.2.25 The other two energy options proposed include solar hot water panels, together with the remaining space heating and hot water demands being met be mains electricity (student accommodation) and/or mains gas (private dwellings).

Significance criteria

3.2.26 The impacts of the development proposals on local air quality have been evaluated against the significance criteria provided in **Appendix H.** These criteria have been developed by WSP Environmental Ltd as there is no quantitative guidance available that is deemed suitable for use in this assessment. CCC does not have any significance criteria that can be used for air quality assessments.

3.2.27 In addition to the quantitative criteria above, guidance published by Environmental Protection UK (EPUK, formerly the National Society for Clean Air (NSCA))[14] outlines a method for assessing the significance of a proposal. The method uses textual descriptors to identify the differing levels of relative priority which should be afforded to the air quality considerations of a development proposal in the planning process. A summary of the assessment method is given in **Table 2** below..

TABLE 2 Summary of method for assessing the significance of air quality impacts

Effect of Development	**Outcome**
Development would lead to a breach or significant(1) worsening of a breach of an EU limit value (this could include introduction of new exposure to cause a breach).	Air Quality an overriding consideration.
Lead to a breach or significant(1) worsening of a breach of an AQ Objective, or cause a new AQMA to be declared(2).	Air Quality a high priority consideration.
Development would interfere significantly with or prevent the implementation of actions within an AQ action plan	Air Quality a high priority consideration.
Development would interfere significantly with the implementation of a local AQ strategy.	Air Quality a medium priority consideration.
Development would lead to a significant increase in emissions, degradation in air quality or increase in exposure, below the level of a breach of an objective.	Air Quality a medium priority consideration.
None of the above.	Air Quality a low priority consideration.
(1) Where the term significant is used, it will be based on the professional judgement of the Local Authority officer.	
(2) This could include the expansion of an existing AQMA or introduction of new exposure to cause a new AQMA to be declared.	

[14] NSCA, September 2006. Development Control: Planning for Air Quality, Updated guidance from NSCA on dealing with air quality concerns within the development control process.

4 Existing conditions

4.1 LOCAL EMISSION SOURCES

4.1.1 The proposed development site is located in an area where air quality is mainly influenced by emissions from road transport. A number of heavily trafficked roads (such as Elizabeth Way and Newmarket Road) pass close to the Site and these roads will influence the air quality in the vicinity of the proposed development.

4.1.2 Review of CCC's Updating and Screening Assessment of Air Quality 2006 shows that there is one Part A2/B[15] industrial pollution source approximately 900m east of the site which is a waste oil burner operated by Wellington Garage, however due to its distance from the proposed development it is unlikely to affect on site pollutant concentrations.

4.1.3 There are a number Part A[16] authorised processes in the vicinity of the proposed development[17]. The Environment Agency's website http://www.environment-agency.gov.uk indicates the nearest Part A1 processes to be approximately 400m southwest and 780m southwest of the proposed development. These are two radioactive processes, operated by Anglia Polytechnic University and University of Cambridge respectively. During 2001 to 2004 neither of these processes made any notifiable releases to air, i.e. above limits prescribed in their authorisation. They are therefore unlikely to have any significant influence on air quality in the vicinity of the proposed development. Cambridge City Airport is approximately 2.4km east of the Site and is therefore unlikely to significantly impact air quality at the Site.

4.2 BACKGROUND AIR QUALITY DATA

4.2.1 CCC does not operate any automatic air quality monitors in locations classified as background within its administrative boundary from which background concentrations can be obtained; therefore suitable background concentration estimates from the UKAQA were obtained.

4.2.2 **Table 3** shows the estimated background concentrations of NO_x, NO_2, and PM_{10} that were used in the assessment. Background values for NO_x are presented, as they are required in the conversion of modelled NO_x concentrations to total NO_2. Concentrations have been factored forward to those years considered in this assessment, using scaling factors given on the UKAQA.

TABLE 3 Estimated background concentrations used in the assessment (µg/m^3)

Pollutant	2006	2008	2010	2011	2013
NO_x	31.7	29.1	26.6	25.8	24.5
NO_2	20.6	19.5	18.6	18.3	17.8
PM_{10}	23.2	22.4	21.5	21.3	20.9

4.2.3 The table above shows that for all years estimated background concentrations of NO_2 are below the objective limit of 40µg/m^3 to be achieved by 2005 and thereafter.

[15] Small scale industrial processes requiring authorisation from the Local Authority

[16] Large scale industrial processes requiring authorisation from the Environment Agency.

[17] An area covering approximately 10.5 x 10.5 km centred on the approximate centre of the proposed development site.

Estimated background concentrations of PM_{10} meet the objective limit of 40µg/m^3 to be achieved by 2004 and thereafter.

4.3 LOCAL AIR QUALITY MONITORING DATA

4.3.1 Concentrations of NO_2 and PM_{10} measured at automatic monitoring stations within the administrative boundary of CCC are provided in **Table 4**.

TABLE 4 Concentrations measured at nearby automatic monitoring stations

Pollutant	2004	2005	2006	2007
Newmarket Road (Roadside)				
Annual mean NO_2 (µg/m^3)	32	30	31	33
Number of hourly mean NO_2 > 200µg/m^3	0	0	3	0
Annual mean PM_{10} (µg/m^3)	21	23	22	23
Number of 24 hour mean PM_{10} > 50µg/m^3	0	4	4	5
Parker Street (Roadside)				
Annual mean NO_2 (µg/m^3)	49	52	60	54
Number of hourly mean NO_2 > 200µg/m^3	0	0	1	0
Annual mean PM_{10} (µg/m^3)	31	33	35	29
Number of 24 hour mean PM_{10} > 50µg/m^3	15	20	28	8
Regent Street (Roadside)				
Annual mean NO_2 (µg/m^3)	42	43	45	42
Number of hourly mean NO_2 > 200µg/m^3	0	0	1	1

4.3.2 The data in Table 4 shows that the air quality standard for annual mean NO_2 concentrations (40 µg/m^3) has been exceeded over the past 5 years at the Parker Street and Regent Street roadside sites. At the Newmarket Road monitoring site, the closest to the proposed development site, no exceedences of the air quality standard for annual mean NO_2 concentrations have been recorded at over the last 4 year. No breaches of the objective for 1-hour mean NO_2 concentrations have been recorded at any of the sites. No exceedences of the objective for annual and 24-hour mean PM_{10} concentrations have been recorded at any of the sites.

4.3.3 There is another continuous (roadside) monitoring station located north of the site adjacent to Elizabeth Way. Data for this location was not available from the Council's Air Quality Review and Assessment reports.

4.4 LOCAL AIR QUALITY MONITORING DATA

4.4.1 CCC also undertakes diffusion tube monitoring at 46 locations in the City. Results from the closest sites to the proposed development site over the last full year when data were available are given in **Table 5**. The results show that concentrations at one of the roadside locations exceed the objective (40µg/m^3).

TABLE 5 CCC NO_2 diffusion tube monitoring results ($\mu g/m^3$)

Tube Location	2007
Newmarket Road 1 (Roadside – in the middle of the roundabout)	44.8
Newmarket Road 2 (Roadside)	35.2
East Road (Roadside)	37.6
Elizabeth Way (Roadside – on median strip of dual carriageway)	38.4

4.4.2 It can be clearly seen that with the exception of the diffusion tube in the middle of the roundabout on Newmarket Road and Elizabeth Way, concentrations at roadside locations in the vicinity of the site do not exceed the objective for annual mean NO_2 concentrations (even for the location in the centre of the dual carriageway (Elizabeth Way)).

4.5 CAMBRIDGE CITY COUNCIL PREDICTIONS OF ANNUAL MEAN NO_2 CONCENTRATIONS

4.5.1 CCC has undertaken dispersion modelling to determine the spatial distribution of NO_2 across the city as a whole and have published concentration contour plots to show where exceedences of the objective for annual mean NO_2 concentrations were likely to exceed in 2005. This shows that the entire proposed development site is in an area where the modelling shows exceedences of the standard are '*less likely to occur*', with areas immediately adjacent to Elizabeth Way and Newmarket Road (near the site) shown as '*may exceed*'. This situation is unlikely to have worsened significantly since this modelling was done due to decreasing background concentrations, improvements in vehicle emissions and measures implemented by the Council through its AQAP to improve air quality in the City. This conclusion is supported by the continuous monitoring and diffusion tube data shown above.

5 Response to comments from the previous application

5.1.1 The following comments were made by the Environmental Health Officer Daniel Bayles (DB) on the air quality assessment submitted with the previous application (ref: 08/0871/FUL).

TABLE 6 Comments raised regarding the previous air quality assessment

DB Comment	WSPE Response
The model verification is extremely weak. The results show negligible agreement between modelled and monitored data and inconsistency over a geographic area. It is therefore not possible to rely on the results of the modelling exercise to any degree.	The methodology undertaken in the model verification process followed guidance given in LAQM.TG(03) and uses data from three monitoring sites in the local area to the site. We therefore consider that the verification was undertaken appropriately and that the modelling results can be relied on to be as accurate as possible. In response to the comment that monitored and modelled concentrations show 'negligible agreement', which is assumed to be about pre-verified modelled results, the verification factors calculated are in the typical range that we would expect based on our extensive experience of air dispersion modelling. Through the model verification process uncertainties in input data are minimised (and this allows for discrepancies in traffic flow data and background concentrations that can occur) so that this is taken into account in the application of factors which are used to correct the modelled output and give confidence in the presented concentrations.
Poor traffic data - scrutiny of the summarised traffic data used in the model exercise show significant discrepancies for modal split and volumes with the County Councils annual monitoring report for Newmarket Road and Elizabeth Way. It is understood that the traffic data is derived from a limited count and factored up to provide AADT flows.	The traffic data was supplied by our colleagues in WSPD&T and contains data from the transport assessment, the methodology for which was agreed via extensive consultation and negotiation with the highways department of Cambridshire County Council, local stake holders and officers from Cambridge City Council's transport team. The verification process will minimise uncertainties associated with input data such as traffic data.

DB Comment	WSPE Response
Treatment of background data – it is not clear where background pollutant values have been taken from nor that they are appropriate. In order to get representative data from a 'roads only' modelling exercise it is necessary to have good, source-apportioned, background concentrations so that account can be made for those sources other than cars, such as industrial, commercial, domestic and long-range pollution. The scope of the model is necessarily limited to a small number of roads close to the development site this can then lead to an underestimation of pollutant emission from the broader road network nearby and again reduces the model output. A contribution from the wider local road network needs to be incorporated in to the background concentration.	The background concentrations used in the assessment where taken from the pollutant maps available from UK Air Quality Archive in line with guidance given in LAQM.TG(03) as there were no suitable local monitoring stations from which such data could be obtained. These maps are available on a 1km x 1km grid square basis. The site is located within grid square 546000, 258000, therefore concentrations were taken from the grid square centred around 546500, 258500. These background concentrations will take into account sources other than roads and a contribution from roads in the wider area.
Choice of receptor – The assessment does not contain a contour plot and so it is difficult to assess whether the most appropriate or worst case receptors have been chosen for the assessment. Receptor location 4 which shows the highest concentrations is very close – within 5 metres of a long standing diffusion tube (Newmarket Road 1) and yet even after the very high verification factor has been applied the baseline concentrations are around 5ug/m^3 less than the long term, bias adjusted average from this monitoring location. This is an under-prediction of around 12.5%.	The closest receptor locations where chosen to the roads that would experience the greatest change in traffic flows as a result of the proposed development. Receptor 4 does show the highest total annual average nitrogen dioxide concentrations, and while it is close to the Newmarket Road 1 diffusion tube, the tube is located within the centre of a busy roundabout and does not represent public exposure, while Receptor 4 is located further away from at least 2 of the road links which meet at the roundabout. Therefore pollution concentrations would be expected to be lower at Receptor 4 than measured at the diffusion tube site. Furthermore the Environmental Health Officer is comparing a 2006 concentration with a 2008 concentration. It is expected that pollution concentrations will gradually decrease with time due to improvements in fuel and vehicle technology. This is taken into account in the background concentrations and emission factors that are used in air quality assessments. Therefore, you would expect a 2008 concentration to be lower than a 2006 concentration based on this in addition to the fact Receptor 4 is further away from some of the road links that make up this junction.
Given the shortcomings of the modelling exercise but looking at the supporting data it is likely that a better model would show a greater impact on local air quality than the report concludes. The site lies within and AQMA (Air Quality Management Area) and as such is subject to local plan policy 4/14. There is little doubt that the development will have a negative impact on air quality in the AQMA and would therefore be in contravention of this policy.	The Breeze Roads model is deemed fit for purpose and is also listed in Government guidance document LAQM.TG3(00) – Review and Assessment: Selection and Use of Dispersion Models. The modelling has been undertaken in line with DEFRA technical guidance and verified appropriately. The use of Breeze Roads for the assessment was discussed and agreed with CCC during the consultation process.

DB Comment	WSPE Response
It is also possible that the development will introduce new receptors (Residents) into an area, which currently has unacceptable air quality. As we are unable to rely on the model output submitted and no additional monitoring was undertaken as we suggested in earlier consultation meetings it is not possible to say if new residents on the Elizabeth way façade of the development will be exposed to NO2 levels above current objectives.	While it is acknowledged that the site lies within a designated AQMA and that the development will introduce new receptors into the area, the Council's own modelling conducted in 2005 shows that the proposed development site is in an area that 'may exceed' the annual mean objective and the majority of the site is within the 'less likely to exceed' band. Given that the Council's modelling predicted concentrations are for 2005 and the concentrations predicted in our modelling at the development site are for 2013 (and allow for a reduction with time in background concentrations and vehicle emissions that is expected to occur with time) we believe that our assessment predictions are robust and that exceedences at the Elizabeth Way façade of the development are very unlikely to occur. The Council did not request monitoring be undertaken at the site in their consultation response.
The assessment offers no concrete mitigation for air quality impacts as the modelling exercise shows no significant impact. As we have no confidence in the model output and the supporting information suggests otherwise we feel that there should be a more pragmatic approach to mitigation. We are pleased by the inclusion of solar water heating and combined heat and power on the site Whilst we encourage the promise of travel planning etc. we would like to see a firm commitment to a package of measures to reduce the emissions of the proposed development to the level of emissions for the current use or better.	The level of mitigation for air quality provided should be commensurate to the increase in air pollution concentrations attributable to the proposed development and believe the mitigation proposed in this report to be sufficient given the predicted impacts.
Mechanical Ventilation drawing fresh air away from the road side may be applicable such that the most vulnerable residents are not over-exposed to emissions from existing road traffic pollution.	It is not considered necessary to include mechanical ventilation within the proposed development as the concentrations predicted on the development site are all well below the annual mean objective for NO_2 and PM_{10}

6 Assessment of impacts, mitigation and residual effects

6.1 IMPACT

Construction phase

Construction sources of dust and PM_{10}

6.1.1 The main sources of dust and PM_{10} during construction activities include:

- haulage routes, vehicles and construction traffic;
- materials handling, storage, stockpiling, spillage and disposal;
- exhaust emissions from site plant, especially when used at the extremes of their capacity and during mechanical breakdown;
- site preparation and restoration after completion;
- demolition;
- construction and fabrication processes; and
- internal and external finishing and refurbishment.

6.1.2 The majority of the releases are likely to occur during the 'working-week'. However, for some potential release sources, e.g. exposed soil produced from significant earthwork activities, in the absence of the dust control mitigation measures that will be implemented at the site during construction (see section on Mitigation Measures below), dust generation has the potential to occur 24 hours per day over the period during which such activities are to take place.

6.1.3 Depending on wind speed and turbulence it is likely that the majority of dust will be deposited in the area immediately surrounding the source (up to 200 metres away). There are a number of residential properties within this distance of the site to the northeast, east and south of the site. To the north of the site is located an open space area and River beyond that. Some residential areas are located on the north side of the river. Commercial land uses largely occupy the area to the west and southwest of the proposed development site within 200m.

6.1.4 The prevailing wind direction at the site is from the southwest and west southwest, therefore properties to the east northeast and northeast of the site are most likely to be affected by dust emissions from the site, should they occur. Winds from these directions occur for approximately 23% of the time for all wind speeds. However, dust generation is more likely to occur during moderate to strong wind speeds (>5 m/s). Moderate to strong winds from the southwest and west southwest occur for around 14% of the time. This wind speed and direction data covers both wet and dry conditions and during wet periods, dust generation will be suppressed. Climate data from the Met Office observing station at Cambridge shows that days where rainfall is greater than or equal to 1mm occur for 29% of the year. This shows the relatively low frequency with which sensitive locations to the east and north east of the site would be subject to unfavourable wind directions that could carry dust emissions from the proposed development site to the sensitive locations if generated and proposed mitigation measures were not implemented on site.

6.1.5 In addition, the intervening bridge structure that forms part of Elizabeth Way and the traffic flows on the road will also provide a significant screening barrier to the

residential properties located to the east and northeast of the proposed development site.

6.1.6 By consideration of the factors described above the overall impact of dust nuisance would therefore be **temporary, short-medium term**, **local** in effect and of a **moderate adverse** significance. During construction, concentrations of PM_{10} in the locality will be elevated. As the magnitude of these releases is relatively small compared to total dust, any **adverse** effects resulting from them are likely to be **temporary, short-term** and of **minor adverse** significance.

Release of emissions to air from construction traffic

6.1.7 Construction traffic associated with the development will contribute to existing traffic levels on the surrounding road network. The greatest potential for impacts on air quality from traffic associated with this phase of the proposed development will be in the areas immediately adjacent to the principal means of site access for construction traffic. However, the nature of the traffic and the periods over which the increases may occur are considered to be localised and short term in duration over the construction period.

6.1.8 The impacts are therefore considered to be **temporary, short-medium** term, **local** and of **minor adverse** significance.

Operational phase

6.1.9 Full results of the dispersion modelling are presented in **Appendix F**, and a summary is provided below.

6.1.10 The results show that the development would cause a small increase in pollutant concentrations at all receptor locations for NO_2 and at the majority of assessment receptors for PM_{10}. The concentrations predicted for future years, either with or without the development, are all below those predicted for the 2008 baseline year. This is due to an expected future improvement (i.e. decrease) in background concentrations and vehicle emissions. According to the significance criteria used the impact of this proposed development is considered to be **insignificant** for NO_2 concentrations and **insignificant** to **neutral** for PM_{10} concentrations.

6.1.11 In accordance with the Environmental Protection UK guidance, air quality is a medium priority consideration.

Annual mean NO_2 concentrations

6.1.12 The objective for annual mean NO_2 concentrations is 40 $\mu g/m^3$ to be achieved by the end of 2005 and thereafter. The results of the assessment show that in the 2008 baseline case concentrations at all the existing receptors were below the objective. The highest predicted concentration is 38.10$\mu g/m^3$ at 119 Newmarket Road (receptor number 4).

6.1.13 By 2010, the year in which the EU limit value should be met, concentrations predicted at all of the receptors are reduced from the 2008 baseline case and the concentrations are all below the objective. The highest concentration is predicted at 116 Newmarket Road where the predicted concentration is 35.46$\mu g/m^3$.

6.1.14 By 2011, the year the proposed development would be approximately 50% complete and occupied, concentrations are further reduced from the 2008 and 2010 baseline cases, both with and without the development. The highest predicted concentrations are 34.47$\mu g/m^3$ without the development and 34.73$\mu g/m^3$ with the development at the 119 Newmarket Road receptor. The greatest increase in concentration due to the development is 0.29$\mu g/m^3$ predicted to occur at 51 Newmarket Road (receptor number 2). Having regard to the assessment undertaken, the impact of the proposed development is considered to be **insignificant** at all nine receptors.

6.1.15 On the proposed development site concentrations are predicted to meet the annual mean objective at all of the receptor locations. The highest predicted concentration of 26.26µg/m^3 occurs at the ground floor level of the southeast corner of the proposed development (receptor number 10).

6.1.16 In 2013, the proposed year of completion and full occupation of the development, predicted concentrations are again reduced from the 2011 case, both with and without the proposed development. The highest predicted concentrations are 32.98µg/m^3 without the development and 33.22µg/m^3 with the development, again occurring at 119 Newmarket Road (receptor number 4). The greatest increase in concentration due to the development is 0.28µg/m^3 predicted to occur at at 51 Newmarket Road (receptor number 2). The impact of the proposed development is therefore considered to be **insignificant** at all nine receptors, according to the assessment criteria used.

6.1.17 On the proposed development site itself, concentrations are predicted to meet the annual mean objective at all of the receptor locations. The highest predicted concentration (25.22µg/m^3) occurs at the ground floor level of the southeast corner of the proposed development (receptor number 10).

6.1.18 These results are not inconsistent with the review and assessment work undertaken by CCC, despite site being located in the AQMA declared by the Council due to exceedences of the annual mean objective for NO_2 concentrations. The Council's monitoring data (see Section 4) and modelling predictions show that exceedences of the annual mean objective occur in only some locations within the AQMA (generally adjacent to heavier trafficked roads), not across the entire area declared as an AQMA.

6.1.19 The assessment results are consistent with the Council's own dispersion modelling results for 2005, where the proposed development site is wholly within an area referred to as an area where "*exceedences are less likely to occur*". Areas between the proposed development site and part of Elizabeth Way and Newmarket Road are areas where the modelling shows that concentrations "*may exceed*" the objective. The monitoring data from the Council's automatic monitoring station and diffusion tubes in these locations show that exceedences are not occurring; therefore, the results of this assessment are consistent with the Council's findings.

Hourly mean NO_2 concentrations

6.1.20 The annual mean NO_2 concentrations predicted by the model were all well below 60 µg/m^3, and therefore exceedences of the hourly mean NO_2 concentration objective are unlikely to occur.

Annual mean PM_{10} concentrations

6.1.21 The objective for annual mean PM_{10} concentrations is 40µg/m^3 to be achieved by the end of 2004 and thereafter. The results of the assessment show that in the 2008 baseline case concentrations at all of the receptors considered are predicted to easily meet the objective. The highest predicted concentration is 25.08µg/m^3 at 119 Newmarket Road. The predicted results in 2008 show good agreement with the data from the continuous monitor located on Newmarket Road where the measured PM_{10} concentration in 2007 was 23.00µg/m^3.

6.1.22 By 2010, predicted concentrations at all of the receptors are reduced from the 2008 baseline case. The highest concentration is predicted at 119 Newmarket Road where the predicted concentration is 23.90µg/m^3.

6.1.23 By 2011, concentrations are further reduced from both the 2008 and 2010 baseline cases. The highest predicted concentrations are 23.56µg/m^3 in the without development case and 23.58µg/m^3 in the with development case at 119 Newmarket

Road. The greatest increase in concentrations due to the development is 0.05µg/m^3 predicted at 231 Newmarket Road (receptor number 6). The proposed development is predicted to cause a small increase in concentrations at eight of the existing receptors considered. The impact of the proposed development is therefore considered to be **insignificant** at eight of the existing receptor locations and **neutral** at the remaining location according to the assessment criteria used.

6.1.24 On the proposed development site concentrations are below the annual mean objective. The highest concentration of 22.32µg/m^3 is predicted to occur at the ground floor level of the southeast corner of the proposed development.

6.1.25 By 2013, concentrations are further reduced from both the 2008 and 2010 baseline cases. The highest predicted concentrations are 23.08µg/m^3 in the without development case and 23.10µg/m^3 in the with development case at 119 Newmarket Road. The greatest increase in concentrations due to the development is 0.03µg/m^3. The proposed development is predicted to cause a small increase in concentrations at of the existing receptors considered. The impact of the proposed development is therefore considered to be **insignificant** according to the assessment criteria used.

6.1.26 In 2013, on the proposed development site itself concentrations are below the annual mean objective. The highest concentration of 21.89µg/m^3 is predicted to occur at the ground floor level of the southeast corner of the proposed development.

6.1.27 These results agree with the conclusions of the review and assessment work undertaken by CCC, which concluded that no AQMAs needed to be designated for this pollutant.

24 hour mean PM_{10} concentrations

6.1.28 The objective for 24 hour mean PM_{10} concentrations is 50 µg/m^3 to be exceeded no more than 35 times a year by the end of 2004 and thereafter. The results of the dispersion modelling show that in the 2008 baseline case the number of exceedences is a maximum of 13 days, which is below the objective.

6.1.29 The number of days of exceedences decreases to 10 days in 2010, 9 days in 2011 and 8 in 2013, both with and without the proposed development, which is also below the objective. The proposed development is predicted to give rise to an extra day of exceedence at 3 Abbey Road (receptor number 8) and 5 Abbey Road (receptor number 9) in 2011 and 2013 respectively.

6.1.30 These results again agree with the conclusions of the review and assessment work undertaken by CCC, which concluded that no AQMA's needed to be designated for this pollutant.

6.2 MITIGATION

Construction phase

6.2.1 A number of mitigation methods should be implemented to control dust and fine particle emissions. Mitigation measures for the construction phase will be identified and set-out in a Construction Environmental Management Plan (CEMP) for the construction phase of the proposed development, in agreement with the CCC. The construction contractor will be required to sign up to a Considerate Contractor Scheme, which will further ensure that mitigation measures are implemented effectively and their performance monitored to confirm impact beyond the boundary of the site is prevented or minimise to an acceptable level.

6.2.2 Mitigation measures will be based on the Best Practice Guidance produced by the London Councils[4]. A number of example mitigation methods from the guidance are

shown and should be implemented as appropriate. The list below is for illustrative purposes and not designed to be exhaustive:

- vehicles carrying loose aggregate and workings should be sheeted at all times;
- implementation of design controls for construction equipment and vehicles and use of appropriately designed vehicles for materials handling;
- completed earthworks should be covered or vegetated as soon as is practicable;
- regular inspection and, if necessary, cleaning of local highways and site boundaries to check for dust deposits (and removal if necessary);
- minimise surface areas of stockpiles (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) to reduce area of surfaces exposed to wind pick-up;
- use of dust-suppressed tools for all operations;
- use of mobile or fixed spray units to dampen surfaces as dictated by weather conditions;
- ensuring that all construction plant and equipment is maintained in good working order and not left running when not in use;
- restrict on-site movements to well within site and not near the perimeter, if possible; and
- no unauthorised burning of any material anywhere on site.

6.2.3 Detailed mitigation measures to control construction traffic should be discussed with CCC to establish the most suitable access and haul routes for the site traffic. The most effective mitigation will be achieved by ensuring that construction traffic, where possible does not pass along sensitive roads (residential roads, congested roads, via unsuitable junctions, etc) and that vehicles are kept clean (through the use of wheel washers, etc) and sheeted when on public highways. Timing of large-scale vehicle movements to avoid peak hours on the local road network will also be beneficial.

6.2.4 Liaison with the local authority will be maintained throughout the construction process.

Operational phase

6.2.5 Given the nature of the proposed development and the very small increase in NO_2 and PM_{10} concentrations that traffic associated with it will generate, it is not considered that significant mitigation measures are required. Notwithstanding the above however, it should be noted that the site is situated close to the City Centre and within walking/cycling distance of the Cambridge Railway Station. The development will also include a significant number of secure cycle parking for both residents and visitors, while car parking provision is limited to an approximate ratio of 0.8 spaces per residential unit, and 7 service spaces provided for the student accommodation. The use of 'Green' forms of transport, as an alternative to the use of the private car will also be encouraged by the adoption of a Green Travel Plan.

6.2.6 Measures are currently being explored by WSPD&T to improve traffic flows and reduce any congestion on the surrounding road network in the vicinity of the site. Any improvements that result in a reduction in congestion and in a more constant flow of traffic (i.e. reducing stop/start vehicle movement) will generally reduce vehicles emissions and their impact on pollutant levels at the proposed development site and surrounding area.

6.2.7 Predicted concentrations at the site itself are below the relevant AQS objectives; therefore, additional mitigation measures are not required to further reduce the exposure of the future occupants of the proposed development to traffic emissions from the surrounding road network.

6.3 RESIDUAL EFFECTS

Construction phase

6.3.1 The greatest potential for nuisance problems to occur will be within 200 metres of the construction site perimeter. There may be limited incidences of increased dust deposited on property within this distance. With appropriate use of mitigation measures and good site management the residual impact of dust deposition would therefore be **temporary, short-medium term**, **local** in effect and of a **minor adverse** significance. During construction, concentrations of PM_{10} in the locality will be elevated.

6.3.2 The potential for short-term releases of PM_{10} from materials handling and site plant will remain following mitigation. However, reducing the use of site plant and equipment near sensitive receptors and implementing the mitigation measures outlined above would reduce the impact to not significant. The magnitude of these releases is relatively small compared to total dust, any **adverse** effects resulting from them are likely to be **temporary, short-term** and insignificant.

6.3.3 The greatest areas where potential impacts on air quality from traffic associated with this phase of the proposed development will be in the areas immediately adjacent to the principal means of site access for construction traffic. Careful management of traffic movements and plant use will ensure impacts will not be significant. The impacts are therefore considered to be **temporary, short-medium** term, **local** and insignificant.

Operational phase

6.3.4 The proposed development is predicted to cause a small increase in NO_2 and PM_{10} concentrations. These increases will be reduced by the implementation of the mitigation measures described above.

6.3.5 In 2008 the annual mean NO_2 objective is predicted to be met at all existing receptor locations considered, by 2010, 2011 and 2013 concentrations are further reduced from the 2008 baseline case. Therefore, the future occupants of the development will not be exposed to pollutant concentrations in excess of the relevant AQS objectives.

6.3.6 The impact of the proposed development on air quality is **insignificant** for NO_2 and **insignificant** to **neutral** for PM_{10} according to the assessment criteria.

7 Summary of air quality impacts

7.1.1 A assessment of the potential impacts on local air quality from construction activities on the proposed development has been carried out. This showed that during site activities releases of dust and PM_{10} were likely to occur. However, through good site practice and the implementation of suitable mitigation measures, the impact of dust and PM_{10} releases will be reduced and excessive releases prevented.

7.1.2 Implementation of the recommended dust prevention and control measures would ensure that dust emissions are controlled to a level where the potential of the surrounding sensitive areas to be affected by dust nuisance would be minimal temporary, short and local in effect. The residual effects of dust deposition during the construction phase are considered to be **minor adverse**.

7.1.3 During construction, concentrations of PM_{10} in the locality are likely to be elevated and construction traffic associated with the Proposed Development will contribute to existing traffic emissions from the surrounding road network. PM_{10} emissions are likely to be relatively small compared to total dust. The increase in traffic emissions will be variable during the construction phases and only likely to impact areas near the principle means of access to the Site. Any adverse effects resulting from emissions of PM_{10} during the construction period and emissions from construction vehicles are likely to be temporary, short to medium term and **insignificant**.

7.1.4 The results show that the development of the combined site, at worst, would cause a very small increase in pollutant concentrations but would not cause any exceedences of the statutory objective. According to the assessment significance criteria the impact of the proposed development is considered to be **insignificant** for NO_2 and **insignificant** to **neutral** for PM_{10}.

7.1.5 Concentrations predicted for the proposed development site itself are below the relevant AQS objectives. Therefore, the proposed development will not give rise to an increase in exposure to pollution concentrations in excess of the current AQS objectives. Therefore, the air quality in the AQMA will not have an adverse impact on the future occupants and users of the proposed development.

7.1.6 The concentrations predicted for both pollutants for 2011 when the development would be partially completed and the completion year of 2013, either with or without the development, are all below those predicted for the baseline year of 2008. This is due to an expected future improvement (i.e. reduction) in background concentrations and vehicle emissions.

7.1.7 Policy 4/14 Air Quality Management Areas of the Cambridge City Council Local Plan states: *'Development within or adjacent to an AQMA will only be permitted if: a) it would have no adverse effect upon air quality within the AQMA, or b) air quality levels within the AQMA would not have a significant adverse effect on the proposed use/users'*. The results of the assessment predict that there will be at worst an insignificant impact on air quality and no exceedences of the air quality objectives in the anticipated opening year of the proposed development (2013) and therefore the proposed development complies with policy 4/14.

Figure 1 Site Plan and Receptor Locations

Appendix A Air quality standards and objectives

Air quality standards and objectives

A summary of the current air quality objectives for the seven pollutants detailed in the *Air Quality Regulations 2000 and (Amendment) Regulations 2002* for the purpose of Local Air Quality Management is provided below.

Air Quality Objectives currently included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002 for the purpose of Local Air Quality Management (LAQM)						
Pollutant	**Applies to**	**Standard**		**Objective**		**EU AQ Daughter Directive**
		Concentration	*Measured as*	*Annual exceedences allowed*	Target date	
Benzene (C_6H_6)	All UK	16.25µg/m^3	running annual mean		31.12.2003	
	England and Wales	5µg/m^3	annual mean		31.12.2010	As standard. target: 01.01.2010
	Scotland	3.25µg/m^3	running annual mean		31.12.2010	
1,3-Butadiene (C_4H_6)	All UK	2.25µg/m^3	running annual mean		31.12.2003	
Carbon monoxide (CO)	All UK	10mg/m^3	maximum daily running 8 hour mean		31.12.2003	As standard. target: 01.01.2005
Lead (Pb)	All UK	0.5µg/m^3	annual mean		31.12.2004	As standard. target: 01.01.2005[8]
	All UK	0.25µg/m^3	annual mean		31.12.2008	
Nitrogen dioxide (NO_2)	All UK	200µg/m^3	1 hour mean	18	31.12.2005	As objective. target: 01.01.2010
	All UK	40µg/m^3	annual mean		31.12.2005	As standard. target: 01.01.2010
Particulate Matter (PM_{10}) (gravimetric)[1]	All UK	40µg/m^3	annual mean		31.12.2004	As standard. target: 01.01.2005
	All UK	50µg/m^3	24 hour mean	35	31.12.2004	As objective. target: 01.01.2005
	Scotland	50µg/m^3	24 hour mean	7	31.12.2010	As objective. target: 01.01.2010
	Scotland	18µg/m^3	annual mean		31.12.2010	
Sulphur dioxide (SO_2)	All UK	266µg/m^3	15 minute mean	35	31.12.2005	
	All UK	350µg/m^3	1 hour mean	24	31.12.2004	As objective. target: 01.01.2005
	All UK	125µg/m^3	24 hour mean	3	31.12.2004	As objective. target: 01.01.2005

Provisional Air Quality Objectives currently NOT included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002 for the purpose of Local Air Quality Management (LAQM)						
Pollutant	**Applies to**	**Standard**		**Objective**		**EU AQ Daughter Directive**
		Concentration	*Measured as*	*Annual exceedences allowed*	Target date	
Polycyclic aromatic hydrocarbons (PAHs)[2]	All UK	0.25ng/m^3 B[a]P[3]	annual mean		31.12.2010	
Particulate Matter ($PM_{2.5}$) (gravimetric)[1,2]	UK (except Scotland)	25µg/m^3	annual mean	-	2020	As standard Target 2010 25µg/m^3
	Scotland	12µg/m^3	annual mean	-	2020	Target 2015
	UK urban areas	Target of 15% reduction in concentrations at urban background	annual mean	-	Between 2010 and 2020	Target 20% reduction in concentrations at urban background Target Between 2010 and 2020

Other Air Quality Strategy Objectives						
Pollutant	**Applies to**	**Standard**		**Objective**		**EU AQ Daughter Directive**
		Concentration	*Measured as*	*Annual exceedences allowed*	Target date	
For the protection of human health						
Ozone (O_3)[4]	All UK	100µg/m^3	maximum daily running 8 hour mean	10	31.12.2005	As objective; but 25 annual exceedences target: 01.01.2010
For the protection of vegetation and ecosystems[5]						
Nitrogen oxides (NO_X)[6]		30µg/m^3	annual mean		31.12.2000[7]	As standard. target: 19.07.2001
Sulphur dioxide (SO_2)		20µg/m^3	annual mean		31.12.2000[7]	As standard. target: 19.07.2001
		20µg/m^3	winter mean (1 October to 31 March)		31.12.2000[7]	As standard. target: 19.07.2001

Explanation:
ng/m^3 = nanogrammes per cubic metre; $\mu g/m^3$ = microgrammes per cubic metre; mg/m^3 = milligrams per cubic metre (i.e. microgrammes per cubic meter x 1,000);
1 Measured using the European gravimetric transfer sampler or equivalent.
2 Objective to be set in regulations in the future.
3 Concentration of Benzo[a]pyrene (B[a]P) to be measured as a marker for the total mixture of PAHs.
4 The objective for this pollutant is provisional and must be tackled at a national level due to its transboundary nature.
5 Only applies to those parts of the UK > 20km from an agglomeration; and > 5km from Part A processes, motorways and built up areas of > 5,000 people.
6 Assuming NO_X is taken as NO_2.
7 These objectives have successfully been achieved.
8 Also an EU AQ Directive Limit Value of $1\mu g/m^3$ to be achieved by 01.01.2010 in the immediate vicinity (1000 m) of certain named industrial sources situated on sites contaminated by decades of industrial activities.

The Air Quality Strategy states that further review and assessment and consultation in relation to air quality will be a rolling process, with additional revisions to the objectives for selected pollutants as appropriate, or where there is new evidence in relation to the effects of pollutants on health or ecosystems. New pollutants may be introduced through future reviews.

Appendix B Overview of the review and assessment process

Round 1 – Review and Assessment Process
Stage 1 Identify all significant pollutant sources within or outside of the authority's area. Identify those pollutants where the risk of exceeding the objectives, and for which further investigation is needed. Compile and collate a list of potentially significant polluting sources using the assessment criteria described in Government guidance document LAQM.TG4(00). Identify sources requiring further investigation.
Stage 2 Further screening of significant sources to determine whether there is a significant risk of the air quality objectives being exceeded. Identify those pollutants where there is a risk of exceeding the objectives, and for which further investigation is needed. Use of screening models or monitoring methods to assess whether there is a risk of exceeding the air quality objectives. The assessment need only consider those locations where the highest likely concentrations are expected, and where public exposure is relevant.
Stage 3 Accurate and detailed assessment of both current and future air quality. Assess the likelihood of the air quality objective being exceeded. Identify the geographical boundary of any exceedences, and description of those areas, if any, proposed to be designated as Air Quality Management Areas (AQMAs). Use of validated modelling and quality-assures monitoring methods to determine current and future pollutant concentrations. The assessment will need to consider all locations where public exposure is relevant.
Stage 4 Further assessment intended to supplement information produced during Stage 3. Assessment to be used to define the relative contribution of different sources within the AQMAs, so as to allow a focused Air Quality Action Plan (AQAP) to be prepared. Should give a clear picture of those sources which authorities can control or influence and include an estimate of the costs and feasibility of different abatement options to allow for the development of proportionate and effective action plans.

Round 2 – Review and Assessment Process
Updating and Screening Assessment (USA) Identification of those aspects that have changed since the first round of Review and Assessments, including by way of lessons learnt, that may require further assessment. Should include an explanation of the conclusion reached as to whether the authority should proceed to a detailed assessment or not.
Detailed Assessment Identification of whether and existing AQMAs needs to be amended or revoked, if further AQMAs need to be designated within the area, whether AQMAs need to be designated for the first time due to changes in circumstances, or there is no need to designate any AQMAs.

Appendix C Details of dispersion model Breeze Roads

Traffic Dispersion Model Breeze Roads

Breeze Roads is a computational dispersion model that is used to model the emissions from road traffic. It is a US EPA regulatory model and its algorithms are based primarily on the line source dispersion model Caline 3. The model permits the inclusion of up to 120 roadway links and 60 receptor locations in each run.

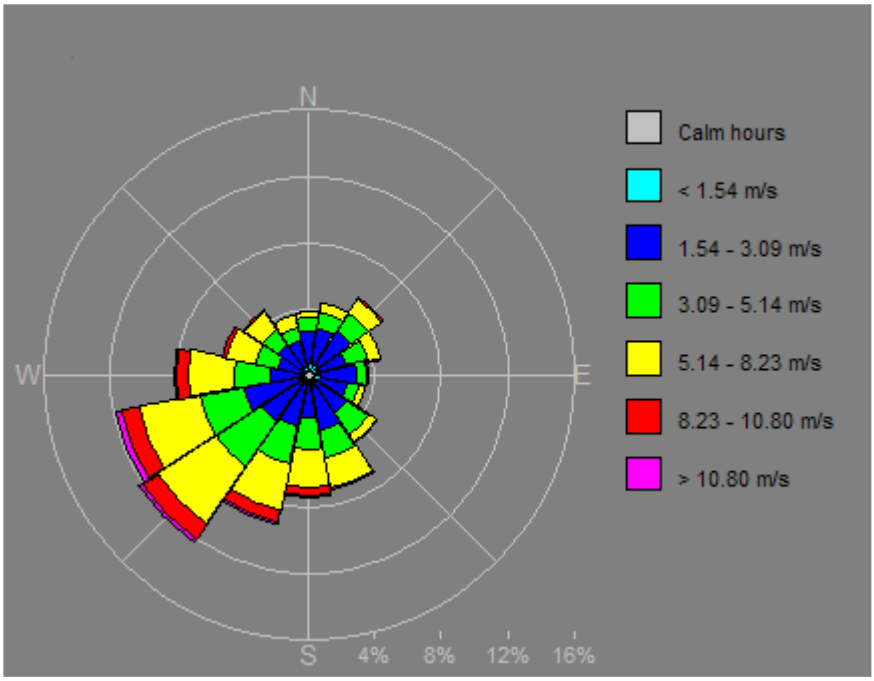
It utilises digital hourly meteorological data to predict the dispersion of emissions. The main meteorological parameter that effects dispersion in the model is wind direction.

The model uses UK vehicular emission factors from the UKAQA, traffic flow information for individual hours or on an average daily basis, and using these it can calculate pollutant concentrations for queuing traffic and idling vehicles at road junctions with traffic signals.

It can be used predict concentrations of carbon monoxide, particulate matter and other inert pollutants along roads and at intersections, such as Oxides of Nitrogen and Nitrogen Dioxide. Individual receptor locations can be input into the model so that the effects of road traffic on air quality at sensitive locations, e.g. school and residential properties, can be calculated.

The model has some limitations, for example, wind speeds should be at least 1 m/s as lower wind speeds have not been validated. Also, the model is highly sensitive to mixing heights lower than 100m, which would typically occur at night. More detail on these assumptions, and other can be found in the Users' Guide.

Appendix D Windrose for Cambridge (2006)


N
W
E
S
4%
8%
12%
16%
Calm hours
< 1.54 m/s
1.54 - 3.09 m/s
3.09 - 5.14 m/s
5.14 - 8.23 m/s
8.23 - 10.80 m/s
> 10.80 m/s

Appendix E Summary of traffic data used in the assessment

Summary of the traffic data used in the assessment

The tables below show the data that was used in the assessment of traffic impacts on local air quality. The emission factors were obtained from the spreadsheet published in July 2003 by Bureau Veritas (formerly Casella Stanger).

2008 Baseline

Road link	Speed (km/hour)	Annual Average Hourly Flows (AAHT)	% HGV	Emission Factors	
				NO_x	PM_{10}
Newmarket Road West of Evening Court	24	673	3.25	0.51047	0.02081
Proposed New Access	24	0	0.00	0.30622	0.01613
Newmarket Road between New Access and Site Access	24	680	3.22	0.50844	0.02076
Site Access	24	62	0.00	0.30622	0.01613
Newmarket Road between Site Access and Newmarket Road roundabout	24	700	3.13	0.50245	0.02063
East Road	24	1037	1.84	0.42181	0.01878
Elizabeth Way 1	24	1338	1.26	0.38524	0.01794
Elizabeth Way 2	24	1338	1.26	0.38524	0.01794
Newmarket Road between Newmarket roundabout and Godesdone Road	24	1249	2.34	0.45297	0.01949
Newmarket Road between Godesdone Road and Coldham's Lane	24	1159	2.47	0.46138	0.01969
Coldham's Lane	24	750	1.65	0.40954	0.01850
Newmarket Road east of Coldham's Lane	24	759	3.70	0.53827	0.02145
Newmarket Road between Evening Court and New Access	24	688	2.12	0.43938	0.01918

2010 Baseline

Road link	Speed (km/hour)	Annual Average Hourly Flows (AAHT)	% HGV	Emission Factors	
				NO_x	PM_{10}
Newmarket Road West of Evening Court	24	676	3.36	0.44453	0.01778
Proposed New Access	24	17	0.00	0.27173	0.01424
Newmarket Road between New Access and Site Access	24	683	3.32	0.44276	0.01774
Site Access	24	0	0.00	0.27173	0.01424
Newmarket Road between Site Access and Newmarket Road roundabout	24	710	3.20	0.43631	0.01761
East Road	24	1065	1.86	0.36741	0.01620
Elizabeth Way 1	24	1374	1.27	0.33715	0.01558
Elizabeth Way 2	24	1374	1.27	0.33715	0.01558
Newmarket Road between Newmarket roundabout and Godesdone Road	24	1279	2.37	0.39354	0.01673
Newmarket Road between Godesdone Road and Coldham's Lane	24	1186	2.51	0.40065	0.01688
Coldham's Lane	24	771	1.66	0.35727	0.01599
Newmarket Road east of Coldham's Lane	24	780	3.74	0.46396	0.01818
Newmarket Road between Evening Court and New Access	24	693	2.19	0.38422	0.01654

2011 Without Development

Road link	Speed (km/hour)	Annual Average Hourly Flows (AAHT)	% HGV	Emission Factors	
				NO_x	PM_{10}
Newmarket Road West of Evening Court	24	676	3.36	0.41612	0.01660
Proposed New Access	24	17	0.00	0.25956	0.01359
Newmarket Road between New Access and Site Access	24	683	3.32	0.41452	0.01657
Site Access	24	0	0.00	0.25956	0.01359
Newmarket Road between Site Access and Newmarket Road roundabout	24	710	3.20	0.40867	0.01646
East Road	24	1065	1.86	0.34625	0.01526
Elizabeth Way 1	24	1374	1.27	0.31883	0.01473
Elizabeth Way 2	24	1374	1.27	0.31883	0.01473
Newmarket Road between Newmarket roundabout and Godesdone Road	24	1279	2.37	0.36992	0.01571
Newmarket Road between Godesdone Road and Coldham's Lane	24	1186	2.51	0.37636	0.01584
Coldham's Lane	24	771	1.66	0.33706	0.01508
Newmarket Road east of Coldham's Lane	24	780	3.74	0.43373	0.01694
Newmarket Road between Evening Court and New Access	24	693	2.19	0.36148	0.01555

2011 With Development

Road link	Speed (km/hour)	Annual Average Hourly Flows (AAHT)	% HGV	Emission Factors	
				NO_x	PM_{10}
Newmarket Road West of Evening Court	24	683	3.47	0.42106	0.01670
Proposed New Access	24	54	0.00	0.25956	0.01359
Newmarket Road between New Access and Site Access	24	690	3.43	0.41943	0.01667
Site Access	24	3	0.00	0.25956	0.01359
Newmarket Road between Site Access and Newmarket Road roundabout	24	745	3.18	0.40761	0.01644
East Road	24	1075	1.92	0.34898	0.01531
Elizabeth Way 1	24	1387	1.31	0.32071	0.01477
Elizabeth Way 2	24	1380	1.36	0.32071	0.01477
Newmarket Road between Newmarket roundabout and Godesdone Road	24	1285	2.45	0.37396	0.01579
Newmarket Road between Godesdone Road and Coldham's Lane	24	1201	2.58	0.37965	0.01590
Coldham's Lane	24	778	1.72	0.33952	0.01513
Newmarket Road east of Coldham's Lane	24	788	3.93	0.44265	0.01711
Newmarket Road between Evening Court and New Access	24	726	3.26	0.41155	0.01651

2013 Without Development

Road link	Speed (km/hour)	Annual Average Hourly Flows (AAHT)	% HGV	Emission Factors	
				NO_x	PM_{10}
Newmarket Road West of Evening Court	24	699	3.25	0.36749	0.01477
Proposed New Access	24	0	0.00	0.24095	0.01263
Newmarket Road between New Access and Site Access	24	706	3.22	0.36618	0.01475
Site Access	24	0	0.00	0.24095	0.01263
Newmarket Road between Site Access and Newmarket Road roundabout	24	708	3.21	0.36583	0.01474
East Road	24	1102	1.80	0.31090	0.01381
Elizabeth Way 1	24	1420	1.23	0.28883	0.01344
Elizabeth Way 2	24	1420	1.23	0.28883	0.01344
Newmarket Road between Newmarket roundabout and Godesdone Road	24	1329	2.28	0.32962	0.01413
Newmarket Road between Godesdone Road and Coldham's Lane	24	1224	2.43	0.33540	0.01423
Coldham's Lane	24	803	1.60	0.30306	0.01368
Newmarket Road east of Coldham's Lane	24	808	3.60	0.38118	0.01500
Newmarket Road between Evening Court and New Access	24	710	2.13	0.32398	0.01404

2013 With Development

Road link	Speed (km/hour)	Annual Average Hourly Flows (AAHT)	% HGV	Emission Factors	
				NO_x	PM_{10}
Newmarket Road West of Evening Court	24	705	3.36	0.37152	0.01484
Proposed New Access	24	37	0.00	0.24095	0.01263
Newmarket Road between New Access and Site Access	24	712	3.32	0.37019	0.01482
Site Access	24	3	0.00	0.24095	0.01263
Newmarket Road between Site Access and Newmarket Road roundabout	24	743	3.19	0.36493	0.01473
East Road	24	1112	1.86	0.31312	0.01385
Elizabeth Way 1	24	1433	1.27	0.29036	0.01347
Elizabeth Way 2	24	1433	1.27	0.29036	0.01347
Newmarket Road between Newmarket roundabout and Godesdone Road	24	1335	2.36	0.33288	0.01419
Newmarket Road between Godesdone Road and Coldham's Lane	24	1239	2.50	0.33809	0.01427
Coldham's Lane	24	810	1.65	0.30506	0.01372
Newmarket Road east of Coldham's Lane	24	816	3.79	0.38842	0.01512
Newmarket Road between Evening Court and New Access	24	743	3.19	0.36491	0.01473

2006 Verification

Road link	Speed (km/hour)	Annual Average Hourly Flows (AAHT)	%HDV	Emission rate g/km/veh	
				NOx	PM_{10}
Newmarket Road	40	705	15.8	0.62996	0.02193
East Road	24	987	1.84	0.49195	0.02265
Elizabeth Way	24	1338	1.26	0.45019	0.02152

Appendix F Assessment results

NO_2 Annual Mean	2005	Source
AQS Objective ($\mu g/m^3$)	40	UK Air Quality Strategy

Receptor Number	Receptor Name/Description	2008 baseline	2010 Baseline	2011 without development	2011 with development	2013 without development	2013 with development	Change	Change
Existing Receptors									
1	37 Newmarket Road	28.04	26.15	25.52	25.68	24.44	24.59	0.16	0.15
2	51 Newmarket Road	26.83	25.15	24.57	24.86	23.50	23.78	0.29	0.28
3	13 Abbey Road	29.47	27.59	26.94	27.10	25.84	26.04	0.16	0.20
4	119 Newmarket Road	38.10	35.46	34.47	34.73	32.98	33.22	0.26	0.24
5	Newmarket Continuous Monitor	37.22	34.62	33.65	33.88	32.18	32.39	0.23	0.21
6	231 Newmarket Road	32.87	30.63	29.78	30.06	28.42	28.67	0.28	0.25
7	76 Riverside	24.87	23.42	22.94	23.00	21.94	22.21	0.06	0.27
8	3 Abbey Road	35.20	32.83	31.96	32.21	30.60	30.85	0.25	0.25
9	5 Abbey Road	34.54	32.22	31.39	31.63	30.06	30.31	0.24	0.25
Proposed Receptors									
14	SE Corner Block A GF				26.26		25.22		
15	SE Corner Block A 1F				25.62		24.61		
16	SE Corner Block A 2F				24.64		23.69		
17	SE Corner Block A 3F				23.60		22.70		
18	NE Corner Block C GF				24.32		23.45		
19	NE Corner Block C 1F				23.74		22.90		
20	NE Corner Block C 2F				24.16		23.30		
21	NE Corner Block C 3F				23.46		22.63		
22	NE Corner Block C 4F				23.95		23.09		
23	Café Block B GF				21.25		20.52		
24	Café Block B 1F				21.20		20.47		
25	Café Block B 2F				21.10		20.38		
26	Café Block B 3F				20.97		20.25		
27	Café Block B 4F				20.80		20.09		
28	Café Block B 5F				20.61		19.92		
29	Café Block B 6F				20.41		19.73		

PM_{10} Annual Mean	2004	Source
AQS Objective (µg/m^3) 2004	40	UK Air Quality Strategy

Receptor Number	Receptor Name/Description	2008 baseline	2010 Baseline	2011 without development	2011 with development	2013 without development	2013 with development	2012 Change	2103 Change
Existing Receptors									
1	37 Newmarket Road	23.40	22.41	22.15	22.16	21.72	21.73	0.01	0.01
2	51 Newmarket Road	23.25	22.29	22.04	22.07	21.61	21.64	0.03	0.03
3	13 Abbey Road	23.72	22.69	22.44	22.45	22.00	22.03	0.01	0.03
4	119 Newmarket Road	25.08	23.90	23.56	23.58	23.08	23.10	0.02	0.02
5	Newmarket Continuous Monitor	24.86	23.72	23.36	23.37	22.90	22.91	0.01	0.01
6	231 Newmarket Road	24.10	22.99	22.69	22.74	22.23	22.24	0.05	0.01
7	76 Riverside	23.07	22.12	21.89	21.89	21.47	21.50	0.00	0.03
8	3 Abbey Road	24.64	23.51	23.21	23.23	22.73	22.76	0.02	0.03
9	5 Abbey Road	24.54	23.42	23.13	23.15	22.65	22.68	0.02	0.03
Proposed Receptors									
14	SE Corner Block A GF				22.32		21.89		
15	SE Corner Block A 1F				22.22		21.81		
16	SE Corner Block A 2F				22.09		21.67		
17	SE Corner Block A 3F				21.94		21.54		
18	NE Corner Block C GF				22.07		21.67		
19	NE Corner Block C 1F				21.99		21.59		
20	NE Corner Block C 2F				22.05		21.65		
21	NE Corner Block C 3F				21.95		21.55		
22	NE Corner Block C 4F				22.02		21.62		
23	Café Block B GF				21.65		21.26		
24	Café Block B 1F				21.64		21.26		
25	Café Block B 2F				21.63		21.25		
26	Café Block B 3F				21.61		21.23		
27	Café Block B 4F				21.59		21.21		
28	Café Block B 5F				21.57		21.19		
29	Café Block B 6F				21.54		21.17		

PM_{10} Daily Mean	2004	Source
AQS Objective days allowed in exceedences per annum (50 µg/m^3)	35	UK Air Quality Strategy

Receptor Number	Receptor Name/Description	2008 baseline	2010 Baseline	2011 without development	2011 with development	2013 without development	2013 with development	Change	Change
Existing Receptors									
1	37 Newmarket Road	9	7	7	7	6	6	0	0
2	51 Newmarket Road	9	7	6	6	6	6	0	0
3	13 Abbey Road	10	8	7	7	6	6	0	0
4	119 Newmarket Road	13	10	9	9	8	8	0	0
5	Newmarket Continuous Monitor	12	10	9	9	8	8	0	0
6	231 Newmarket Road	10	8	8	8	7	7	0	0
7	76 Riverside	8	7	6	6	5	5	0	0
8	3 Abbey Road	12	9	8	9	8	8	1	0
9	5 Abbey Road	11	9	8	8	7	8	0	1
Proposed Receptors									
14	SE Corner Block A GF				7		6		
15	SE Corner Block A 1F				7		6		
16	SE Corner Block A 2F				6		6		
17	SE Corner Block A 3F				6		6		
18	NE Corner Block C GF				6		6		
19	NE Corner Block C 1F				6		6		
20	NE Corner Block C 2F				6		6		
21	NE Corner Block C 3F				6		6		
22	NE Corner Block C 4F				6		6		
23	Café Block B GF				6		5		
24	Café Block B 1F				6		5		
25	Café Block B 2F				6		5		
26	Café Block B 3F				6		5		
27	Café Block B 4F				6		5		
28	Café Block B 5F				6		5		
29	Café Block B 6F				6		5		

Appendix G Model verification calculations

Project: **Brunswick Site**
Project No. **12266636-002**
Year **2006**

Roadside total monitored NO_2 concentration	=	31	**$[NO_2]$TotMon**	
Roadside total monitored NOx concentration	=	62	**$[NO_X]$TotMon**	181.9
Background NO_x	=	31.65	**$[NO_X]$Bkgd**	
Background NO_2	=	20.6	**$[NO_2]$Bkgd**	
Modelled Roadside NO_x Concentration	=	7.1	**$[NO_X]$RoadsMod**	

$[NO_X]$TotMon	-	**$[NO_X]$Bkgd**	=	**$[NO_X]$RoadsMon**
62	-	31.65	=	30.35

$[NO_2]$TotMon	-	**$[NO_2]$Bkgd**	=	**$[NO_2]$RoadsMon**
31	-	20.6	=	10.4

Step 2: Determine Adjustment Factor for the modelled roadside contribution

$[NO_X]$RoadsMon	/	**$[NO_X]$RoadsMod**	=	**NO_x[AdjustmentRoadsMod]**
30.35	/	7.1	=	4.274648

Therefore, all modelled roads contributions should be multiplied by 4.27465 to give the corrected modelled contribution, **NO_x[CorrRoadsMod]**

NOx[CorrRoadsMod]	=	**$[NO_X]$RoadsMod**	x	**NO_x[AdjustmentRoadsMod]**
30.35	=	7.1	x	4.27

Post 2003 Outside Greater London

Step 3: Calculate Factor F (proportion of NO_x converted to NO_2)

F = -0.0719* ln([NO_X]TotMon) + 0.6248
= 0.30

Step 4: Calculate modelled roadside NO_2 contribution (µg/m^3)

$[NO_2]$RoadsMod	=	**NOx[CorrRoadsMod]**	x	**F**
9.1	=	30.35	x	0.30

Step 5: Calculate final NO_2 concentration (µg/m^3)

$[NO_2]$TotMod	=	**$[NO_2]$RoadsMod**	+	**$[NO_2]$Bkgd**
29.7	=	9.1	+	20.6

Newmarket Diffusion Tube

Monitored NO_2 conc at receptor in 2006	43
Assumed background NO_2 in 2006	20.6
Assumed background NO_x in 2006	31.65
Modelled conc NO_x at rec in 2006 base case	9.56
Assuming LAQM.TG(03) NO_x to NO_2 conversions	
Required NO_2 (road)	22.40
Required modelled NO_x to get monitored conc	78.05
Validated NO_2 (road)	22.40

Calculated validation factor	8.17

East Road Diffusion Tube

Monitored NO_2 conc at receptor in 2006	34
Assumed background NO_2 in 2006	20.6
Assumed background NO_x in 2006	31.65
Modelled conc NO_x at rec in 2006 base case	6.53
Assuming LAQM.TG(03) NO_x to NO_2 conversions	
Required NO_2 (road)	13.40
Required modelled NO_x to get monitored conc	42.5
Validated NO_2 (road)	13.40

Calculated validation factor	6.50

Average Validation Factor	6.32

Appendix H Significance criteria used in the assessment

Significance criteria used in the assessment

The following criteria relate to changes in annual mean NO_2 and PM_{10} concentrations resulting from the development.

Significance criteria	Definition
NEUTRAL	The development causes no change in concentrations.
NO SIGNIFICANT IMPACT	The development gives rise to a SMALL change in concentrations and NO EXCEEDENCES of the objectives are predicted.
A MINOR ADVERSE IMPACT	The development gives rise to a SMALL increase in concentrations and EXCEEDENCES of the objectives are predicted with the development in place, or The development gives rise to a MODERATE increase in concentrations but NO EXCEEDENCES of the objectives are predicted.
A MODERATE ADVERSE IMPACT	The development gives rise to a MODERATE increase in concentrations and EXCEEDENCES of the objectives are predicted with the development in place, or The development gives rise to a LARGE increase in concentrations but NO EXCEEDENCES of the objectives are predicted.
A MAJOR ADVERSE IMPACT	The development gives rise to a LARGE increase in concentrations and EXCEEDENCES of the objectives are predicted.
A MINOR BENEFICIAL IMPACT	The development gives rise to a SMALL decrease in concentrations and EXCEEDENCES of the objectives are predicted, or The development gives rise to a MODERATE decrease in concentrations but NO EXCEEDENCES of the objectives are predicted.
A MODERATE BENEFICIAL IMPACT	The development gives rise to a MODERATE decrease in concentrations and EXCEEDENCES of the objectives are predicted, or The development gives rise to a LARGE decrease in concentrations but NO EXCEEDENCES of the objectives are predicted.
A MAJOR BENEFICIAL IMPACT	The development gives rise to a LARGE decrease in concentrations and EXCEEDENCES of the objectives are predicted.

Where the magnitude of changes in concentration have been defined as follows:

A SMALL change is a change of less than 1$\mu g/m^3$ (or less than 2.5% of the standard)

A MODERATE change is a change of ≥ 1 to <4$\mu g/m^3$ (or ≥ 2.5% to <10% of the standard)

A LARGE change is a change of greater than or equal to ≥ 4$\mu g/m^3$ (or ≥ 10% standard)

An EXCEEDENCE is defined as a concentration that is predicted to be above the standard (40$\mu g/m^3$) in, or after the objective achievement year (2005 for NO_2 and 2004 for PM_{10}) at a location where members of the public are likely to be exposed over the averaging period (1 year).

REPORT COMPILED BY WSP

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