Edge Lane Retail Park, Liverpool Air Quality Assessment Report

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Derwent Holdings

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Contents

EXECUTIVE SUMMARY 1

1 Introduction 2

1.1 Objectives 2

1.2 Description of the Proposed Development 3

1.3 Local Environment 3

2 Legislative Background and Guidance 5

2.1 Air Quality (England) Regulations 2000 and Air Quality (England) Amendment Regulations 2002 5

2.2 Planning Policy Statement 23 (PPS23): Planning and Pollution Control 6

2.3 The Environmental Protection Act 1990 (EPA) 7

2.4 Best Practice Guidance: Control of Dust Emissions from Construction Activities . 7

3 Assessment Methodology 9

3.1 Assessment Year 9

3.2 Analysis of Traffic Data 9

3.3 Definition of the Study Area 9

3.4 Identification of Relevant Receptors of Public Exposure 9

3.5 Characterisation of Baseline Conditions 10

3.6 Identification of Hot Spot Locations 10

3.7 Background Concentrations 10

3.8 Monitoring Data 11

3.9 Construction Impacts on Local Air Quality 13

3.10 Operation Impacts on Local Air Quality 16

4 Baseline Conditions 20

4.1 Selected Relevant Receptors of Public Exposure 20

4.2 Local Air Quality Management Findings 22

4.3 Background Concentrations 22

4.4 Local Air Quality Monitored Concentrations 23

5 Results 25

5.1 Construction Phase 25

5.2 Construction Site Proposed Mitigation Measures 28

5.3 Operation Phase 35

6 Conclusions 42

6.1 Construction Phase 42

6.2 Operation Phase 42

6.3 Overall Impacts on Local Air Quality 43

7 References 44

8 Appendices 45

8.1 Appendix A - Proposed Development Layout (Provided by DPP) 46

8.2 Appendix B - Summary of Health Effects of NO_2 and PM_{10} 47

8.3 Appendix C - Traffic Data and Detailed Modelling Procedures 48

8.4 Appendix D - Meteorological Data 54

Figures

Figure 1 - Location of the Proposed Development 4
Figure 2 - Locations of the Diffusion Tubes within the Study Area (Liverpool City Counci Survey) 12
Figure 3 - Location of Representative Sites of Relevant Receptors (including Sensitive Receptors) 21
Figure 4 - Construction Phase Estimated Impact Magnitude Bands (Pre Mitigation Controls) 27
Figure 5 - Construction Phase Estimated Impact Magnitude Bands (Post Mitigation Controls) 34
Figure 6 - Modelled Annual Mean NO_2 Concentrations in 2016 within the Study Area (Relevant Receptors) - DM and DS Scenarios 37
Figure 7 - Modelled Annual Mean PM_{10} Concentrations in 2016 within the Study Area (Relevant Receptors) - DM and DS Scenarios 40
Figure 8 - 2008 Wind Rose for Liverpool John Lennon Airport Meteorological Station 54

Tables

Table 1 - Relevant Air Quality Objectives 5
Table 2 - Description of Local Authorithy Monitoring Sites Considered for Model Verification..... 11
Table 3 - Best Practice Guidance Construction Dust Risk Classification 15
Table 4 - Construction Impact Magnitude Categories (Source: Mouchel) 16
Table 5 - Location and Description of Representative Locations of Relevant Receptors............. 20
Table 6 - Average Background Concentrations across the Study Area (µg/m^3)........................... 22
Table 7 - Locations of Continuous Monitoring Sites.. 23
Table 8 - Continuous NO_2 Monitoring Data (2008) 23
Table 9 - Continuous PM_{10} Monitoring Data 24
Table 10 - Diffusion Tube Monitoring - Annual Mean NO_2 Concentrations Measured by Liverpool in 2008.. 24
Table 11 - Summary of Annual Mean NO_2 Concentrations in 2016 for the DM and DS Scenarios 35
Table 12 - Summary of Annual Mean PM_{10} Concentrations in 2016 for the DM and DS Scenarios 38
Table 13 - Summary of Traffic Characteristics Data 49
Table 14 - Model Adjustment Factor 53

EXECUTIVE SUMMARY

Mouchel Limited has been commissioned by Derwent Holdings to undertake an Air Quality Assessment in support of their planning application for a proposed retail park at Edge Lane, Liverpool.

The current report evaluates the air quality conditions registered in the Baseline Year (2008) and estimates the likely contributions of the proposed development to local air quality in the Assessment Year (2016).

The main sources of local pollution associated with the construction phase are those of fugitive dust emissions arising from demolition, excavation and materials storing and handling activities. The main sources of pollution arising from the operation phase are those of road traffic emissions arising from vehicles accessing and parking at the Site.

Available local diffusion tube monitoring data provided by Liverpool City Council (LCC) were analysed and used for model verification purposes. Advanced air dispersion modelling was used in the assessment undertaken taking into account the effects of the car park and likely changes in traffic characteristics associated with the proposed development. The proposed development is located within an Air Quality Management Area (AQMA) and representative locations of worst case receptors were modelled to produce conservative results.

The construction site was classified as a high risk site with relevant receptors identified as being exposed to major magnitude impacts. Therefore, a series of hard and soft measures are recommended to reduce the magnitude of these. Once such mitigation controls are implemented it is estimated that the majority of the receptors will fall under either the minor or moderate impact magnitude categories.

Analysis of the modelled results indicates that exceedences of the Annual Mean Air Quality Objective for nitrogen dioxide (NO_2) and particulate matter (PM_{10}) for both the Do-Minimum and Do-Something Scenarios in the Assessment Year (2016) are unlikely.

Overall, this Air Quality Assessment indicates that the proposed development is likely to be compliant with the national and European Air Quality Objectives and Limit Values and as such, there are no air quality reasons to prevent the local planning authority from granting planning permission.

1 Introduction

1.1 Objectives

Mouchel Limited has been commissioned by Derwent Holdings to undertake an Air Quality Assessment (AQA) in support of their planning application for a proposed redevelopment retail park at Edge Lane, Liverpool.

This assessment will be undertaken in accordance with the Department for Environment, Food and Rural Affairs' (Defra) current Technical Guidance on Local Air Quality Management (Defra, 2009) and covers air quality impacts associated with the proposed development in regards to both the construction and operation phases.

The proposed development may have a temporary effect on local air quality during construction. Demolition activities, earth-moving works and the storage of aggregates at Site pose the highest risk with respect to the occurrence of 'nuisance dust'. These activities increase the risk of dust entrainment and possible nuisance occurrence from increased deposition to surrounding surfaces. The assessment of construction phase impacts focuses on likely impacts of airborne and deposited particulate matter in the vicinity of the proposed development Site. Potential mitigation measures are also recommended.

Changes in local traffic flow characteristics resulting from the operation of the proposed development may have an impact on air quality. Vehicle exhausts contain a number of air pollutants. The quantities of each pollutant emitted depend upon the type and quantity of fuel used, engine size, speed of the vehicle and the type of emissions abatement equipment fitted. Therefore changes in traffic flow characteristics may result in changes in pollutant concentrations at properties near to roads affected by the proposed development.

Finally, the operation of a car park may equally have an effect on local air quality and will be assessed in the exercise.

The pollutants NO_x/NO_2 and PM_{10} are the main pollutants with relevance for local air quality and will be evaluated in the current assessment.

The potential impact of the development on local air quality will be assessed on the basis of the findings of advanced dispersion modelling (ADMS-Roads) calculations to be undertaken in the context of relevant national and European Air Quality Objectives and Limit values (described in Section 2) and relevant guidance.

1.2 Description of the Proposed Development

The proposed Site works consist of the demolition of the existing Edge Lane Retail Park and construction of a retail park comprising retail and leisure units at Edge Lane, Liverpool.

The proposed development lies within Liverpool City Council (LCC) and is situated along the Edge Lane Central corridor between Rathbone Road and the former Marconi complex.

The proposed development will comprise a 75,661 m^2 gross internal area of retail and leisure units, with associated car parking facilities. There are a total of 1,795 car parking spaces proposed for the development. A layout drawing of the proposed development is provided in Appendix A.

1.3 Local Environment

The Site is approximately 21.5 ha and is located approximately 4 km to the west of the Liverpool City Centre. The immediate local highway network comprises major trunk roads including A5047 (Edge Lane), A5080 (Edge Lane Drive) which leads to M62 (1.7 km west of the Site).

The nearest bus stop to the Site is adjacent to the Site entrance at Edge Lane. This bus stop is served by a variety of bus service providers which operate frequent bus services to the existing retail and leisure park from various areas across the City.

The development Site is located within an Air Quality Management Area (AQMA) declared by LCC in 2005 for exceedences of the Annual Mean NO_2 objective.

Figure 1 presents the location of the proposed development in Liverpool.

Client: Derwent Holdings	Description: Location of the Proposed Development	Google Earth Data SIO, NOAIA, U.S.Navy, NGA, GEBCO © 2010 Tele Atlas © 2010 Infoterra Ltd & Bluesky	Design	AS	27/09/2010	mouchel
			Drawn	AS	27/09/2010	
Rev: A / Description: FINAL	Project: Edge Lane Retail Park, Liverpool		Checked	MIC	27/09/2010	Figure 1
			Approved	AG	27/09/2010	Scale: Not to Scale

Figure 1 - Location of the Proposed Development

2 Legislative Background and Guidance

2.1 Air Quality (England) Regulations 2000 and Air Quality (England) Amendment Regulations 2002

The UK Government and the devolved administrations published the latest Air Quality Strategy for England, Scotland, Wales and Northern Ireland in July 2007 (Defra, 2007a) defining both standards and objectives for each of a range of air pollutants.

The 'standards' are set as concentrations below which health effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of a particular pollutant.

The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of the costs, benefits, feasibility and practicality of achieving the standards. The objectives are prescribed within The Air Quality (England) Regulations 2000 (Stationery Office, 2000) and The Air Quality (England) (Amendment) Regulations 2002 (Stationery Office, 2002) (termed the 'Regulations'). Air Quality Objectives included in the Regulations and current legislation which are relevant to the current study (NO_2 and PM_{10}) are outlined in Table 1.

Table 1 - Relevant Air Quality Objectives

Pollutant	Air Quality Objective		To be achieved by:
	Concentration	Measured as	
Nitrogen Dioxide (NO_2)			
All UK	200 µg/m^3, not to be exceeded more than 18 times a year	1 Hour Mean	31 December 2005
	40 µg/m^3	Annual Mean	31 December 2005
Particulate Matter (PM_{10}) (gravimetric)			
All UK	50 µg/m^3, not to be exceeded more than 35 times a year	24 Hour Mean	31 December 2004
	40 µg/m^3	Annual Mean	31 December 2004

Appendix B provides a brief summary of the health effects of NO_2 and PM_{10}.

The Air Quality Objectives only apply where members of the public are likely to be regularly present for the averaging time of the objective (i.e. where people will be exposed to pollutants).

The Annual Mean objectives apply to all locations where members of the public might be regularly exposed; these include building façades of residential properties, schools, hospitals, care homes etc. The 24 Hour Mean objective applies to all locations where the Annual Mean objective would apply, together with hotels and gardens of residential properties[1]. The 1 Hour Mean objective also applies at these locations as well as at any outdoor location where a member of the public might reasonably be expected to stay for 1 hour or more, such as shopping streets, parks and sports grounds, as well as bus stations and railway stations that are not fully enclosed.

Measurements across the UK have shown that the 1 Hour Mean NO_2 objective is unlikely to be exceeded unless the Annual Mean NO_2 concentration is greater than 60 µg/m^3 (Laxen and Marner, 2003). Thus exceedences of 60 µg/m^3 as an Annual Mean NO_2 concentration are used as an indicator of potential exceedences of the 1 Hour Mean NO_2 objective.

Similarly, studies (Defra, 2003) have also established a relationship between the Annual Mean PM_{10} concentration and number of exceedences of the 24 hour objective: those areas where the Annual Mean concentrations is greater than 32 µg/m^3 were demonstrated to be at risk of exceeding the 24 hour objective. Thus exceedences of 32 µg/m^3 as an Annual Mean PM_{10} concentration are used as an indicator of potential exceedences of the 24 Hour Mean PM_{10} objective.

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

PPS23 is guidance which covers planning and pollution control and new development in England. 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. Annex 1, Paragraph 1.48 states…

"planning conditions could be used in respect of […] impacts such as noise, vibrations, odour, air pollutants and dust from certain phases of the development such as demolition and construction".

(ODPM, 2004)

[1] Such locations should represent parts of the garden where relevant public exposure is likely, for example where there are seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied.

2.3 The Environmental Protection Act 1990 (EPA)

Dust and air pollution, can cause nuisance affecting properties and the public adjacent to a construction Site and can also adversely affect other environmental receptors including watercourses and ecological receptors. In addition there are statutory objectives in relation to NO_2 and PM_{10} which have known health impacts.

The EPA (Section 79, Chapter 43, Part III - Statutory Nuisances and Inspections) contains a definition of what constitutes a “statutory nuisance” with regard to dust, and places a duty on Local Authorities to detect any such nuisances within their area. Section 79 of the Act further defines “Best Practicable Means” (BPM) as…

“reasonably practical having regard, among other things, to local conditions and circumstances, to the current state of technical knowledge and to the financial implications”.

(EPA, 1990)

It also defines a number of factors relating to dust and air pollution which constitute a statutory nuisance. This includes:

i. smoke emitted from premises so as to be prejudicial to health or a nuisance;

ii. fumes or gases emitted from premises so as to be prejudicial to health or a nuisance;

iii. any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance; and

iv. any accumulation or deposit which is prejudicial to health or a nuisance.

Local Authorities have the power under Section 80, Chapter 43, Part III of the EPA (Summary Proceedings for Statutory Nuisances) to serve an abatement notice requiring the abatement of a nuisance or requiring works to be executed to prevent their occurrence. Generally, if something is unreasonable to an average person, a court might decide that it is a nuisance. A typical example of statutory nuisance is dust produced by construction activities.

2.4 Best Practice Guidance: Control of Dust Emissions from Construction Activities

The Greater London Authority and London Councils published this Best Practice Guidance document in November 2006 (London Councils, 2006).

While it is specifically aimed at developments in London, it is the most comprehensive guidance document available, and the Environment Agency (EA) and others are encouraging its use across the country. The basic principles to be applied in the selected approach are the targeted prevention, suppression and containment of emissions. This document is used in line with Annex 1 of the Minerals Policy Statement 2 (OPDM, 2005) which gives examples of reducing and controlling dust, and outlines good practice in dust assessment.

These documents together with Mouchel's professional judgement were used to localise and evaluate the potential construction impacts associated with the proposed development.

3 Assessment Methodology

3.1 Assessment Year

Assessment has been undertaken for the Baseline Year (2008) and the Assessment Year (2016). The associated scenarios were as follow:

- 2008 Baseline for model verification and adjustment purposes;
- 2016 Do-Minimum (DM); and
- 2016 Do-Something (DS).

The DM scenario includes 2008 Baseline traffic flows factored for local growth to 2016, and includes traffic associated with the existing use of the Site.

The DS scenario includes 2008 Baseline traffic flows factored for local growth to 2016, and includes changes to traffic associated with the proposed redevelopment of Edge Lane Retail Park.

3.2 Analysis of Traffic Data

Traffic data including daily flows, speed information and composition were analysed and processed for the Baseline and Assessment Year for the DM and DS scenarios. These comprised:

i. annual average daily traffic flows (AADT, combined – vehicle/day) for relevant links;
ii. the percentage of Heavy Duty Vehicles (vehicles > 3.5t GVW (HDVs)) on each of the roads for each year modelled;
iii. road type; and
iv. speed limits.

3.3 Definition of the Study Area

The full extent of the study area was defined by drawing a buffer of 200m around all the roads within the traffic network for the proposed development. These were considered to be relevant for the Air Quality Assessment undertaken.

3.4 Identification of Relevant Receptors of Public Exposure

The Air Quality Regulations require that likely exceedences of Air Quality Objectives are assessed in relation to:

"…the quality of the air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present…".

(Stationery Office, 2000 and 2002)

Existing and planned properties where people might experience a change in local air quality within 200m of the relevant roads with clear identification of properties hosting susceptible groups of the public (establishment of locations of any receptors that may be sensitive to changes in air quality during the construction and operation phases of the development - e.g. schools, hospitals, homes for the elderly, residential properties, etc.) were identified. Representative receptors of such locations were subsequently selected and used in the model.

3.5 Characterisation of Baseline Conditions

The identification of baseline air quality conditions in and around the proposed development included:

i. review of LAQM information - evaluation of the most recent LAQM Assessment Reports to ascertain the existence, location and extent of any AQMAs and ascertain air quality trends in the study area;

ii. analysis of local air quality monitoring data - this entailed obtaining and reviewing of local pollutant monitoring data held by the Local Authority. Local Authority and National AURN (Automatic Urban and Rural Network) monitoring data for NO_2 and PM_{10} were analysed for location and type of station, pollutant measured, data capture, validity and values recorded; and

iii. background concentrations - this comprised the review of estimated Annual Mean background pollutant concentrations for the Baseline Year 2008 and Assessment Year 2016.

3.6 Identification of Hot Spot Locations

Areas likely to experience higher-than-average pollution concentrations, such as roundabouts and junctions, were identified.

3.7 Background Concentrations

Background concentrations of NO_2 and PM_{10} within the study area for the Baseline Year (2008) and Assessment Year (2016) have been derived from national maps (1 km x 1 km spatial resolution) of Annual Mean background concentrations. These maps were downloaded from the Defra Local Air Quality Management webpage[2].

[2] Defra LAQM webpage - http://www.defra.gov.uk/environment/quality/air/airquality/local/support/

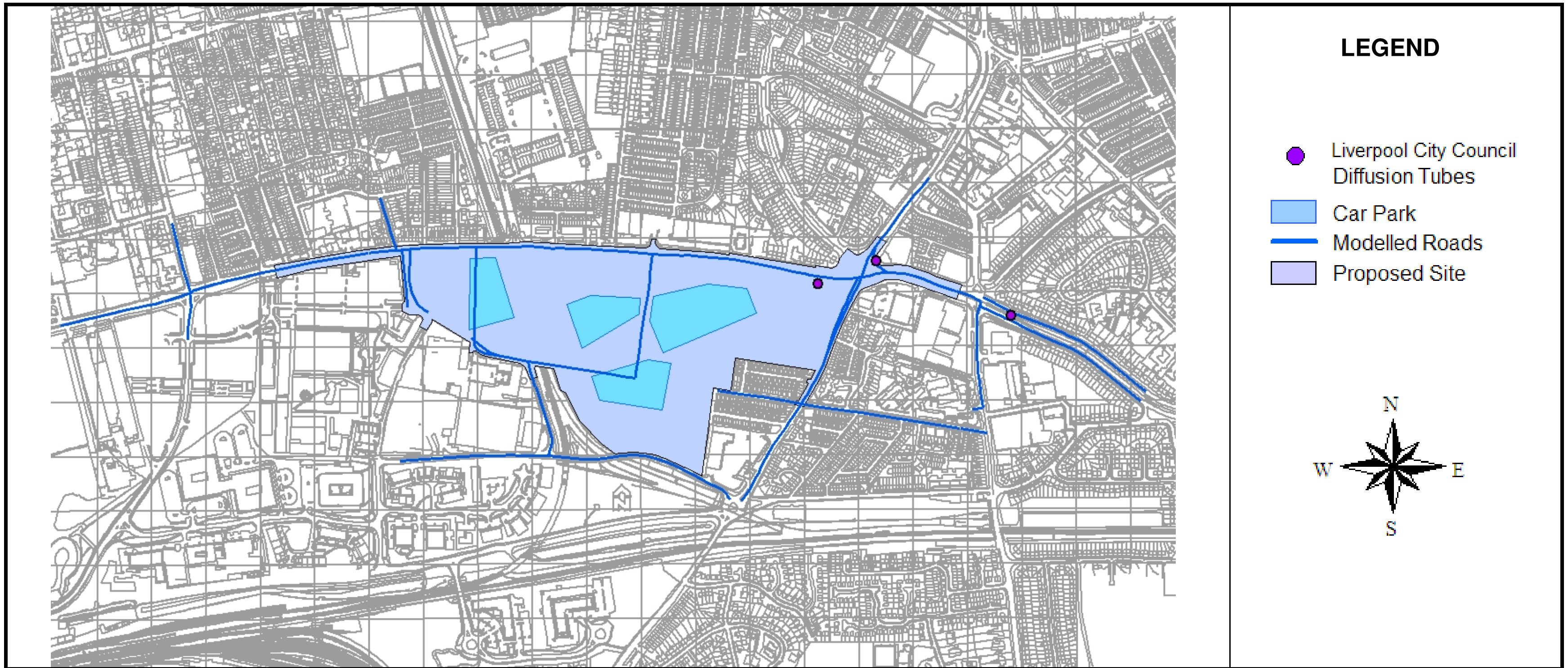
Total background concentrations from the Defra were disaggregated to provide relative contributions from different sources. The contributions of emissions from all sources have been included in the background concentrations for the purpose of this assessment. This conservative approach has been taken as not all roads within background grids were included in our model.

3.8 Monitoring Data

Liverpool City Council manages a network of diffusion tube monitoring NO_2 concentrations in the City area. Three of these locations were close to the Site and were analysed for model verification purposes. Table 2 and Figure 2 present the description and location of these sites.

Table 2 - Description of Local Authorithy Monitoring Sites Considered for Model Verification

Site Number	Site Description	Site Type	X (m)	Y (m)
B12	Edge Lane / Rathbone Road Jct	Roadside	339023	390715
B13	Edge Lane Drive / Mill Lane	Roadside	339381	390656
B59	St Oswald's Street / Paraffin Oil Shop	Roadside	339132	390759
B60	St Oswald's Street / Paraffin Oil Shop	Roadside	339132	390759
B61	St Oswald's Street / Paraffin Oil Shop	Roadside	339132	390759
Note: - St Osward Street is a triplicate co-location site - B13 is located in the central reservation of Edge Lane				



Client: Derwent Holdings	Description: Locations of the Diffusion Tube within the Study Area (Liverpool City Council Survey)	This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. © Crown Copyright. Licence number 100020449 Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.	Design	AS	28/09/2010	mouchel
			Drawn	AS	28/09/2010	
Rev: A / Description: FINAL	Project: Edge Lane Retail Park, Liverpool		Checked	MIC	28/09/2010	Figure 2
			Approved	AG	28/09/2010	Scale: Not to Scale

Figure 2 - Locations of the Diffusion Tubes within the Study Area (Liverpool City Counci Survey)

3.9 Construction Impacts on Local Air Quality

During the construction phase, there will be a number of activities undertaken that have the potential to generate and/or re-suspend dust and PM_{10} / $PM_{2.5}$. At the time of assessment the exact activities to be undertaken during construction are unknown. In order to evaluate the magnitude and extent of potential adverse impacts likely to result from the proposed development the following construction activities have therefore been assumed:

i. site clearance and preparation;

ii. storage of materials;

iii. laying of hard surfaces; and

iv. landscaping.

The likely impacts on local air quality associated with the construction phase of the development were evaluated through the following steps:

3.9.1 Evaluation of Value or Sensitivity of Receptors

The value or sensitivity of the affected receptors is measured by their sensitivity to changes in particulate matter and dust levels in the ambient air. If the area is already heavily polluted, it is likely to have a high sensitivity to dust emissions.

This variable was not assessed in the current exercise as there were no dust deposition monitoring data available nor a register of complaints with reference to the study area. All receptors within the 200m of the construction area were therefore considered to have the same value (sensitivity level).

3.9.2 Magnitude of Impacts

The magnitude of potential impacts of a construction site on air quality is mainly determined by its size, the range of activities undertaken across the site, proximity to sensitive receptors, prevailing wind direction, complexity of terrain and any barriers between sources and receptors. These are addressed in turn in the following sub-sections.

3.9.2.1 Prevailing Wind Conditions

Meteorological data for 2008 from Liverpool John Lennon Airport meteorological station was assumed representative of the study area and analysed for wind speed and direction. A wind rose was produced to ascertain the likelihood of receptors to be affected by dust resulting from construction activities.

3.9.2.2 Barriers Between Emission Sources and Receptors

The existence and location of any barriers between emission sources and receptors was ascertained and evaluated. This enabled the evaluation of risk of nuisance associated with downwind emissions and the selection of suitable mitigation measures wherever such need was identified.

3.9.2.3 Analysis of Distance Bands from Source to Near-by Receptors

Distance bands were created from the boundaries of the site to account for likelihood of levels of dust and PM_{10} / $PM_{2.5}$ originated by construction related activities. The distance classes considered were 0-50m, 50-100m, 100-200 and >200m. These distance bands were then combined with the magnitude of construction risks and prevailing wind conditions of the site to ascertain the order of significance of the estimated impacts associated with the construction activities of the proposed development.

3.9.3 Magnitude of Construction Risks

Best Practice guidance issued by the London Councils (London Councils, 2006) provides guidelines that allow the evaluation of potential risk of air quality impacts occurring during the demolition or construction of a site. A summary of these details is presented in Table 3.

Table 3 - Best Practice Guidance Construction Dust Risk Classification

Risk Category	Criteria
Low Risk Site (Small Developments)	Development of up to 1,000 square metres of land; or
	Development of one property and up to a maximum of ten; or
	Potential for emissions and dust to have an infrequent impact on sensitive receptors.
Medium Risk Site (Medium Sized Developments)	Development of between 1,000 and 15,000 square metres of land; or
	Development of between ten and 150 properties; or
	Potential for emissions and dust to have an intermittent or likely impact on sensitive receptors.
High Risk Site (Large Developments or Developments of Strategic Importance)	Development of greater than 15,000 square metres of land; or
	Development of greater than 150 properties; or
	Major development referred to Central Government; or
	Major development as defined by the Local Planning Authority; or
	Potential for emissions and dust to have a significant impact on sensitive receptors.

These guidelines were designed to be applied in London, which is very densely built and often has multiple construction sites in close proximity. As such professional judgment has to be applied to these criteria in order to ensure that the risk evaluation reflects site specific characteristics.

3.9.4 Estimation of Magnitude of Impacts

Based on the London Councils' guidance and the spatial extent of effects, the Impact Criteria detailed in Table 4 have been developed by Mouchel for assessment of construction phase impacts.

Table 4 - Construction Impact Magnitude Categories (Source: Mouchel)

		Risk from Development		
		Low	**Medium**	**High**
Distance to Receptors	>200m	Outside zone of influence	Outside zone of influence	Outside zone of influence
	100 - 200m	Negligible	Minor	Moderate
	50 - 100m	Minor	Moderate	Major
	0 - 50m	Moderate	Major	Major

The 200m distance criterion is based on the distance beyond which no significant impacts are expected from construction activities (HA, 2007). The 100m distance criterion is based on guidance which identifies that the majority of dust is deposited within 100m of the emission source (Minerals Policy Statement, 2005). The 50m criterion is based on a study showing that half of people living beside road works were bothered by construction nuisance (OPDM, 2005).

Further than 200m is generally considered to be outside of the zone of influence; however there is still the possibility that nuisance may occur during atypical meteorological conditions.

The impact criteria were used to identify possible mitigation measures appropriate for dust management purposes during the construction phase of the proposed development. Allowance was made for the number of receptors per distance band and the prevailing wind direction when control or mitigation measures were being considered based on these impact criteria.

3.10 Operation Impacts on Local Air Quality

This assessment considered the combined impacts of road traffic and car park emissions on local air quality at representative relevant receptors.

3.10.1 Traffic Data

In this report the 2008 and 2016 traffic flow data were provided by Sanderson Associates. These traffic data were provided in the form of two ways AADT and with number of HDVs for Baseline, DM and DS scenarios. Speed limits were also used.

Traffic data were used as input to the ADMS-Roads model for the Baseline Year and Assessment Year for DM and DS scenarios. Details on traffic data used in the current assessment are provided in Appendix C.

3.10.2 Car Park

The proposed redevelopment will provide a total of 1,795 car parking spaces. The emissions associated with large existing car parks in the study area and the proposed new store car park were modelled assuming the car park surface as an area source in the ADMS-Roads. Details on car park input data used in the current assessment are provided in Appendix C.

3.10.3 Selection of Relevant Receptors

The assessment focused on locations within 200m of the traffic network where members of the public are likely to be regularly present and are likely to be exposed to air pollution over the 'averaging-period' of the relevant Objectives. Particular attention was paid to the locations of the young, the elderly and other susceptible populations, such as schools and hospitals. In addition, properties in areas likely to experience potential exceedences of Air Quality Objectives were also identified.

The relevant receptors were identified using Google Earth/Map tools, mapped onto the Ordnance Survey base map using a Geographic Information System (GIS) and modelled to ascertain concentrations at these worst case locations.

3.10.4 Modelling

Annual Mean concentrations of NO_2 and PM_{10} during 2008 and 2016 have been modelled using the Atmospheric Dispersion Modelling System for Roads (ADMS-Roads) model. ADMS-Roads is one of the dispersion models accepted for modelling within the Government's Technical Guidance (Defra, 2009). The model has been run using a full year of meteorological data for 2008 from the Liverpool John Lennon Airport meteorological station which is approximately 9 km south of the development site. Appendix D presents the wind rose for the meteorological conditions modelled in the current assessment.

Concentrations have been modelled for both specific worst case relevant receptor locations and all the relevant sensitive receptors. The modelling methodology, and the input data (traffic data and car park emissions) utilised are described in further detail in Appendix B. The model was verified against local diffusion tube measurements and its performance evaluated to ascertain whether an adjustment of the results obtained was required.

LAQM.TG(09) does not provide a method for the conversion of (long term) Annual Mean NO_2 concentrations to (short term) 1 Hour Mean NO_2 concentrations. However, research has concluded that exceedences of the 1 Hour Mean NO_2 objective are unlikely to occur where Annual Mean concentrations do not exceed 60 µg/m^3. Where exposure to Annual Mean NO_2 concentrations are predicted to exceed 60 µg/m^3, the formula provided in LAQM.TG4(00)[3] is used to estimate equivalent 1 Hour Mean NO_2 concentrations.

The number of days predicted to exceed the 24 Hour Mean PM_{10} objective were analysed by using the empirical formula[4] provided in LAQM.TG(09). The formula indicates that the 24 Hour Mean PM_{10} objective is unlikely to be exceeded if Annual Mean concentrations are less than 32 µg/m^3. Predicted Annual Mean concentrations were compared against this threshold in order to consider likelihood exceedence of the 24 Hour Mean PM_{10} objective.

3.10.5 Uncertainty

There is an element of uncertainty in all measured and modelled data. All values presented in this report are the best possible estimates, but uncertainties in the results might cause over-predictions or under-predictions. All of the measurements presented in this report have an intrinsic margin of error. Defra (2009) suggest that this is of the order of plus or minus 20% for diffusion tube data and plus or minus 10% for automatic measurements. The model results rely on traffic count data, and predictions of future traffic flows, and thus any uncertainties inherent in these data will carry into this assessment.

There will be additional uncertainties introduced because the modelling has simplified real-world processes into a series of algorithms. For example, it has been assumed that:

i. during each year, the vehicle fleet within the study area will conform to the national (UK) average composition;

ii. the emissions per vehicle conform to the factors published in the last quarter of 2009 by DfT[5] ;

iii. wind conditions measured at the meteorological station during 2008 will occur throughout the study area during 2016; and

iv. the subsequent dispersion of emitted pollutants will conform to a Gaussian distribution over flat terrain.

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[3] Part IV of the Environment Act 1995: Local Air Quality Management LAQM.TG4(00) May 2000: Review and Assessment: Pollutant Specific Guidance.
[4] Figure 8.1: Relationship between the number of 24 Hour Mean exceedences of 50 µg/m^3 and the Annual Mean concentration (derived from UK Automatic Network Sites 1997-2001).
[5] http://www.dft.gov.uk/pgr/roads/environment/emissions/

An important step in the assessment is verifying the dispersion model against the measured data. By comparing the model results with measurements, data will be corrected for any under- or over-prediction.

The UK Government's Air Quality Expert Group (AQEG) has published a report on trends in primary NO_2 in the UK (AQEG, 2007).

This examines evidence that shows that while NO_x emissions have fallen in line with predictions made a decade previously, the composition of NO_x has, in some urban environments, changed. This may have caused NO_2 concentrations at some locations to fall less rapidly than was expected.

The latest guidance from Defra has been followed regarding NO_x to NO_2 relationships, but there is still uncertainty as to whether these relationships will continue to apply in 2016. Any effect is likely to be greatest close to major roads, where future concentrations may have been underestimated.

These limitations to the assessment should be borne in mind when considering the results set out in the following Sections. While the model should give an overall accurate picture, i.e. one without bias, there will be uncertainties for individual receptors. Clearly in future years the uncertainties are likely to be greater than they are now. The results are 'best estimates' and have been treated as such in the discussion.

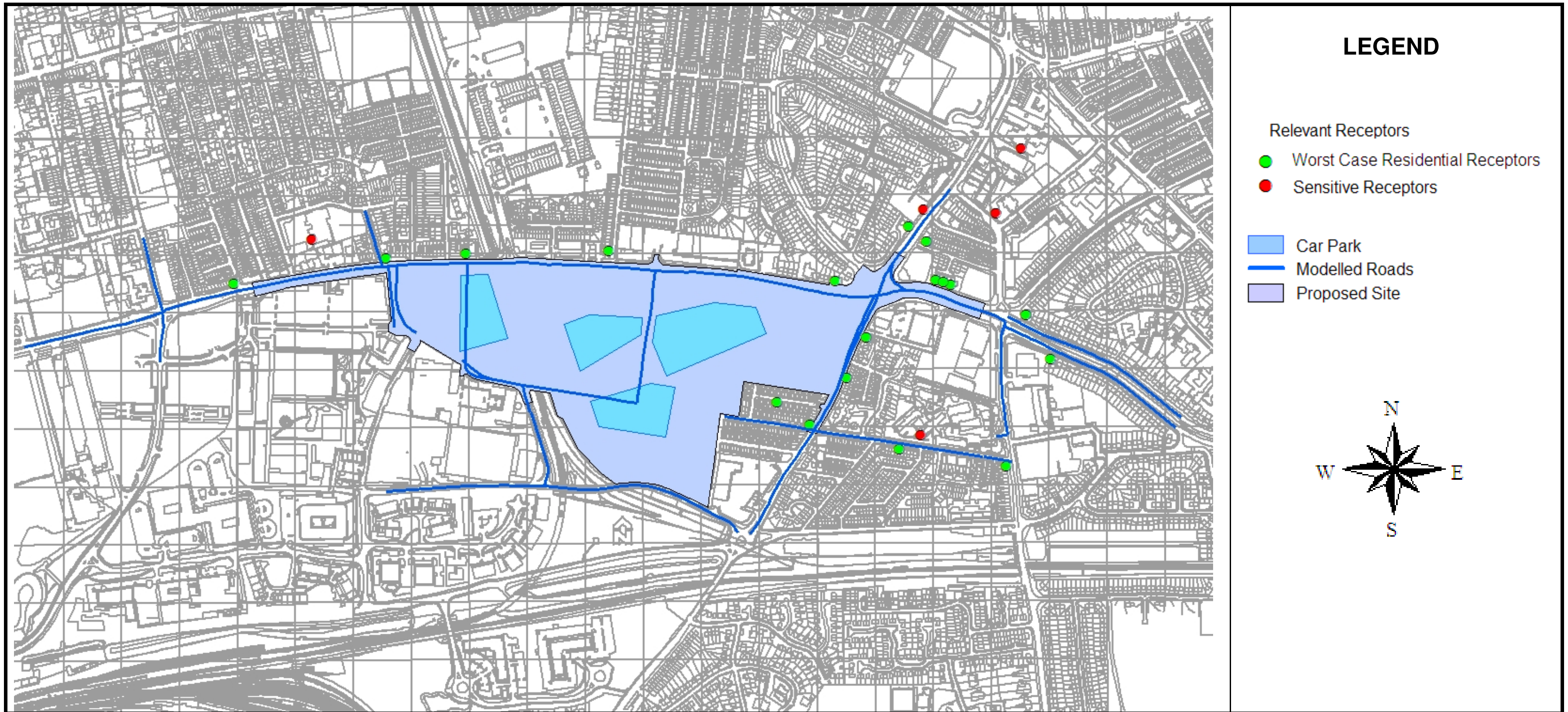
4 Baseline Conditions

4.1 Selected Relevant Receptors of Public Exposure

Overall 23 specific relevant receptors (including 5 known sensitive locations such as a health centre and schools) were identified and presented in Table 5 and Figure 3.

Table 5 - Location and Description of Representative Locations of Relevant Receptors

Receptor Number	Receptor Type	Receptor Location	X (m)	Y (m)
1	Residential	No 312 Rathbone Road	339083	390655
2	Residential	No 40 Edge Lane Drive	339405	390618
3	Residential	No 567 Edge Lane	339029	390753
4	Residential	No 2 Foxdell Close	339157	390849
5	Residential	No 71 St Oswald's Street	339188	390822
6	Residential	No 30 Macqueen Street	339204	390754
7	Residential	No 38 Macqueen Street	339231	390747
8	Residential	No 292 Rathbone Road	339049	390584
9	Residential	No 352 Binns Road	339141	390460
10	Residential	No 395 Edge Lane	338386	390800
11	Residential	No 333a Edge Lane	337981	390748
12	Residential	No 357 Edge Lane	338246	390793
13	Residential	No 122 Church Road	338635	390806
14	Residential	No 185 Rathbone Road	338986	390503
15	Residential	No 27 Oceanic Road	338928	390542
16	Residential	No 34 Macqueen Street	339217	390751
17	Residential	No 49 Edge Lane Drive	339361	390694
18	Residential	No 108 Mill Lane	339328	390430
19	Health Centre	Old Swan Health Centre	339183	390878
20	School	Phoenix Primary School	338118	390826
21	Hospital	Rathbone Hospital	339178	390485
22	School	St Oswald’s Junior School	339309	390870
23	School	St Oswald’s Infant School	339328	391012



Client: Derwent Holdings	Description: Location of Representative Sites of Relevant Receptors (including Sensitive Receptors)	This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. © Crown Copyright. Licence number 100020449 Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.	Design	AS	27/09/2010	mouchel
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Rev: A / Description: FINAL	Project: Edge Lane Retail Park, Liverpool		Checked	MIC	27/09/2010	Figure 3
			Approved	AG	27/09/2010	Scale: Not to Scale

Figure 3 - Location of Representative Sites of Relevant Receptors (including Sensitive Receptors)

4.2 Local Air Quality Management Findings

LCC has provided copies of their most recently published Review and Assessment reports[6,7,8]. A summary of the conclusions of the Review and Assessment is provided below:

- LCC operated a network of NO_2 diffusion tubes, and four continuous monitors which measured NO_x / NO_2 using a chemiluminescent analyser and PM_{10} using a TEOM[9];

- LCC have declared two AQMAs, the M62/Rocket Junction area and the whole city centre, for exposure to exceedences of the Annual Mean NO_2 Objective; and

- LCC have produced an Air Quality Action Plan (AQAP) outlining measures to tackle issues such as traffic flow problems which affect air quality.

The development Site is located within the Annual Mean NO_2 AQMA declared by LCC in 2005.

4.3 Background Concentrations

Annual Mean concentrations at 1 x 1 km grid squares covering the study area were averaged to produce background concentrations for the relevant receptors to be modelled. These are presented in Table 6.

Table 6 - Average Background Concentrations across the Study Area (µg/m^3)

1 x 1 km Grid Square Background Concentrations	2008 (Baseline Year) µg/m^3			2016 (Assessment Year) µg/m^3		
	NO_x	NO_2	PM_{10}	NO_x	NO_2	PM_{10}
Minimum	38.5	24.9	14.4	24.3	17.1	12.8
Maximum	44.3	27.6	15.0	29.2	19.9	13.4
Mean	40.7	25.9	14.7	26.5	18.3	13.1

[6] LCC, Air Quality: Detailed Assessment 2007, 2007

[7] LCC, Liverpool City Council Final Air Quality Action Plan, 2007

[8] LCC, 2009 Air Quality Updating and Screening Assessment for Liverpool City Council, 2009

[9] TEOM is a Tapered Element Oscillating Microbalance

Table 6 shows that Annual Mean background concentrations of NO_2 and PM_{10} within the study area are below the Annual Mean Objective for both NO_2 and PM_{10} of 40 µg/m^3 during either of the assessment years.

4.4 Local Air Quality Monitored Concentrations

4.4.1 Continuous Monitoring

Liverpool City Council has four continuous NO_2 monitoring sites and one continuous PM_{10} monitoring site located within 10 km of the proposed development. The locations of these monitoring stations are presented in Table 7.

Table 7 - Locations of Continuous Monitoring Sites

Name	Location	Type	X	Y	Distance from Proposed Development
Speke (NO_2 & PM_{10})	St. Christoper's Primary School	Background	343884	393601	8.1 km
Islington (NO_2)	Stafford Street	Roadside	335394	390956	2.9 km
Queens Drive (NO_2)	Lakeside Court/Queens Drive	Roadside	336164	394906	4.6 km
Old Haymarket (NO_2)	Approach to the Birkenhead Tunnel	Kerbside	334762	390686	3.5 km

Monitoring data for Annual Mean NO_2 and PM_{10} concentrations recorded at these locations in 2008 and 2009 are shown in Table 8 and Table 9.

Table 8 - Continuous NO_2 Monitoring Data (2008)

Location	2008		2009	
	Annual Data Capture (%)	Annual Mean NO_2 (µg/m^3)	Annual Data Capture (%)	Annual Mean NO_2 (µg/m^3)
Speke	94.6	22.0	94.0	22.2
Islington	99.8	32.0	N/A	N/A
Queens Drive	99.7	40.0	99.0	38.4
Old Haymarket	53.3	36.0	N/A	N/A

Table 8 shows that the Annual Mean NO_2 concentration at the Queens Drive monitoring site was at the Objective Limit of 40 µg/m^3 in 2008.

Table 9 - Continuous PM_{10} Monitoring Data

Location	2008		2009	
	Annual Data Capture (%)	Annual Mean PM_{10} Gravimetric Equivalent (µg/m^3)	Annual Data Capture (%)	Annual Mean PM_{10} Gravimetric Equivalent (µg/m^3)
Speke	98.0	16.0	87.3	16.2

Table 9 shows that the Annual Mean PM_{10} concentration at the Speke monitoring site was well below the Objective Limit of 40 µg/m^3 for PM_{10} in 2008 and 2009

4.4.2 Local Diffusion Tubes Monitoring

Liverpool City Council has a network of diffusion tube monitoring across the Liverpool area. There are three locations identified that are close to the proposed development area and the respective monitored NO_2 concentrations are summarised in Table 10.

Table 10 - Diffusion Tube Monitoring - Annual Mean NO_2 Concentrations Measured by Liverpool in 2008

Site Number	Site Type	Data Capture (%)	Annual Mean (µg/m^3)	UWE Bias Adjustment Factor*	Bias Adjusted Annual Mean NO_2 (µg/m^3)
B12	Roadside	83.3	62	0.83	**52**
B13	Roadside	100	74	0.83	**61**
B59	Co-location	100	73	0.83	**61**
B60	Co-location	100	73	0.83	**60**
B61	Co-location	100	74	0.83	**62**

*Version 03/10
Note: exceedence is **Bold**

Table 10 indicates that Annual Mean NO_2 concentrations around the proposed development exceed the Objective Limit of 40 µg/m^3.

5 Results

5.1 Construction Phase

5.1.1 Estimated Magnitude of Impacts of Dust and Particulate Matter Emitted from Site Construction Activities

The main expected sources of emissions of dust and $PM_{10}/PM_{2.5}$ during the construction phase of the proposed development include:

i. pollution caused by construction vehicles;

ii. use of haul routes;

iii. exhaust emissions from Site off-road machinery, especially when used at the extremes of their capacity and during mechanical breakdown;

iv. transportation and storage of materials;

v. materials handling, storage, stockpiling, spillage and disposal;

vi. excavations and earthworks construction;

vii. drilling and grouting works; and

viii. processing, cutting, crushing and grinding activities.

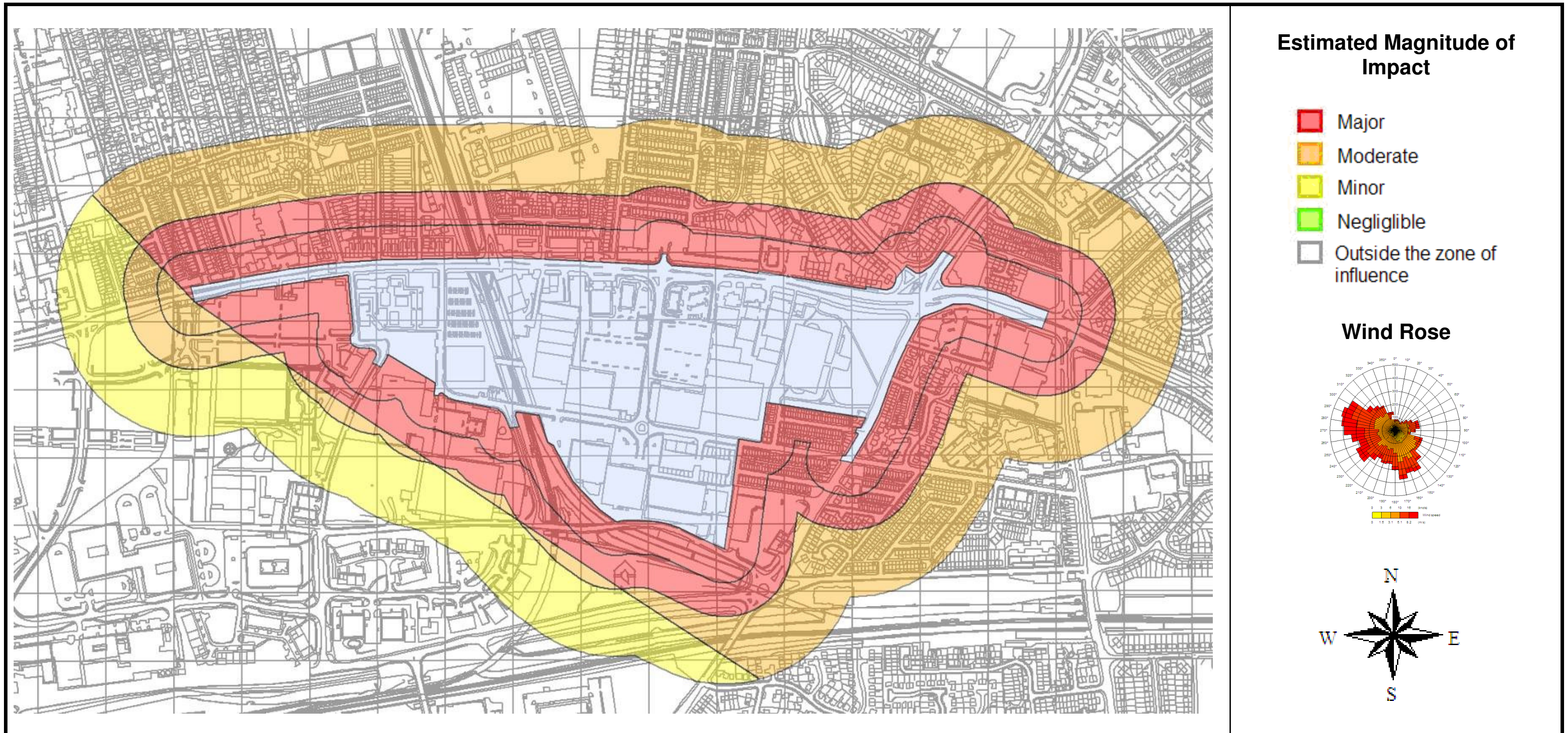
The majority of releases are likely to occur during the ‘working-week’ (anticipated to be 09:00 to 17:30 Monday to Friday). However, for some potential release sources (e.g. exposed soil produced from significant earthwork activities) in the absence of dust control mitigation measures, dust and $PM_{10}/PM_{2.5}$ generation has the potential to occur 24 hours per day over the period during which such activities are to take place.

Depending on wind direction, speed and turbulence, the greatest potential for nuisance problems associated with dust deposition/soiling is likely to be within 100m of the maximum extent of the Site perimeter. There may be limited incidences of increased dust deposited on properties beyond this distance.

According to the matrix presented in Table 4, the Site is classified as a High risk site. This is due to the size of the proposed development (282,000 m^2) and the fact that the Site presents a potential for emissions and dust to have an intermittent or likely impact on sensitive receptors.

Readily available meteorological data for 2009 from Liverpool John Lennon Airport indicates that the prevailing wind direction is from the south-west. A wind rose showing wind speed and direction trend is presented in Appendix D.

Receptors were identified at locations very close to the site boundary. Figure 4 shows the bands of estimated magnitude of impacts based on the criteria set out in Table 4. This shows that there are a number of properties within the Major magnitude impact zone.



Client: Derwent Holdings		Description: Construction Phase Estimated Impact Magnitude Bands (Pre Mitigation Controls)	This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. © Crown Copyright. Licence number 100020449 Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.	Design	AS	28/09/2010	mouchel	
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Rev: A	Description: FINAL	Project: Edge Lane Retail Park, Liverpool		Checked	MIC	28/09/2010	Figure 4	
				Approved	AG	28/09/2010	Scale	Not to Scale

Figure 4 - Construction Phase Estimated Impact Magnitude Bands (Pre Mitigation Controls)

5.2 Construction Site Proposed Mitigation Measures

This Section lists the mitigation measures identified as required to minimise the potential impacts associated with the activities anticipated to take place during the construction phase of the development. These resulted from the analysis of information available to date and can be tailored further when more specific description of construction Sites activities becomes available.

Construction activities with the potential to generate potential impacts from emissions to atmosphere require two levels of mitigation measures to be adopted. These are termed 'Hard' and 'Soft' measures. Hard measures include physical actions taken to prevent, suppress, or contain emissions; while Soft measures include management and communication actions.

Each level is presented separately and prioritised in the scope of the current development.

The most effective way to manage and prevent dust and PM_{10} / $PM_{2.5}$ generation and re-suspension during construction is through effective control of the potential source. In order to minimise likely construction phase impacts, a number of 'Best Practice' methods are usually implemented.

A set of mitigation measures considered appropriate for a High risk Site are recommended by Mouchel and listed in detail in the following Sub-Sections.

5.2.1 Hard Measures

a) Site Management

Where appropriate, reasonable, and practicable, it is recommended that the Contractor would:

i. plan the Site layout to locate machinery and dust-causing activities away from sensitive receptors;

ii. use appropriate methods, such as the erection of hoardings or other barriers along the Site boundary, to mitigate the spread of dust to any sensitive buildings or other environmental receptors;

iii. provide hard standing areas for vehicles and regularly inspect and clean these areas; and

iv. consider weather conditions prior to conducting potentially dusty works. If there are strong winds blowing towards residential properties, works may need to be postponed until more favourable conditions return.

b) Construction Plant and Vehicles

Where appropriate, reasonable, and practicable, it is recommended that the Contractor would:

i. operate construction plant in accordance with the manufacturer's written recommendations;

ii. switch off vehicles and plant when not in use;

iii. direct vehicle and plant exhausts away from the ground and at a height greater than the relative surroundings to facilitate improved dispersion of exhaust emissions;

iv. enclose, shield or provide filters for plant likely to generate excessive quantities of dust beyond the Site boundaries. It is recommended the use of items such as dust extractors, filters and collectors on rigs and silos;

v. keep movements of construction traffic around the Site to the minimum reasonable for the effective and efficient operation of the Site and construction of the development;

vi. locate construction plant away from site boundaries which are close to sensitive receptors;

vii. design site access points to avoid queuing traffic adjacent to access points. Parking of vehicles to be controlled;

viii. avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment;

ix. use ultra low sulphur tax-exempt diesel for all non-road mobile machinery. Machinery with power outputs of over 37 kW would need to be fitted with appropriate exhaust after-treatment from approved Energy Saving Trust list (achieving filtration efficiency of over 85%); and

x. keep roads and accesses clean.

c) Transportation, Storage and Handling of Materials

Where appropriate, reasonable, and practicable, it is recommended that the Contractor would:

i. employ appropriate measures, such as covering materials deliveries or loads entering and leaving the construction site by a fixed cover or sheeting appropriately fixed and suitable for the purposes of preventing materials and dust spillage;

ii. not overload vehicles transporting materials within or outside the construction site;

iii. keep stockpiles and mounds away from the Site boundary and sensitive receptors, and site them to take into account the predominant wind direction;

iv. ensure stockpiles and mounds are set at a suitable angle of repose and avoid sharp changes in shape to prevent material slippage;

v. enclose, securely sheet or kept watered materials stockpiles;

vi. cover or stabilise long-term stockpiles, which give rise to a risk of dust or air pollution;

vii. Store fine dry material (under 3 mm particle size) inside buildings or enclosures;

viii. undertake mixing of large quantities of concrete or bentonite slurries in enclosed or shielded areas;

ix. keep the number of handling operations for materials to the minimum;

x. maintain materials handling areas to constrain dust emissions;

xi. use appropriate measures such as watering facilities to reduce or prevent escape of dust from the Site boundaries; and

xii. mix grout or cement-based materials using a process suitable for the prevention of dust emissions.

d) Haul Routes

Where appropriate, reasonable, and practicable, it is recommended that the Contractor would:

i. agree haul routes prior to their construction and use and advise of the intended level of trafficking for haul routes. The surfacing of haul routes will be appropriate to avoid dust emissions as far as practicable, taking into account the intended level of trafficking;

ii. maintain the surface of haul routes in a condition appropriate to the surface material and for the purposes of suppressing dust emissions;

iii. inspect haul routes regularly and promptly repair haul routes if required;

iv. provide areas of hard-standing at site access and egress points to be used by any waiting vehicles;

v. use appropriate methods to clean and suppress dust on haul routes and in designated vehicle waiting areas. The frequency of cleaning will be suitable for the purposes of suppressing dust emissions from the Site boundaries; and

vi. impose and enforce appropriate speed limits on haul roads for safety reasons and for the purposes of suppressing dust emissions.

e) Excavation and Earthworks Activities

Where appropriate, reasonable, and practicable, it is recommended that the Contractor would:

i. strip topsoil as close as reasonably practicable to the period of excavation or other earthworks activities to avoid risks associated with run-off or dust generation;

ii. keep drop heights from excavators to vehicles involved in the transport of excavated material to the minimum practicable to control dust generation associated with the fall of materials;

iii. use appropriate methods to suppress dust emissions, such as shielding or damping sprays;

iv. compact deposited materials, with the exception of topsoil, as soon as possible after deposition; and

v. undertake soiling, seeding, planting or sealing of completed earthworks as soon as reasonably practicable following completion of the earthworks.

f) Drilling and Grouting Activities

Where appropriate, reasonable, and practicable, it is recommended that the Contractor would:

i. employ measures such as enclosing, shielding or provision of filters on plant likely to generate excessive quantities of dust beyond the Site boundaries. Items such as dust extractors, filters and collectors on rigs and silos will need to be used;

ii. extract dust at source to prevent exposure of workers to excessive dust inhalation;

iii. water exposed surfaces to limit dust emissions where drilling is used for the purposes of excavating within rock; and

iv. mix grout or cement-based materials using a process suitable for the prevention of dust emissions.

g) Processing, Crushing, Cutting and Grinding Activities

Where appropriate, reasonable, and practicable, it is recommended that the Contractor would:

i. keep drop heights from excavators to crushing plant, and from crushing plant to stockpiles to the minimum practicable to control dust generation associated with the fall of materials; and

ii. use measures for any processing, crushing, cutting and grinding activities as required to limit dust pollution, such as shielding and damping sprays.

5.2.2 Soft Measures

In addition to the 'Hard' mitigation measures set out above, there are a number of 'Soft' mitigation measures that are recommended in order to further reduce the risk of nuisance. The effect of these measures is difficult to quantify; however engagement of the local community is known to have a beneficial effect on the way that construction is viewed by local residents.

Mouchel recommends that the Contractor would keep vehicle, plant and equipment maintenance records on site and these would be made available to LCC Environmental Health Department whenever requested.

The Contractor would establish a clear protocol of communication with the local residents. A complaints line number will be set up, and a member of staff on site will be available at all times during site operation to take calls. Complaints must be logged and investigated. The Contractor may wish to set up a website to keep residents informed of activities on the Site and allow them to log issues on the Site.

If any very dusty works are unavoidable, local residents will be given prior warning so that they can avoid undertaking activities that will be significantly affected by dust (e.g. hanging washing out).

Liaison with LCC will be maintained throughout the construction process, and any incidents that may have led to an excessive increase in dust deposition/soiling and/or PM concentrations at nearby residential properties must be reported to the Environmental Health Department of LCC. If complaints are received from local residents, these are to be documented in a diary or log held on-site by the Site Manager and the information used in establishing improved construction nuisance management protocols where necessary.

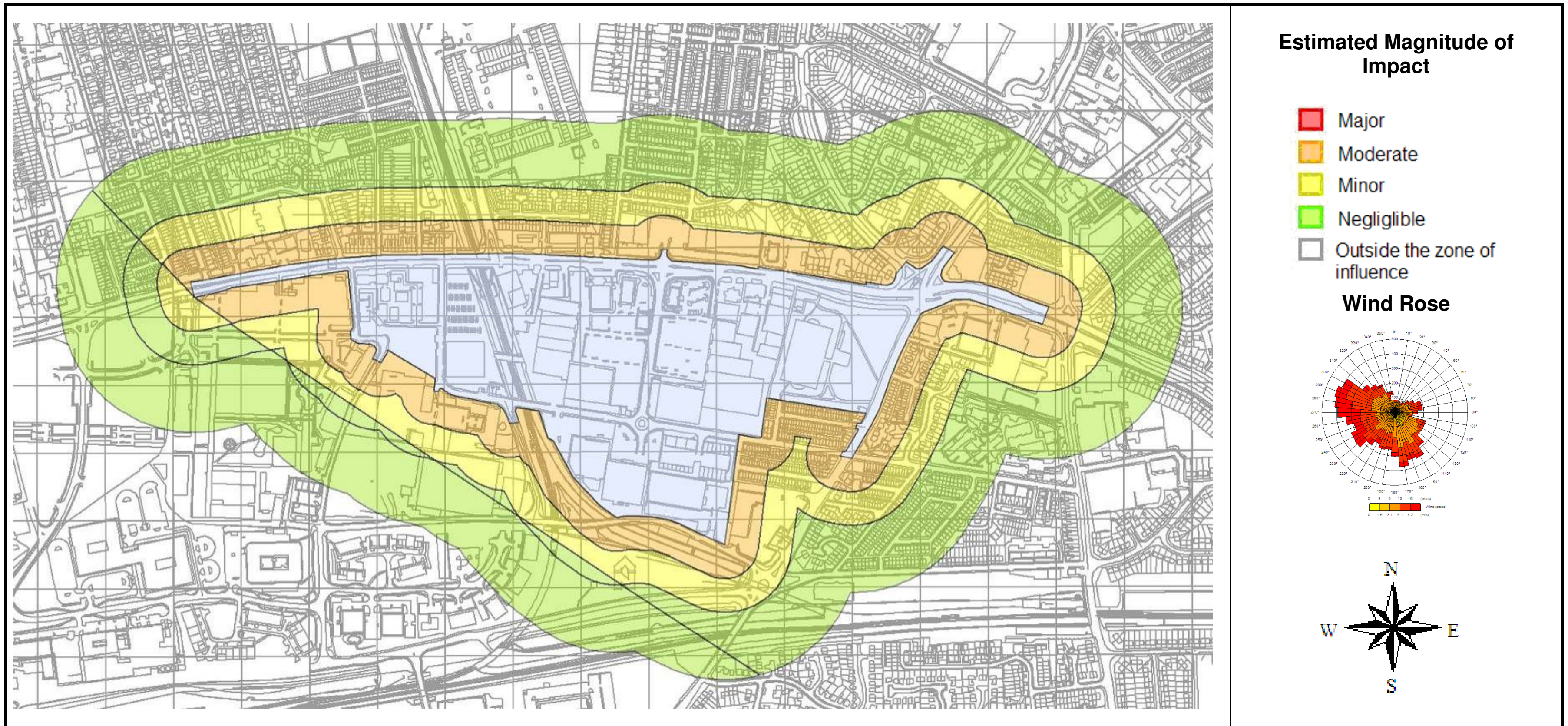
With the implementation of good communication and building of trust with the local community, it is anticipated that the impact of the development could be further reduced from the categories shown in Figure 4.

5.2.3 Estimated Magnitude of Impacts of Dust and Particulate Matter Emitted from Site Construction Activities Post Implementation of Recommended Mitigation Measures

With the implementation of the measures set out in Section 5.2, the formation of dust and harmful emissions from the construction site are estimated to be minimised as much as practicable. Once the mitigation measures recommended are implemented it is anticipated that the impact bands are reclassified according to Table 4, as shown in Figure 5.

After post mitigation controls are implemented estimated results indicate that receptors are expected to be exposed to the moderate and minor impact categories instead.

Mouchel recognises that the final design solutions for the construction phase will be developed with input from the Contractor and is happy to provide further advice at a later stage providing input guidance on the design and implementation of an effective Construction Environmental Management Plan (CEMP) to achieve the above predicted results.



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				Approved	AG	28/09/2010	Scale: Not to Scale

Figure 5 - Construction Phase Estimated Impact Magnitude Bands (Post Mitigation Controls)

5.3 Operation Phase

NO_2 and PM_{10} concentrations have been predicted by modelling selected receptor locations representative of both worst case locations and locations representative of sensitive receptors. The results for each pollutant are presented in the following sub-sections.

5.3.1 NO_2

Modelled Annual Mean concentrations of NO_2 at selected receptor locations shown in Figure 3 are presented in Table 11 and Figure 6 for the DM and DS scenarios for the Assessment Year (2016).

The results indicate that the maximum NO_2 concentrations in both the DM and DS scenarios at representative worst case relevant receptors in the study area are below the Annual Mean Limit Value (40 µg/m^3) for this pollutant. It is therefore anticipated that exceedences of the Annual Mean NO_2 objectives are unlikely at all locations within the study area in the Assessment Year (2016).

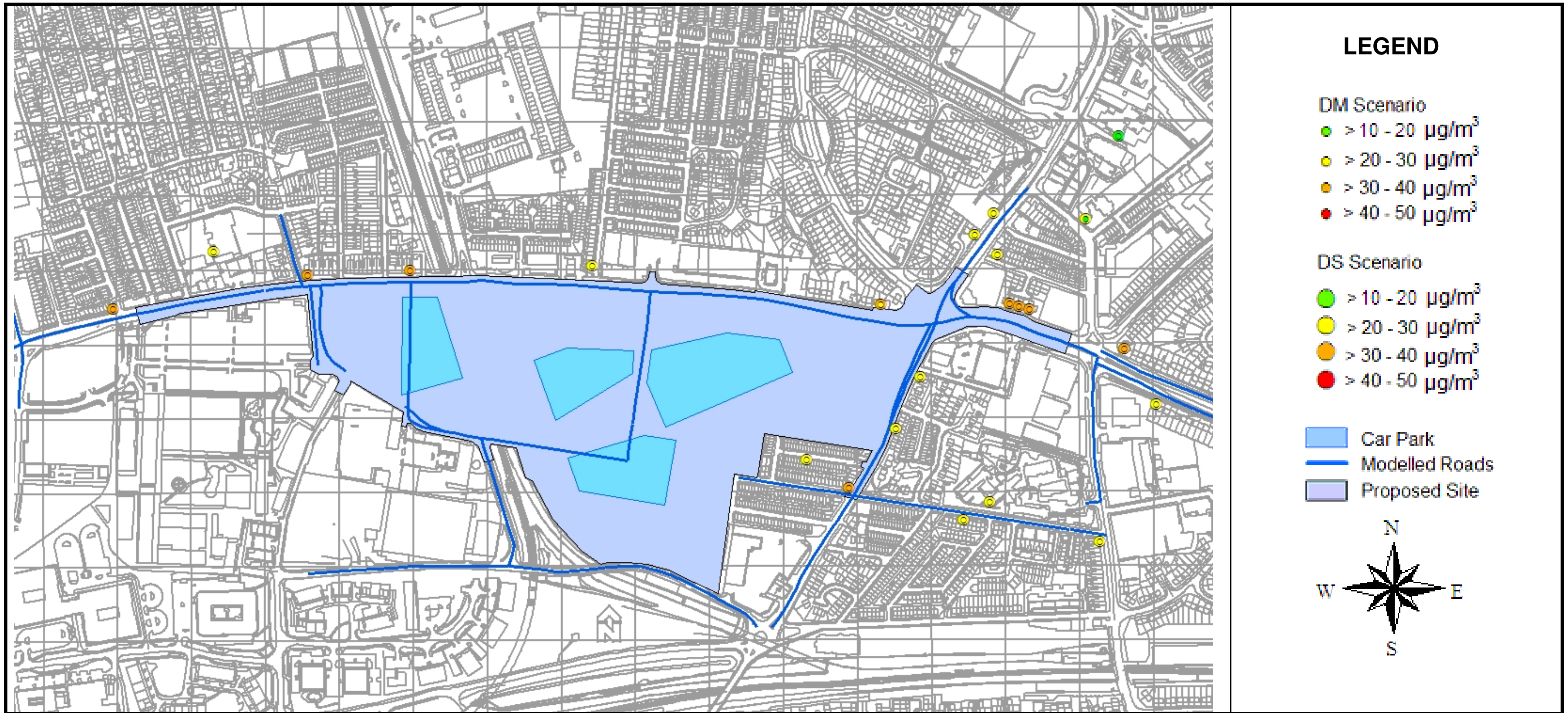
The analysis of the range of change in Annual Mean NO_2 concentrations between the DS and DM scenarios has shown that the largest worsening change is 3.2 µg/m^3.

No exceedences of 60 µg/m^3 as an Annual Mean NO_2 concentration have been identified at locations relevant for the 1 Hour Mean objective and thus exceedences of the 1 Hour Mean objective are unlikely with the implementation of the proposed development.

Table 11 - Summary of Annual Mean NO_2 Concentrations in 2016 for the DM and DS Scenarios

Assessment Year	2016	DM NO_2	DS NO_2	Changes
Receptor Number	Receptor Type	µg/m^3	µg/m^3	µg/m^3
1	Residential	27.1	27.2	+0.1
2	Residential	27.4	29.0	+1.6
3	Residential	29.9	32.4	+2.5
4	Residential	27.6	28.7	+1.1
5	Residential	26.1	27.2	+1.1
6	Residential	31.4	33.5	+2.0
7	Residential	30.7	32.7	+2.0
8	Residential	28.0	29.5	+1.5
9	Residential	21.4	21.7	+0.3
10	Residential	33.0	32.3	-0.7
11	Residential	33.5	36.5	+3.0
12	Residential	35.7	38.9	+3.2
13	Residential	26.1	28.4	+2.3
14	Residential	32.3	33.4	+1.1
15	Residential	20.9	21.5	+0.6

Assessment Year	2016	DM NO_2	DS NO_2	Changes
Receptor Number	Receptor Type	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$
16	Residential	30.4	32.5	+2.1
17	Residential	33.2	35.8	+2.6
18	Residential	20.1	20.4	+0.3
19	Health Centre	27.6	28.8	+1.2
20	School	21.7	22.7	+1.0
21	Hospital	20.2	20.6	+0.4
22	School	19.8	20.2	+0.4
23	School	18.3	18.6	+0.3
Maximum		35.7	38.9	+3.2
Minimum		18.3	18.6	-0.7
Mean		27.1	28.4	+1.3



Client: Derwent Holdings		Description: Modelled Annual Mean NO_2 Concentrations in 2016 within the Study Area (Relevant Receptors) – DM and DS Scenarios	This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. © Crown Copyright. Licence number 100020449 Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.	Design	AS	27/09/2010	mouchel
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				Approved	AG	27/09/2010	Scale: Not to Scale

Figure 6 - Modelled Annual Mean NO_2 Concentrations in 2016 within the Study Area (Relevant Receptors) - DM and DS Scenarios

5.3.2 PM_{10}

Modelled Annual Mean concentrations of PM_{10} at selected receptor locations shown in Figure 3 are presented in Table 12 and Figure 7 for the DM and DS scenarios for the Assessment Year (2016).

The results show that the maximum PM_{10} concentrations in both the DM and DS scenarios at representative relevant receptors in the study area are well below the Annual Mean Limit Value (40 µg/m^3) for this pollutant. It is therefore anticipated that exceedences of the Annual Mean PM_{10} objectives are unlikely at all locations within the study area in the Assessment Year (2016).

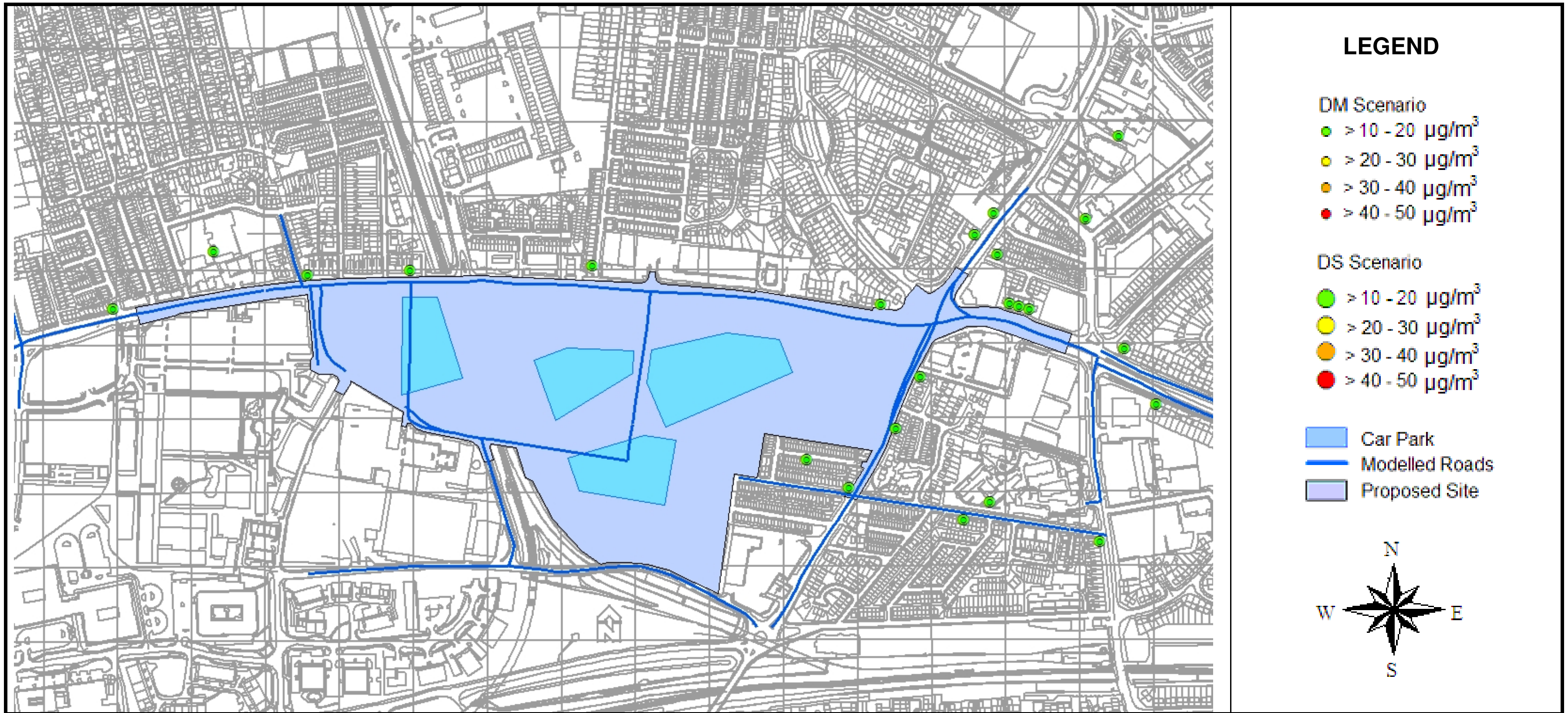
The analysis of the range of change in Annual Mean PM_{10} concentrations between the DS and DM scenarios has shown that the largest worsening change is 1.7 µg/m^3.

No exceedences of 32 µg/m^3 as an Annual Mean PM_{10} concentration have been identified at locations relevant to the 24 Hour Mean objective and thus exceedences of the 24 Hour Mean objective are unlikely with the implementation of the proposed development.

Table 12 - Summary of Annual Mean PM_{10} Concentrations in 2016 for the DM and DS Scenarios

Assessment Year	2016	DM PM_{10}	DS PM_{10}	Changes
Receptor Number	Receptor Type	µg/m^3	µg/m^3	µg/m^3
1	Residential	15.6	15.7	+0.1
2	Residential	15.7	16.4	+0.7
3	Residential	16.5	17.5	+1.0
4	Residential	15.8	16.3	+0.5
5	Residential	15.3	15.7	+0.4
6	Residential	17.0	18.0	+1.0
7	Residential	16.8	17.7	+0.9
8	Residential	16.0	16.6	+0.6
9	Residential	13.9	14.0	+0.1
10	Residential	16.9	17.9	+1.0
11	Residential	17.6	19.0	+1.4
12	Residential	17.4	19.1	+1.7
13	Residential	15.3	16.2	+0.9
14	Residential	16.5	16.9	+0.4
15	Residential	13.6	13.8	+0.2
16	Residential	17.6	18.6	+1.0
17	Residential	17.9	18.9	+1.0
18	Residential	14.3	14.4	+0.1
19	Health Centre	16.8	17.3	+0.5
20	School	13.9	14.3	+0.4
21	Hospital	14.4	14.5	+0.1
22	School	14.2	14.4	+0.2

Assessment Year	2016	DM PM_{10}	DS PM_{10}	Changes
Receptor Number	Receptor Type	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$
23	School	13.8	13.9	+0.1
Maximum		17.9	19.1	+1.7
Minimum		13.6	13.8	+0.1
Mean		15.8	16.4	+0.6



Client: Derwent Holdings		Description: Modelled Annual Mean PM_{10} Concentrations in 2016 within the Study Area (Relevant Receptors) – DM and DS Scenarios	This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. © Crown Copyright. Licence number 100020449 Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.	Design	CC	27/09/2010	mouchel
				Drawn	CC	27/09/2010	
Rev: A	Description: FINAL	Project: Edge Lane Retail Park, Liverpool		Checked	MIC	27/09/2010	Figure 7
				Approved	AG	27/09/2010	Scale: Not to Scale

Figure 7 - Modelled Annual Mean PM_{10} Concentrations in 2016 within the Study Area (Relevant Receptors) - DM and DS Scenarios

5.3.3 Operation Phase Mitigation Measures

Given the likely exceedences estimated for the study area in association with the implementation of the proposed development, Mouchel recommends that future occupiers of the proposed retail units provide LCC with Travel Plans to demonstrate the encouragement of future staff and customers to use sustainable modes of transport. For example walking, cycling and public transport should be encouraged to reduce the number of car journeys associated with the development. The Site is well served by bus routes and has been designed to encourage walking. The Site also consists of cycling facilities to encourage cycling as much as possible.

In addition, Mouchel recommends that the following amelioration measures should be considered to minimise the potential impacts of the operation of the proposed development and improve local air quality in the vicinity of the site:

i. contractors and goods suppliers should use vehicles compliant to at least EURO IV emission standards, goods suppliers to the site should also show a commitment to environmental sustainability through the adoption of an environmental policy which seeks to minimise their own impacts on local air quality;

ii. delivery times could be altered, as necessary, to avoid periods of congested traffic and thus minimise the proposed development contribution to pollutant emissions resulting from local congestion;

iii. retail staff and customers should be encouraged to travel to the premises via local public transport. Incentives, such as flexible working hours, and the provision of shuttle buses could be provided;

iv. disincentives for the use of cars to travel to work, such as the provision of minimal car parking facilities and operating a workplace car parking charge for staff who travel to work by car could also be considered;

v. retail staff could be encouraged to participate in environmentally sustainable practices, such as the use of a car-share scheme which would be managed by the Retail Park Consortium;

vi. electricity provided to the Retail Park could be obtained through a ‘Green Energy’ supplier; and

vii. where practicable, any improvements to road junctions close to the site which may reduce congestion and modify traffic behaviour so that vehicles are operating in free flow conditions would also help to reduce emissions.

6 Conclusions

6.1 Construction Phase

The magnitude of impacts associated with the construction phase was estimated in the current exercise using a method adapted by Mouchel using current guidance.

The construction site was classified as a High risk site and a series of hard and soft measures are recommended to reduce the magnitude of the estimated impacts.

The implementation of the measures set out in Section 5.2 is likely to reduce the level of estimated magnitude of impacts associated with the construction phase of the proposed development.

The PM_{10} concentrations estimated in the Assessment Year (2016) are relatively low when compared to the Air Quality Objectives.

The estimated magnitude of impacts associated with the construction phase of the proposed development, assuming the mitigation measures recommended are put in place, range from moderate to minor.

6.2 Operation Phase

The study area defined in the assessment was identified as being at risk of exceeding the Annual Mean air quality objective for NO_2 in the Updating and Screening Assessment (LCC, 2009) exercise.

It is inside an AQMA and the 2008 LCC local diffusion tube monitoring measurements indicated that the Annual Mean Objectives for NO_2 are likely to be exceeded.

An assessment of the likely impacts of the proposed development on local air quality has been carried out for representative locations of relevant properties within the study area. Annual Mean concentrations of NO_2 and PM_{10} have been modelled for 2016 (Assessment Year) for the DM and DS scenarios using the dispersion model ADMS-Roads.

Although the modelled results indicated that implementation of the proposed development is likely to lead to an increase in Annual Mean concentrations for NO_2 and PM_{10}, the results show the predicted Annual Mean NO_2 and PM_{10} concentrations in the DS scenario are below the Objective Limit Values.

With the implementation of the proposed development, results of the assessment undertaken indicate that exceedences of the Annual Mean objective for NO_2 and PM_{10} predicted are unlikely throughout the study area in the Assessment Year (2016).

6.3 Overall Impacts on Local Air Quality

Overall, this Air Quality Assessment indicates that the proposed development is likely to be compliant with the national and European Air Quality Objectives and Limit Values and as such, there are no air quality reasons to prevent the local planning authority from granting planning permission.

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8 Appendices

8.1 Appendix A - Proposed Development Layout (Provided by DPP)

8.2 Appendix B - Summary of Health Effects of NO_2 and PM_{10}

Pollutant	Main Health Effects
Nitrogen Dioxide	Short-term exposure to high concentrations may cause inflammation of respiratory airways. Long-term exposure may affect lung function and enhance responses to allergens in sensitised individuals. Asthmatics will be particularly at risk (Defra, 2007a).
Particulate Matter	Particulate matter can affect our health. The available evidence suggests that it is the fine components of PM_{10}, which have a diameter of 10 µm or less and are formed by combustion, that are the main cause of the harmful effects of particulate matter. Particles cause the most serious health problems among those susceptible groups with pre-existing lung or heart disease and/or the elderly and children. There is evidence that short- and long-term exposure to particulate matter cause respiratory and cardiovascular illness and even death. It is likely that the most severe effects on health are caused by exposure to particles over long periods of time. However, UK estimates indicate that short-term exposure to the levels of PM_{10} that we experienced in 2002 led to 6,500 deaths and 6,400 hospital admissions being brought forward that year, although it is not possible to know by what length of time those deaths were brought forward.

8.3 Appendix C - Traffic Data and Detailed Modelling Procedures

8.3.1 Horizontal Road Alignment

Road alignment was based around Ordnance Survey data. Those roads not explicitly included in the modelling have been accounted for via the background component of the modelled results.

8.3.2 Traffic Data Limitations and Assumptions

Traffic data for the study area have been produced by Sanderson Associates. Assumptions have made during data processing as following:

i. no average vehicle speed data was available. As such, speed limit information was applied (i.e. 30 mph – modelled to the nearest 5kph (50 kph)) for free flow links on the local network;
ii. reduced speeds (20 kph) were applied to 50m sections approaching junctions in accordance with LAQM.TG(09) paragraph A2.77.

The Department for Transport (DfT) has recently made available new emission factors. The Transport Research laboratory (TRL - on behalf of DfT and Defra) prepared mathematical formulae that relate the rate of emission of a pollutant and fuel consumption to average vehicle speed. The new emission factors incorporate the latest test data on vehicles meeting the new vehicle Euro emission standards; the formulae also address published future standards. These new data were used in the current assessment[10].

The traffic links, associated composition, flows and speeds in each assessment year are presented in Table 13.

[10] http://www.dft.gov.uk/pgr/roads/environment/emissions/

Table 13 - Summary of Traffic Characteristics Data

		2008 (Baseline Year)				2016 DM				2016 DS			
Link ID	Link Location	24 Hour AADT	Number of HDV	HDV %	Average Speed	24 Hour AADT	Number of HDV	HDV %	Average Speed	24 Hour AADT	Number of HDV	HDV %	Average Speed
A1	Laurel Road – Between Edge Lane & Holly Road	6,213	124	2.0	50	6,947	139	2.0	50	7,723	139	1.8	50
A2	Edge Lane – Between Laurel Road and West Bank Road	29,865	896	3.0	50	33,389	1,002	3.0	50	45,011	1,002	2.2	50
A3	Unnamed Road – Off Edge Lane	635	13	2.0	50	1,046	21	2.0	50	1,046	21	2.0	50
A4	Edge Lane – Between Laurel Road and Beech Street	26,780	803	3.0	50	2,9941	898	3.0	50	39,819	898	2.3	50
B1	West Bank Road – Between Edge Lane and Birchfield Road	301	1	0.3	50	336	1	0.3	50	336	1	0.3	50
B2	Edge Lane – Between West Bank Road and Binns Road	29,408	588	2.0	50	32,879	657	2.0	50	44,504	657	1.5	50
B3	Milton Road – Between Edge Lane and Dryden Road	1,191	59	5.0	50	1,332	67	5.0	50	10,958	67	0.6	50
C2a	Edge Lane – Between Binns Road and Market	28,161	845	3.0	50	31,484	945	3.0	50	43,109	945	2.2	50
C2b	Edge Lane – Between Market and Montrose Way	27,215	816	3.0	50	30,426	913	3.0	50	42,051	913	2.2	50
C3	Binns Road – Between Edge Lane and Crawford Way	2,149	0	0.0	50	2,403	0	0.0	50	12,029	0	0.0	50
D2	Edge Lane – Between Montrose Way and St Oswald Street	31,658	950	3.0	50	35,393	1062	3.0	50	47,047	1062	2.3	50

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		2008 (Baseline Year)				2016 DM				2016 DS			
Link ID	**Link Location**	**24 Hour AADT**	**Number of HDV**	**HDV %**	**Average Speed**	**24 Hour AADT**	**Number of HDV**	**HDV %**	**Average Speed**	**24 Hour AADT**	**Number of HDV**	**HDV %**	**Average Speed**
D3	Montrose Way – Between Edge Lane and Binns Road	7,438	74	1.0	50	8,316	83	1.0	50	21,790	83	0.4	50
E1b	St Oswald Street – Between Edge Lane and Turn for Edge Lane Drive	18,451	553	3.0	50	20,628	619	3.0	50	23,723	619	2.6	50
E1a	St Oswald Street – Between Turn for Edge Lane Drive and Mill Lane	20,801	624	3.0	50	23,255	698	3.0	50	26,350	698	2.6	50
E2a	Edge Lane Drive – Between Edge Lane and Turn for Edge Lane Drive	35,744	1,072	3.0	50	39,962	1199	3.0	50	50,459	1,199	2.4	50
E2	Edge Lane Drive – Between Edge Lane and Mill Lane	38,072	1,142	3.0	50	42,564	1277	3.0	50	53,061	1,277	2.4	50
E5	St Oswald Street – Turn for Edge Lane Drive	2,327	93	4.0	50	2,602	104	4.0	50	2,607	104	4.0	50
F2a	Edge Lane Drive (Eastbound) – Between Mill Lane and Domville Road	20,183	606	3.0	50	22,564	677	3.0	50	27,140	677	2.5	50
F2b	Edge Lane Drive (Westbound) – Between Mill Lane and Domville Road	20,183	605	3.0	50	22,564	676	3.0	50	27,139	676	2.5	50
F3	Mill Lane – Between Edge Lane Drive and Hospital	12,394	124	1.0	50	13,856	138	1.0	50	25,837	138	0.5	50
G2	Binns Road – Between Crawford Way and Montrose Way	5,423	54	1.0	50	6,063	61	1.0	50	17,611	61	0.3	50

Link ID	Link Location	2008 (Baseline Year)				2016 DM				2016 DS			
		24 Hour AADT	Number of HDV	HDV %	Average Speed	24 Hour AADT	Number of HDV	HDV %	Average Speed	24 Hour AADT	Number of HDV	HDV %	Average Speed
G3	Crawford Way – Between Binns Road and Pighue Lane	5,222	52	1.0	50	5,839	58	1.0	50	17,387	58	0.3	50
H2	Binns Road – Between Garnett Street and Rathbone Road	390	0	0.0	50	436	0	0.0	50	436	0	0.0	50
I1	Rathbone Road – Between Binns Road and Site Access	17,004	510	3.0	50	19,010	570	3.0	50	20,935	570	2.7	50
I2	Binns Road – Between Rathbone Road and Mill Lane	5,189	104	2.0	50	5,801	116	2.0	50	5,866	116	2.0	50
I3	Rathbone Road – Between Binns Road and Pighue Lane	21,113	633	3.0	50	23,604	708	3.0	50	25,563	708	2.8	50
J2	Pighue Lane – Between Crawford Way and Rathbone Road	4,565	0	0.0	50	5,104	0	0.0	50	12,032	0	0.0	50
J4	Pighue Lane – Between Crawford Way and Dryden Road	5,089	0	0.0	50	5,689	0	0.0	50	10,309	0	0.0	50
L4	Hospital Entrance Road	367	0	0.0	50	411	0	0.0	50	674	0	0.0	50
M1	Rathbone Road – Between Site Access and Edge Lane	15,645	469	3.0	50	17,491	525	3.0	50	19,416	525	2.7	50

8.3.3 Car Park

The proposal includes a car park that would release emissions as an area source:

i. The proposed car park areas were estimated based on the proposed development layout drawing (Appendix A);
ii. The number of parking spaces and area for each existing car park was estimated using aerial imagery from 2007 using Google Earth;
iii. The number of parking spaces and area for each proposed car park was provided by Sanderson Associates;
iv. The distance travelled inside each car park was estimated based on the size of the car park and location of entrance/exits;
v. For existing and proposed car parks, it was assumed that activity was on the basis of one car per space per day;
vi. Car parks were assumed to only be used by cars and light duty vehicles, i.e. 100% LDV; and
vii. Vehicle speeds within the car park were assumed to be 5 km/hr.

8.3.4 Model Verification and Adjustment

Most NO_2 is produced in the atmosphere by reaction of NO_x with ozone (O_3). It is therefore most appropriate to verify the model in terms of primary pollutant emissions. The model was run to predict Annual Mean road-NO_x concentrations for the Baseline Year (2008) at a single diffusion tube location within the study area.

The model outputs of road-NO_x (i.e. the component of total NO_x coming from road traffic) were compared with the measured road-NO_x. Total measured NO_x was calculated from the measured NO_2 concentrations at the monitoring location using the recently updated NO_x from NO_2 calculator available on the NAQIA website (Defra, 2007b).

The measured road-NO_x contribution was then calculated as the difference between the total and the background value (determined as described in Section 4).

A primary adjustment factor was determined as the multiplier between the calculated (measured) road contribution and the model derived road contribution.

The primary adjustment factor was then applied to each modelled road-NO_x concentration to provide an adjusted modelled road-NO_x concentration. The background concentration was added to these concentrations to determine the adjusted total modelled NO_x concentration.

The road contribution to the total Annual Mean NO_2 concentration was then determined from these adjusted modelled concentrations, following the method set out by Defra (2009), taking into account the most recent guidance.

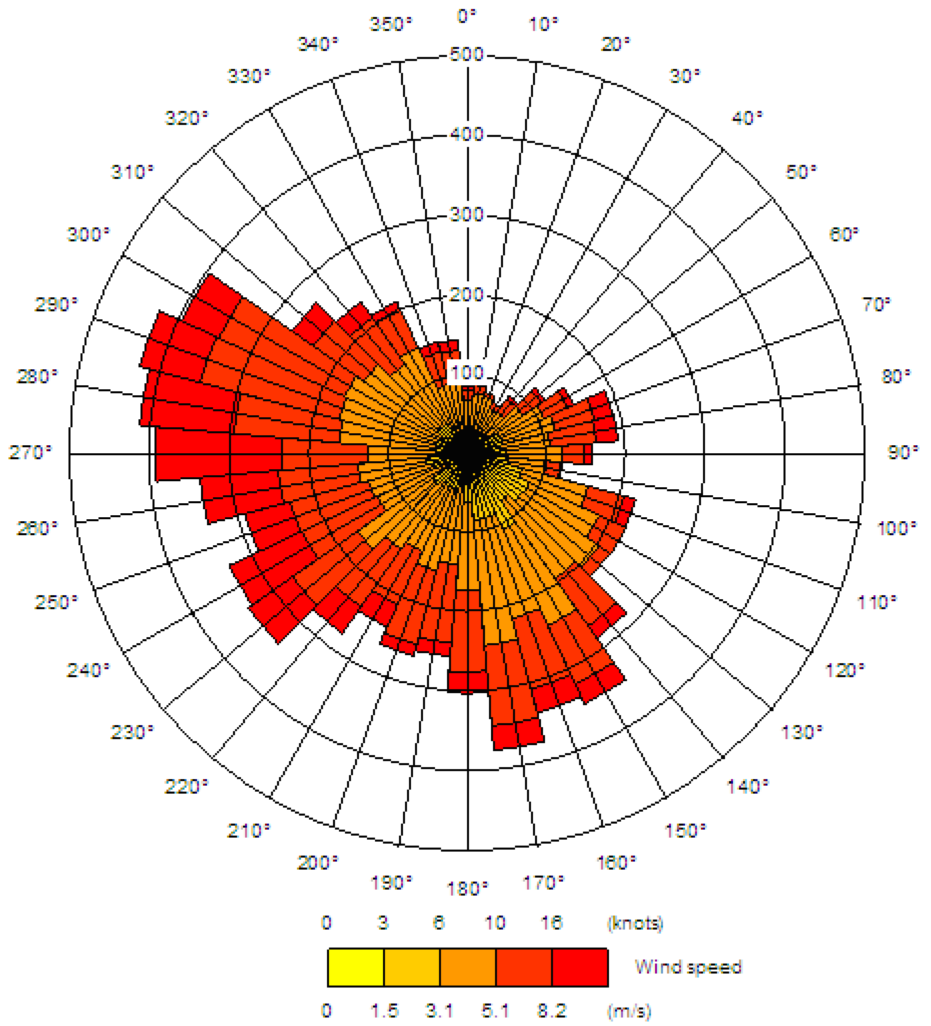
The primary adjustment factor was applied to all modelled data presented in this report.

The total NO_2 concentration was determined by adding the background NO_2 concentration (determined as described above) to this calculated road contribution.

Table 14 - Model Adjustment Factor

Adjustment Factor (Primary)
5.366

8.4 Appendix D - Meteorological Data



Client: Derwent Holdings		Description: 2008 Wind Rose for Liverpool John Lennon Airport Meteorological Station	This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. © Crown Copyright. Licence number 100020449 Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.	Design	AS	28/09/2010	mouchel	
				Drawn	AS	28/09/2010		
Rev: A	Description: FINAL	Project: Edge Lane Retail Park, Liverpool		Checked	MIC	28/09/2010	Figure 8	
				Approved	AG	28/09/2010	Scale	Not to Scale

Figure 8 - 2008 Wind Rose for Liverpool John Lennon Airport Meteorological Station