REC
Resource & Environmental Consultants Ltd

National Consultancy, Locally Delivered

Air Quality Assessment
Former Gateacre Community Comprehensive School, Gateacre, Liverpool

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Report Prepared For: Countryside Properties (UK) Ltd

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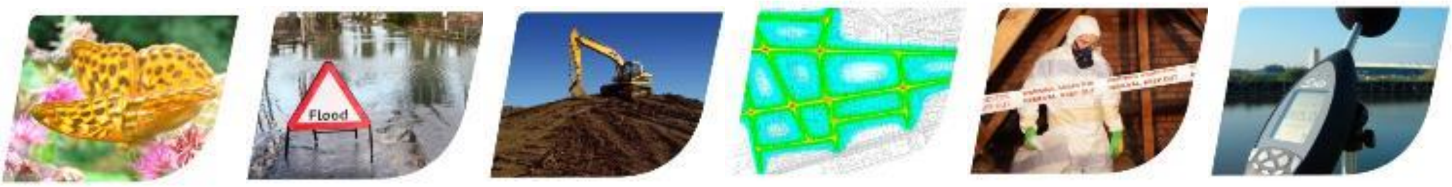

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EXECUTIVE SUMMARY

Resource and Environmental Consultants Ltd was commissioned by Countryside Properties (UK) Ltd to undertake an Air Quality Assessment in support of a planning application for a residential development at the Former Gateacre Community Comprehensive School off Grange Lane in Gateacre, Liverpool.

The proposals comprise 202 residential units and associated infrastructure.

The site is located in an area identified by Liverpool City Council as experiencing elevated pollutant concentrations and subsequently there are concerns that the proposals will introduce future users into an area of poor air quality. Additionally, the development has the potential to cause air quality impacts at sensitive locations. These may include fugitive dust emissions from construction works and road vehicle exhaust emissions associated with traffic generated by the site during the operational phase. As such, an Air Quality Assessment was required to quantify pollution levels across the site, consider its suitability for the proposed use and assess potential impacts as a result of the development.

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

Dispersion modelling was undertaken in order to quantify existing pollutant concentrations at the site and predict air quality impacts as a result of road vehicle exhaust emissions associated with traffic generated by the development.

The dispersion modelling indicated pollution levels at the development were below the relevant air quality standards and the location is considered suitable for residential use without the inclusion of mitigation methods. Additionally, the assessment concluded that impacts on pollutant levels as a result of operational phase vehicle exhaust emissions were not predicted to be significant at any sensitive location in the vicinity of the site. The use of robust assumptions, where necessary, was considered to provide sufficient results confidence for an assessment of this nature.

Based on the assessment results, air quality issues are not considered a constraint to planning consent for the development.

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1.0 INTRODUCTION

1.1 Background

Resource and Environmental Consultants (REC) Ltd was commissioned by Countryside Properties (UK) Ltd to undertake an Air Quality Assessment in support of a planning application for a residential development at the Former Gateacre Community Comprehensive School off Grange Lane in Gateacre, Liverpool.

The site is located in an area identified by Liverpool City Council (LCC) as experiencing elevated pollutant concentrations and subsequently there are concerns that the proposals will introduce future users into an area of poor air quality. Additionally, the development has the potential to cause air quality impacts at sensitive locations. As such, an Air Quality Assessment was required to quantify potential effects in the vicinity of the site.

1.2 Site Location and Context

The site is located on land at the Former Gateacre Community Comprehensive School off Grange Lane in Gateacre, Liverpool, at approximate National Grid Reference (NGR): 342200, 388200. Reference should be made to Figure 1 for a location plan and Figure 2 for a site layout plan.

The proposals comprise 202 residential units and associated infrastructure.

The development is located within an Air Quality Management Area (AQMA), declared by LCC due to exceedences of the annual mean Air Quality Objective (AQO) for nitrogen dioxide (NO_2). As such, there are concerns that the proposals could expose future site users to elevated pollution levels. Additionally, the proposals have the potential to cause air quality impacts at sensitive receptor locations as a result of emissions associated with the construction and operational phases. An Air Quality Assessment was therefore required to determine baseline conditions, consider location suitability for residential use and provide consideration of potential effects as a result of the proposals. This is detailed in the following report.

1.3 Limitations

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

2.0 LEGISLATION AND POLICY

2.1 European Legislation

European Union (EU) air quality legislation is provided within Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidated previous legislation which was designed to deal with specific pollutants in a consistent manner and provided new air quality objectives for particulate matter with an aerodynamic diameter of less than 2.5µm ($PM_{2.5}$). The consolidated Directives include:

- Directive 99/30/EC - the First Air Quality "Daughter" Directive - sets ambient Air Quality Limit Values (AQLVs) for NO_2, oxides of nitrogen (NO_x), sulphur dioxide, lead and particulate matter with an aerodynamic diameter of less than 10µm (PM_{10});
- Directive 2000/69/EC - the Second Air Quality "Daughter" Directive - sets ambient AQLVs for benzene and carbon monoxide; and,
- Directive 2002/3/EC - the Third Air Quality "Daughter" Directive - seeks to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

The fourth daughter Directive was not included within the consolidation and is described as:

- Directive 2004/107/EC - sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

2.2 UK Legislation

The Air Quality Standards Regulations (2010) came into force on 11th June 2010 and transpose the EU Directive 2008/50/EC into UK law. AQLVs were published in these regulations for 7 pollutants, as well as Target Values for an additional 5 pollutants.

Part IV of the Environment Act (1995) requires UK government to produce a national Air Quality Strategy (AQS) which contains standards, objectives and measures for improving ambient air quality. The most recent AQS was produced by the Department for Environment, Food and Rural Affairs (DEFRA) and published in July 2007[1]. The AQS sets out AQOs that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedences over a specified timescale. These are generally in line with the AQLVs, although the requirements for compliance vary slightly.

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

1 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA, 2007.

Table 1 Air Quality Objectives

Pollutant	Air Quality Objective	
	Concentration (µg/m^3)	Averaging Period
NO_2	40	Annual mean
	200	1-hour mean; not to be exceeded more than 18 times a year
PM_{10}	40	Annual mean
	50	24-hour mean; not to be exceeded more than 35 times a year

Table 2 summarises the advice provided in DEFRA guidance LAQM.TG(09)[2] on where the AQOs for pollutants considered within this report apply.

Table 2 Examples of Where the Air Quality Objectives Apply

Averaging Period	Objectives Should Apply At	Objectives Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed Building façades of residential properties, schools, hospitals, care homes etc	Building façades of offices or other places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean and 8-hour mean	All locations where the annual mean objective would apply, together with hotels Gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term

2 Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.

Averaging Period	Objectives Should Apply At	Objectives Should Not Apply At
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more Any outdoor locations where members of the public might reasonably expected to spend one hour or longer	Kerbside sites where the public would not be expected to have regular access

2.3 Local Air Quality Management

Under Section 82 of the Environment Act (1995) (Part IV) Local Authorities (LAs) are required to periodically review and assess air quality within their area of jurisdiction under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves considering present and likely future air quality against the AQOs. If it is predicted that levels at sensitive locations where members of the public are regularly present for the relevant averaging period are likely to be exceeded, the LA is required to declare an AQMA. For each AQMA the LA is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.4 Dust

The main requirements with respect to dust control from industrial or trade premises not regulated under the Environmental Permitting (England and Wales) Regulations (2010) and subsequent amendments, such as construction sites, is that provided in Section 79 of Part III of the Environmental Protection Act (1990). The Act defines nuisance as:

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

Enforcement of the Act, in regard to nuisance, is currently under the jurisdiction of the local Environmental Health Department, whose officers are deemed to provide an independent evaluation of nuisance. If the LA is satisfied that a statutory nuisance exists, or is likely to occur or happen again, it must serve an Abatement Notice under Part III of the Environmental Protection Act (1990). Enforcement can insist that there be no dust beyond the boundary of the works. The only defence is to show that the process to which the nuisance has been attributed and its operation are being controlled according to best practice measures.

2.5 National Planning Policy

2.5.1 National Planning Policy Framework

The National Planning Policy Framework[3] (NPPF) was published on 27th March 2012 and sets out the Government's core policies and principles with respect to land use planning, including air quality. The document includes the following considerations which are relevant to this assessment:

> "The planning system should contribute to and enhance the natural and local environment by: […]
>
> Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability"
>
> "Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

The implications of the NPPF have been considered throughout this assessment.

2.5.2 National Planning Practice Guidance

The National Planning Practice Guidance[4] (NPPG) web-based resource was launched by the Department for Communities and Local Government on 6th March 2014 to support the NPPF and make it more accessible. The air quality pages are summarised under the following headings:

1. Why should planning be concerned about air quality?
2. What is the role of Local Plans with regard to air quality?
3. Are air quality concerns relevant to neighbourhood planning?
4. What information is available about air quality?
5. When could air quality be relevant to a planning decision?
6. Where to start if bringing forward a proposal where air quality could be a concern?
7. How detailed does an air quality assessment need to be?
8. How can an impact on air quality be mitigated?
9. How do considerations about air quality fit into the development management process?

These were reviewed and the relevant guidance considered as necessary throughout the undertaking of this assessment.

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[3] National Planning Policy Framework, Department for Communities and Local Government, 2012.
[4] http://planningguidance.planningportal.gov.uk/.

2.6 Local Planning Policy

The City of Liverpool Unitary Development Plan[5] (UDP) was formally adopted in 2002 and provides a framework for development within the city. A number of policies contained within the UDP have been saved in accordance with the Planning and Compulsory Purchase Act (2004) and therefore provide the basis for the determination of planning applications prior to the finalisation of the Local Development Framework.

A review of the UDP indicated the following policy in relation to air quality that is relevant to this assessment:

> "Policy EP11
>
> 1. Planning permissions will not be granted for development which has the potential to create unacceptable air, water, noise or other pollution or nuisance."

This policy has been considered throughout this report by considering potential air quality impacts as a result of the proposed development.

[5] The City of Liverpool Unitary Development Plan, Liverpool City Council, 2002.

3.0 METHODOLOGY

The proposed development has the potential to cause air quality impacts during the construction and operational phases in addition to exposing future site users to elevated pollution levels. These issues have been assessed in accordance with the following methodology, agreed with Paul Farrell, Principal Environmental Protection Officer at LCC, on 24th October via email.

3.1 Construction Phase Assessment

There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the methodology outlined within the Institute of Air Quality Management (IAQM) document 'Guidance on the Assessment of Dust from Demolition and Construction'[6].

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

- Earthworks;
- Construction; and,
- Trackout.

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

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

The assessment steps are detailed below.

3.1.1 Step 1

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

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

3.1.2 Step 2

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

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[6] Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management, 2014.

factors:

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

The two factors are combined in Step 2C to determine the risk of dust impacts without mitigation applied.

Step 2A defines the potential magnitude of dust emission through the construction phase. The relevant criteria are summarised in Table 3.

Table 3 Construction Dust - Magnitude of Emission

Magnitude	Activity	Criteria
Large	Earthworks	• Total site area greater than 10,000m^2 • Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) • More than 10 heavy earth moving vehicles active at any one time • Formation of bunds greater than 8m in height • More than 100,000 tonnes of material moved
	Construction	• Total building volume greater than 100,000m^3 • On site concrete batching • Sandblasting
	Trackout	• More than 50 Heavy Duty Vehicle (HDV) trips per day • Potentially dusty surface material (e.g. high clay content) • Unpaved road length greater than 100m
Medium	Earthworks	• Total site area 2,500m^2 to 10,000m^2 • Moderately dusty soil type (e.g. silt) • 5 to 10 heavy earth moving vehicles active at any one time • Formation of bunds 4m to 8m in height • Total material moved 20,000 tonnes to 100,000 tonnes
	Construction	• Total building volume 25,000m^3 to 100,000m^3 • Potentially dusty construction material (e.g. concrete) • On site concrete batching
	Trackout	• 10 to 50 HDV trips per day • Moderately dusty surface material (e.g. high clay content) • Unpaved road length 50m to 100m

Magnitude	Activity	Criteria
Small	Earthworks	• Total site area less than 2,500m^2 • Soil type with large grain size (e.g. sand) • Less than 5 heavy earth moving vehicles active at any one time • Formation of bunds less than 4m in height • Total material moved less than 20,000 tonnes • Earthworks during wetter months
	Construction	• Total building volume less than 25,000m^3 • Construction material with low potential for dust release (e.g. metal cladding or timber)
	Trackout	• Less than 10 HDV trips per day • Surface material with low potential for dust release • Unpaved road length less than 50m

Step 2B defines the sensitivity of the area around the development site for construction, earthworks and trackout. The factors influencing the sensitivity of the area are shown in Table 4.

Table 4 Examples of Factors Defining Sensitivity of an Area

Sensitivity	Examples	
	Human Receptors	Ecological Receptors
High	• Users expect of high levels of amenity • High aesthetic or value property • People expected to be present continuously for extended periods of time • Locations where members of the public are exposed over a time period relevant to the AQO for PM_{10} e.g. residential properties, hospitals, schools and residential care homes	• Internationally or nationally designated site e.g. Special Area of Conservation
Medium	• Users would expect to enjoy a reasonable level of amenity • Aesthetics or value of their property could be diminished by soiling • People or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land e.g. parks and places of work	• Nationally designated site e.g. Sites of Special Scientific Interest

Sensitivity	Examples	
	Human Receptors	Ecological Receptors
Low	• Enjoyment of amenity would not reasonably be expected • Property would not be expected to be diminished in appearance • Transient exposure, where people would only be expected to be present for limited periods. e.g. public footpaths, playing fields, shopping streets, playing fields, farmland, footpaths, short term car park and roads	• Locally designated site e.g. Local Nature Reserve

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

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

These factors were considered in the undertaking of this assessment.

The sensitivity of the area to dust soiling effects on people and property is shown in Table 5.

Table 5 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		Less than 20	Less than 50	Less than 100	Less than 350
High	More than 100	High	High	Medium	Low
	10 - 100	High	Medium	Low	Low
	1 - 10	Medium	Low	Low	Low
Medium	More than 1	Medium	Low	Low	Low
Low	More than 1	Low	Low	Low	Low

Table 6 outlines the sensitivity of the area to human health impacts.

Table 6 Sensitivity of the Area to Human Health Impacts

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

Table 7 outlines the sensitivity of the area to ecological impacts.

Table 7 Sensitivity of the Area to Ecological Impacts

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

Step 2C combines the dust emission magnitude with the sensitivity of the area to determine the risk of unmitigated impacts. Table 8 outlines the risk category from earthworks and construction activities.

Table 8 Dust Risk Category from Earthworks and Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	**Medium**	**Small**
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table 9 outlines the risk category from trackout.

Table 9 Dust Risk Category from Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	**Medium**	**Small**
High	High	Medium	Low
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

3.1.3 Step 3

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

3.1.4 Step 4

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

The determination of significance relies on professional judgement and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts. The IAQM[7] guidance suggests the provision of details of the assessor's qualifications and experience. These are provided in Appendix III.

7 Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management, 2014.

3.2 Operational Phase Assessment

The development has the potential to impact on existing air quality as a result of road traffic exhaust emissions, such as NO_2 and PM_{10}, associated with vehicles travelling to and from the site, as well as expose future users to elevated pollutant levels. Potential impacts have been defined by predicting pollutant concentrations at sensitive locations using dispersion modelling for the following scenarios:

- Verification;
- Opening year do-minimum (DM) (predicted traffic flows in 2019 should the proposals not proceed); and,
- Opening year do-something (DS) (predicted traffic flows in 2019 should the proposals be completed).

Reference should be made to Appendix II for assessment input data and details of the verification process.

Receptors potentially sensitive to changes in NO_2 and PM_{10} concentrations were identified within 200m of the affected highway network in accordance with the guidance provided within the Design Manual for Roads and Bridges (DMRB)[8] on the likely limits of pollutant dispersion from road sources. LAQM.TG(09)[9] provides the following examples of where annual mean AQOs should apply:

- Residential properties;
- Schools;
- Hospitals; and,
- Care homes.

The sensitivity of each receptor was defined in accordance with the criteria shown in Table 10. These are based upon the guidance provided within the Environmental Protection UK (EPUK) Development Control: Planning for Air Quality (2010 update)[10].

Table 10 Operational Traffic Exhaust Emissions - Receptor Sensitivity

Sensitivity	Description
Very high	Pollutant levels above environmental assessment criteria e.g. • NO_2 or PM_{10} annual mean greater than 40µg/m^3
High	Pollutant levels between 90% and 100% of environmental assessment criteria e.g. • NO_2 or PM_{10} annual mean 36 - 40µg/m^3
Medium	Pollutant levels between 75% and 90% of environmental assessment criteria e.g. • NO_2 and PM_{10} annual mean 30 - 36µg/m^3

8 Design Manual for Roads and Bridges Volume 11, Section 3, Part 1, HA207/07, Highways Agency, 2007.
9 Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.
10 Development Control: Planning for Air Quality (2010 update), Environmental Protection UK, 2010.

Sensitivity	Description
Low	Pollutant levels below 75% of environmental assessment criteria e.g. • NO_2 or PM_{10} annual mean below 30µg/m^3

The magnitude of change in pollutant concentrations was defined based on the criteria outlined in Table 11.

Table 11 Operational Traffic Exhaust Emissions - Magnitude of Change

Magnitude of Change	Change in Pollutant Level as Proportion of Assessment Criteria (%)
Large	Greater than 10
Medium	5 - 10
Small	1 - 5
Imperceptible	Less than 1

Impact significance was defined based on the interaction between the sensitivity of the affected receptor and the magnitude of change, as outlined in Table 12.

Table 12 Operational Traffic Exhaust Emissions - Significance of Impact

Sensitivity	Magnitude of Change			
	Imperceptible	Small	Medium	Large
Very high	Negligible	Slight	Moderate	Substantial
High	Negligible	Slight	Moderate	Moderate
Medium	Negligible	Negligible	Slight	Slight
Low	Negligible	Negligible	Negligible	Slight

It should be noted that the criteria shown in Table 10 and Table 11 and the matrix shown in Table 12 are adapted from the EPUK Development Control: Planning for Air Quality (2010 update)[11] guidance document with sensitivity descriptors included to allow comparisons of various air quality impacts.

Following the prediction of impacts at discrete receptor locations, the EPUK[12] document provides guidance on determining the overall air quality impact significance of the operation of a development. The following factors are identified for consideration by the assessor:

- Number of properties affected by significant air quality impacts and a judgement on the overall balance;

11 Development Control: Planning for Air Quality (2010 update), Environmental Protection UK, 2010.
12 Development Control: Planning for Air Quality (2010 update), Environmental Protection UK, 2010.

- Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant;
- The magnitude of changes and the descriptions of the impacts at the receptors;
- Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased;
- Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced; and,
- The extent to which an objective or limit value is exceeded e.g. an annual mean NO_2 concentration of 41µg/m^3 should attract less significance than an annual mean of 51µg/m^3.

These factors were considered and an overall significance determined for the impact of operational phase road traffic emissions. It should be noted that the determination of significance relies on professional judgement and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts. The EPUK[13] guidance suggests the provision of details of the assessor's qualifications and experience. These are provided in Appendix III.

[13] Development Control: Planning for Air Quality (2010 update), Environmental Protection UK, 2010.

4.0 BASELINE

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

4.1 Local Air Quality Management

As required by the Environment Act (1995), LCC has undertaken Review and Assessment of air quality within their area of jurisdiction. This process concluded that concentrations of NO_2 are above the AQO within the city. As such, an AQMA has been declared, which is described as:

> "An area encompassing the whole City of Liverpool"

Review of the DEFRA website[14] indicated that the proposed development is located within the AQMA. As such, there is the potential for adverse impacts to existing pollution levels in this sensitive location as a result of the scheme, as well as the exposure of future residents to poor air quality. This has been considered within this report. Reference should be made to Figure 3 for a map of the Liverpool City AQMA in the vicinity of the proposed development site.

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

4.2 Air Quality Monitoring

Monitoring of pollutant concentrations is undertaken by LCC using continuous and periodic methods throughout their area of jurisdiction. A review of the most recent LAQM report[15] indicated that the closest continuous monitor to the proposed development is Liverpool Speke at NGR: 343884, 383601. This is approximately 4.9km south of the site boundary at an urban background location. Recent monitoring results are shown in Table 13.

Table 13 Liverpool Speke Continuous Monitoring Results

Pollutant	Annual Mean Concentration ($\mu g/m^3$)			
	2010	2011	2012	2013
NO_2	30	24	25	23
PM_{10}	17	16	13	11

As indicated in Table 13, annual mean NO_2 and PM_{10} concentrations were below the relevant AQOs during recent years at the Liverpool Speke monitoring site.

LCC also utilise diffusion tubes to measure ambient levels of NO_2 within their area of jurisdiction. Recent monitoring results are shown in Table 14. Exceedences of the relevant AQO are shown in **bold** text.

14 http://aqma.defra.gov.uk/1aqma/aqma_detail.php?aqma_id=229.
15 2013 Air Quality Progress Report for Liverpool City Council, Liverpool City Council, 2013.

Table 14 NO_2 Diffusion Tube Monitoring Results

Site ID	Location	Annual Mean NO_2 Concentration (µg/m^3)			
		2010	2011	2012	2013
S50	Renville Road/Bowring Park Road (Triplicate Tubes)	**64**	**59**	**62**	**57**
S51		**60**	**59**	**68**	**58**
S52		**61**	**59**	**56**	**56**
S53	Bowring Park Road on Give Way sign	**55**	**42**	**52**	**51**
S54	Hillfoot Road/Allerton Road	**50**	**44**	**54**	**58**

As indicated in Table 14, the annual mean AQO for NO_2 was exceeded at all monitoring locations within the vicinity of the site in recent years. This is to be expected as the diffusion tubes are located at roadside locations in the LCC AQMA. Reference should be made to Figure 4 for a graphical representation of the diffusion tube locations.

4.3 Background Pollutant Concentrations

Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist LAs in their Review and Assessment of air quality. The proposed development site is located in grid square NGR: 342500, 388500. The most recent data for this location, released in June 2014, was downloaded from the DEFRA website[16] for the purpose of this assessment and is summarised in Table 15.

Table 15 Predicted Background Pollutant Concentrations

Pollutant	Predicted Background Concentration (µg/m^3)	
	2013	2014
NO_x	26.75	26.13
NO_2	19.06	18.70
PM_{10}	14.70	14.50

As shown in Table 15, background concentrations in the vicinity of the site are predicted to below the relevant AQOs.

4.4 Sensitive Receptors

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

16 http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2011.

4.4.1 Construction Phase Sensitive Receptors

Receptors sensitive to potential dust impacts during earthworks and construction were identified from a desk-top study of the area up to 350m from the development boundary. These are summarised in Table 16.

Table 16 Earthworks and Construction Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Residential Receptors	Approximate Number of Ecological Receptors
Less than 20	More than 100	0
20 - 50	More than 100	0
50 - 100	More than 100	-
100 - 350	More than 100	-

Reference should be made to Figure 5 for a graphical representation of earthworks and construction dust receptors. The proposed development is located in a predominantly residential area with receptors located in each direction.

Receptors sensitive to potential dust impacts from trackout were identified from a desk-top study of the area up to 100m from the road network within 500m of the site access. These are summarised in Table 17. The exact construction vehicle access routes were not available for the purpose of this assessment as they will depend on sourcing of materials. This is likely to be decided by the contractor. However, it was assumed traffic would access the site from a number of different routes to ensure the maximum potential trackout distance was considered.

Table 17 Trackout Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Residential Receptors	Approximate Number of Ecological Receptors
Less than 20	More than 100	0
20 - 50	More than 100	0
50 - 100	More than 100	-

Reference should be made to Figure 6 for a graphical representation of trackout dust sensitive receptor locations.

There are no ecological receptors within 50m of the site or trackout boundary. As such, ecological impacts have not been assessed further within this report.

A number of additional factors have been considered when determining the sensitivity of the surrounding area. These are summarised in Table 18.

Table 18 Additional Area Sensitivity Factors

Guidance	Comment
Whether there is any history of dust generating activities in the area	The development site is currently vacant, previously occupied by school buildings. This area has now been cleared and dust may have been circulated as a result of this process
The likelihood of concurrent dust generating activity on nearby sites	Due to the site location, in an established residential area, there is a very low possibility that any dust generating activities may occur that could account for cumulative impacts
Pre-existing screening between the source and the receptors	There is no clear pre-existing screening between the source and the receptors
Conclusions drawn from analysing local meteorological data which accurately represent the area: and if relevant the season during which works will take place	The wind direction is predominantly from the south and west of the development, as shown in Figure 7. As such, properties to the north and east of the site would be most affected by dust emissions
Conclusions drawn from local topography	The land use in close proximity to the site is mainly residential, and there are no large scale buildings. The surrounding area appears relatively flat, as such there are no topography constraints to dust dispersion
Duration of the potential impact, as a receptor may become more sensitive over time	Currently it is unclear as to the duration of the construction phase. However, it is likely that it will extend over one year
Any known specific receptor sensitivities which go beyond the classifications given in the document.	No specific receptor sensitivities identified during the baseline

Based on the criteria shown in Table 4, the sensitivity of the receiving environment to potential dust impacts was considered to be **high**. This was because users would expect to enjoy a reasonable level of amenity, aesthetics or value of their property could be diminished by soiling and people would be expected to be present for extended periods of time e.g. residential properties.

The sensitivity of the receiving environment to specific potential dust impacts, based on the criteria shown in Section 3.1.2, is shown in Table 19.

Table 19 Sensitivity of the Surrounding Area

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

4.4.2 Operational Phase Sensitive Receptors

Receptors sensitive to potential operational phase road vehicle exhaust emission impacts were identified from a desk-top study and are summarised in Table 20.

Table 20 Road Vehicle Exhaust Emission Sensitive Receptors

Receptor		NGR (m)	
		X	Y
R1	443 Woolton Road	341963.8	387960.2
R2	Brookfield	341940.8	387930.5
R3	445 Woolton Road	341994.1	387948.6
R4	1 Cuckoo Way	342321.5	387804.3
R5	41 Bower Road	342337.5	387747.0
R6	1a Rose Brow	342376.2	387772.3
R7	Briancon	342430.8	387607.4
R8	Eden-Roc	342440.7	387580.1
R9	The Brae	342493.3	387607.9
R10	44 Gateacre Brow	342761.9	387722.5
R11	1 Halewood Road	342785.0	387717.5
R12	25 Grange Lane	342143.6	388418.1
R13	The Lodge	342057.2	388480.3
R14	1 Acersgate Court	342066.5	388515.5
R15	134 Gateacre Park Drive	342025.9	388493.0
R16	158 Gateacre Park Drive	342014.3	388349.0
R17	168 Gateacre Park Drive	342004.7	388288.0
R18	3 Dunlin Court	342042.6	388259.6
R19	7 Dunnock Close	342101.6	388183.1
R20	20 Cuckoo Lane	342113.7	388164.3
R21	165 Childwall Valley Road	341289.0	389566.9
R22	137 Bentham Drive	341333.6	389584.7
R23	6 Givenchy Close	341295.8	389521.9

The sensitive receptors identified in Table 20 represent worst-case locations. However, this is not an exhaustive list and there may be other locations within the vicinity of the site that may experience air quality impacts as a result of the proposed development that have not been individually identified above. Reference should be made to Figure 8 for a graphical representation of road vehicle exhaust emission sensitive receptor locations.

Receptor sensitivity was defined based upon the methodology outlined in Table 10 and predicted pollutant concentrations for the development opening year of 2019. These are detailed within Table 21.

Table 21 Road Vehicle Exhaust Emission Receptor Sensitivity

Receptor	NO_2		PM_{10}	
	Predicted Annual Mean Concentration ($\mu g/m^3$)	Sensitivity	Predicted Annual Mean Concentration ($\mu g/m^3$)	Sensitivity
R1	31.76	Medium	15.99	Low
R2	29.31	Low	15.63	Low
R3	31.30	Medium	15.95	Low
R4	28.89	Low	15.60	Low
R5	27.14	Low	15.31	Low
R6	30.18	Medium	15.75	Low
R7	28.68	Low	15.52	Low
R8	28.23	Low	15.48	Low
R9	28.29	Low	15.49	Low
R10	32.21	Medium	16.15	Low
R11	33.81	Medium	16.40	Low
R12	27.79	Low	15.53	Low
R13	29.63	Low	15.85	Low
R14	27.97	Low	15.55	Low
R15	27.38	Low	15.47	Low
R16	26.64	Low	15.35	Low
R17	25.93	Low	15.22	Low
R18	26.45	Low	15.31	Low
R19	25.44	Low	15.13	Low
R20	25.48	Low	15.14	Low
R21	32.85	Medium	16.02	Low

Receptor	NO_2		PM_{10}	
	Predicted Annual Mean Concentration (μg/m^3)	Sensitivity	Predicted Annual Mean Concentration (μg/m^3)	Sensitivity
R22	32.62	Medium	16.06	Low
R23	29.18	Low	15.50	Low

As indicated in Table 21, receptor sensitivity to changes in annual mean NO_2 concentrations was **medium** at seven locations and **low** at sixteen locations. Receptor sensitivity to changes in annual mean PM_{10} concentrations was **low** at all locations.

5.0 ASSESSMENT

There is the potential for air quality impacts as a result of the construction and operation of the proposed development in addition to the exposure of future site users to elevated pollution levels. These issues are assessed in the following Sections.

5.1 Construction Phase Assessment

5.1.1 Step 1

The undertaking of activities such as excavation, ground works, cutting, construction, concrete batching and storage of materials has the potential to result in fugitive dust emissions throughout the construction phase. Vehicle movements both on-site and on the local road network also have the potential to result in the re-suspension of dust from haul road and highway surfaces.

The potential for impacts at sensitive locations depends significantly on local meteorology during the undertaking of dust generating activities, with the most significant effects likely to occur during dry and windy conditions.

The desk-study undertaken to inform the baseline identified a number of sensitive receptors within 350m of the site boundary. As such, a detailed assessment of potential dust impacts was required.

5.1.2 Step 2

Earthworks

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling, as well as site levelling and landscaping. Information on soil type was not available for the purpose of this assessment. As such, the soil type was considered to be potentially dusty in order to provide a worst-case scenario.

The proposed development site is estimated to cover an area greater than 10,000m^2. In accordance with the criteria outlined in Table 3, the magnitude of potential dust emissions from earthworks is therefore **large**.

Table 19 indicates the sensitivity of the area to dust soiling effects on people and property is **high**. In accordance with the criteria outlined in Table 8, the development is considered to be a **high** risk site for dust soiling as a result of earthworks activities.

Table 19 indicates the sensitivity of the area to human health is **medium**. In accordance with the criteria outlined in Table 8, the development is considered to be a **medium** risk site for human health as a result of earthwork activities.

Construction

Due to the size of the development site the total building volume is likely to be greater than 100,000m^3. In accordance with the criteria outlined in Table 3, the magnitude of potential dust emissions from construction is therefore **large**.

Table 19 indicates the sensitivity of the area to dust soiling effects on people and property is **high**. In accordance with the criteria outlined in Table 8, the development is considered to be a **high** risk site for dust soiling as a result of construction activities.

Table 19 indicates the sensitivity of the area to human health is **medium**. In accordance with the criteria outlined in Table 8, the development is considered to be a **medium** risk site for human health as a result of construction activities.

Trackout

Information on the number of HDV trips to be generated during the construction phase of the development was not available at the time of assessment. Similarly, the surface material and unpaved road length was not known at this stage of the project.

Based on the site area, it is anticipated that the unpaved road length is likely to be greater than 100m. In accordance with the criteria outlined in Table 3, the magnitude of potential dust emissions from trackout is therefore **large**.

Table 19 indicates the sensitivity of the area to dust soiling effects to people and property is **high**. In accordance with the criteria outlined in Table 9, the development is considered to be a **high** risk site for dust soiling as a result of trackout activities.

Table 19 indicates the sensitivity of the area to human health is **medium**. In accordance within the criteria outlined in Table 9, the development is considered to be a **medium** risk site for human health as a result of trackout activities.

Summary of the Risk of Dust Effects

A summary of the risk from each dust generating activity is provided in Table 22.

Table 22 Summary of Potential Unmitigated Dust Risks

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

As indicated in Table 22, the potential risk of dust soiling is **high** from earthworks, construction and trackout activities. The potential risk of human health impacts is **medium** from earthworks, construction and trackout activities.

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

5.1.3 Step 3

The IAQM guidance provides a number of potential mitigation measures to reduce impacts during the construction phase. These measures have been adapted for the development site as summarised in Table 23. These may be reviewed prior to the commencement of construction works and incorporated into a Construction Environmental Management Plan if required by the Local Planning Authority.

Table 23 Fugitive Dust Mitigation Measures

Issue	Control Measure
Communications	• Develop and implement a Stakeholder Communications Plan that includes community engagement • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary • Display the head or regional office contact information • Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the LA
Site Management	• Record all dust and air quality complaints • Record any exceptional incidents that cause dust/or air emissions, and the action taken to resolve the situation
Monitoring	• Undertake daily on-site and off-site inspection to monitor dust. This should include regular dust soiling checks of surfaces within 100m of site boundary. Cleaning to be provided if necessary • Carry out regular site inspections to monitor compliance with the DMP • Increase frequency of site inspections when activities with a high potential to produce dust are being carried out
Preparing and Maintaining the Site	• Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible • Fully enclose site or specific operations where there is a high potential for dust production and the site as actives for an extensive period • Avoid site runoff of water or mud • Use water as dust suppressant where applicable • Remove materials that have a potential to produce dust from site as soon as possible • Cover, seed or fence stockpiles to prevent wind whipping
Operating Vehicle/ Machinery and Sustainable Travel	• All vehicles to switch off engines - no idling vehicles • Avoid the use of diesel or petrol powered generators where practicable • Impose a maximum-speed-limit of 15mph on surfaced and 10mph on un-surfaced haul roads and work areas • Produce a Construction Logistics Plan to manage sustainable deliveries • Implement a Travel Plan that supports and encourages sustainable travel

Issue	Control Measure
Operations	• Cutting equipment to use water as dust suppressant or suitable local extract ventilation • Use enclosed chutes and covered skips • Minimise drop heights • Ensure equipment is readily available on site to clean any spillages
Waste Management	• No bonfires
Earthworks and Construction	• Re-vegetate earthworks and exposed areas • Use Hessian, mulches or trackifiers where it is not possible to re-vegetate • Only remove the cover in small areas during work and not all at once • Avoid scabbling • Ensure sand and other aggregates are stored and not able to dry out • Ensure bulk cement and other fine power materials are delivered and stored to prevent escape
Trackout	• Use water-assisted dust sweeper on the access and local roads • Avoid dry sweeping of large areas • Ensure vehicles entering and leaving sites are covered to prevent escape of materials • Inspect on-site routes for integrity, instigate necessary repairs and record in site log book • Install hard surfaced haul routes which are regularly damped down Implement a wheel washing system at a suitable location near site exit • Access gates 10m from receptors where possible

5.1.4 Step 4

Assuming the relevant mitigation measures outlined in Table 23 are implemented, the residual effect from all dust generating activities is predicted to be **negligible**, in accordance with the IAQM guidance.

5.2 Operational Phase Assessment

Additional vehicle movements associated with the operation of the proposed development will generate exhaust emissions, such as NO_2 and PM_{10}, on the local and regional road networks. An assessment was therefore undertaken using dispersion modelling in order to quantify potential changes in pollutant concentrations at sensitive locations in the vicinity of the site.

The assessment considered the following scenarios:

- 2013 Verification;
- 2019 DM; and,
- 2019 DS.

The DM (i.e. without development) scenario is representative of anticipated traffic data for 2019. The DS (i.e. with development) scenario is representative of anticipated traffic data for 2019 with the addition of predicted variations in traffic flow patterns as a result of the proposals.

For the purpose of this assessment traffic data was supplied for 2019, the development opening year. Air quality is predicted to improve in the future. However, in order to provide a robust assessment, emission factors for 2013 were utilised within the dispersion model. The use of 2019 traffic data and 2013 emission factors is considered to provide a worst-case scenario and therefore a sufficient level of confidence can be placed within the predicted pollution concentrations.

Reference should be made to Appendix II for full assessment input details.

5.2.1 Nitrogen Dioxide

Predicted Concentrations at the Development Site

Annual mean NO_2 concentrations were predicted across the development site for the 2019 DM and DS scenarios, as shown in Figures 9 and 10. As indicated, concentrations were predicted to be below the AQO throughout the entirety of the site both with and without the proposal in place. The NO_2 concentration across the development was predicted to range from 24.28µg/m^3 to 30.61µg/m^3 in the 2019 DS scenario.

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

Predicted Concentrations at Sensitive Receptors

Annual mean NO_2 concentrations were predicted for each scenario and are summarised in Table 24. Reference should be made to Figures 9 and 10 for graphical representations of predicted levels throughout the assessment extents without and with the development.

Table 24 Predicted Annual Mean NO_2 Concentrations

Sensitive Receptor		Predicted Annual Mean NO_2 Concentration (µg/m^3)		
		DM	DS	Change
R1	443 Woolton Road	31.58	31.76	0.18
R2	Brookfield	29.21	29.31	0.10
R3	445 Woolton Road	31.16	31.30	0.14
R4	1 Cuckoo Way	28.84	28.89	0.05
R5	41 Bower Road	27.09	27.14	0.05
R6	1a Rose Brow	30.05	30.18	0.13
R7	Briancon	28.61	28.68	0.07

Sensitive Receptor		Predicted Annual Mean NO_2 Concentration (µg/m^3)		
		DM	DS	Change
R8	Eden-Roc	28.17	28.23	0.06
R9	The Brae	28.26	28.29	0.03
R10	44 Gateacre Brow	32.11	32.21	0.10
R11	1 Halewood Road	33.73	33.81	0.08
R12	25 Grange Lane	27.64	27.79	0.15
R13	The Lodge	29.36	29.63	0.27
R14	1 Acersgate Court	27.78	27.97	0.19
R15	134 Gateacre Park Drive	27.20	27.38	0.18
R16	158 Gateacre Park Drive	26.46	26.64	0.18
R17	168 Gateacre Park Drive	25.79	25.93	0.14
R18	3 Dunlin Court	26.26	26.45	0.19
R19	7 Dunnock Close	25.28	25.44	0.16
R20	20 Cuckoo Lane	25.34	25.48	0.14
R21	165 Childwall Valley Road	32.73	32.85	0.12
R22	137 Bentham Drive	32.49	32.62	0.13
R23	6 Givenchy Close	29.10	29.18	0.08

As indicated in Table 24, predicted annual mean NO_2 concentrations were below the relevant AQO at all sensitive receptors for both scenarios considered.

Predicted impacts on annual mean NO_2 concentrations at the sensitive receptor locations are summarised in Table 25.

Table 25 Predicted NO_2 Impacts

Sensitive Receptor		Magnitude of Change	Receptor Sensitivity	Significance of Impact
R1	443 Woolton Road	Imperceptible	Medium	Negligible
R2	Brookfield	Imperceptible	Low	Negligible
R3	445 Woolton Road	Imperceptible	Medium	Negligible
R4	1 Cuckoo Way	Imperceptible	Low	Negligible
R5	41 Bower Road	Imperceptible	Low	Negligible

Sensitive Receptor		Magnitude of Change	Receptor Sensitivity	Significance of Impact
R6	1a Rose Brow	Imperceptible	Medium	Negligible
R7	Briancon	Imperceptible	Low	Negligible
R8	Eden-Roc	Imperceptible	Low	Negligible
R9	The Brae	Imperceptible	Low	Negligible
R10	44 Gateacre Brow	Imperceptible	Medium	Negligible
R11	1 Halewood Road	Imperceptible	Medium	Negligible
R12	25 Grange Lane	Imperceptible	Low	Negligible
R13	The Lodge	Imperceptible	Low	Negligible
R14	1 Acersgate Court	Imperceptible	Low	Negligible
R15	134 Gateacre Park Drive	Imperceptible	Low	Negligible
R16	158 Gateacre Park Drive	Imperceptible	Low	Negligible
R17	168 Gateacre Park Drive	Imperceptible	Low	Negligible
R18	3 Dunlin Court	Imperceptible	Low	Negligible
R19	7 Dunnock Close	Imperceptible	Low	Negligible
R20	20 Cuckoo Lane	Imperceptible	Low	Negligible
R21	165 Childwall Valley Road	Imperceptible	Medium	Negligible
R22	137 Bentham Drive	Imperceptible	Medium	Negligible
R23	6 Givenchy Close	Imperceptible	Low	Negligible

As indicated in Table 25, the significance of impacts on annual mean NO_2 concentrations as a result of the development was predicted to be **negligible** at all locations.

5.2.2 Particulate Matter

Predicted Concentrations at the Development Site

Annual mean PM_{10} concentrations were predicted across the development site for the 2019 DM and DS scenarios, as shown in Figures 11 and 12. As indicated, concentrations were predicted to be below the AQO throughout the entirety of the site both with and without the proposal in place. The PM_{10} concentration across the development was predicted to range from 14.80µg/m^3 to 15.37µg/m^3 in the 2019 DS scenario.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for residential use without the implementation of mitigation techniques to protect future residents from elevated PM_{10} concentrations.

Predicted Concentrations at Sensitive Receptors

Annual mean PM_{10} concentrations were predicted for each scenario and are summarised in Table 26. Reference should be made to Figures 11 and 12 for graphical representations of predicted levels throughout the assessment extents without and with the development.

Table 26 Predicted Annual Mean PM_{10} Concentrations

Sensitive Receptor		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	443 Woolton Road	15.96	15.99	0.03
R2	Brookfield	15.62	15.63	0.01
R3	445 Woolton Road	15.92	15.95	0.03
R4	1 Cuckoo Way	15.59	15.60	0.01
R5	41 Bower Road	15.30	15.31	0.01
R6	1a Rose Brow	15.73	15.75	0.02
R7	Briancon	15.51	15.52	0.01
R8	Eden-Roc	15.47	15.48	0.01
R9	The Brae	15.47	15.49	0.02
R10	44 Gateacre Brow	16.13	16.15	0.02
R11	1 Halewood Road	16.38	16.40	0.02
R12	25 Grange Lane	15.50	15.53	0.03
R13	The Lodge	15.79	15.85	0.06
R14	1 Acersgate Court	15.52	15.55	0.03
R15	134 Gateacre Park Drive	15.43	15.47	0.04
R16	158 Gateacre Park Drive	15.32	15.35	0.03
R17	168 Gateacre Park Drive	15.19	15.22	0.03
R18	3 Dunlin Court	15.28	15.31	0.03
R19	7 Dunnock Close	15.10	15.13	0.03
R20	20 Cuckoo Lane	15.11	15.14	0.03
R21	165 Childwall Valley Road	15.99	16.02	0.03
R22	137 Bentham Drive	16.03	16.06	0.03
R23	6 Givenchy Close	15.49	15.50	0.01

As indicated in Table 26, annual mean PM_{10} concentrations were below the relevant AQO at all sensitive receptor locations for both scenarios considered.

Predicted impacts on annual mean PM_{10} concentrations are summarised in Table 27.

Table 27 Predicted PM_{10} Impacts

Sensitive Receptor		Magnitude of Change	Receptor Sensitivity	Significance of Impact
R1	443 Woolton Road	Imperceptible	Low	Negligible
R2	Brookfield	Imperceptible	Low	Negligible
R3	445 Woolton Road	Imperceptible	Low	Negligible
R4	1 Cuckoo Way	Imperceptible	Low	Negligible
R5	41 Bower Road	Imperceptible	Low	Negligible
R6	1a Rose Brow	Imperceptible	Low	Negligible
R7	Briancon	Imperceptible	Low	Negligible
R8	Eden-Roc	Imperceptible	Low	Negligible
R9	The Brae	Imperceptible	Low	Negligible
R10	44 Gateacre Brow	Imperceptible	Low	Negligible
R11	1 Halewood Road	Imperceptible	Low	Negligible
R12	25 Grange Lane	Imperceptible	Low	Negligible
R13	The Lodge	Imperceptible	Low	Negligible
R14	1 Acersgate Court	Imperceptible	Low	Negligible
R15	134 Gateacre Park Drive	Imperceptible	Low	Negligible
R16	158 Gateacre Park Drive	Imperceptible	Low	Negligible
R17	168 Gateacre Park Drive	Imperceptible	Low	Negligible
R18	3 Dunlin Court	Imperceptible	Low	Negligible
R19	7 Dunnock Close	Imperceptible	Low	Negligible
R20	20 Cuckoo Lane	Imperceptible	Low	Negligible
R21	165 Childwall Valley Road	Imperceptible	Low	Negligible
R22	137 Bentham Drive	Imperceptible	Low	Negligible
R23	6 Givenchy Close	Imperceptible	Low	Negligible

As indicated in Table 27, predicted impacts on annual mean PM_{10} concentrations as a result of road vehicle exhaust emissions associated with the development were predicted to be **negligible** at all receptor locations.

5.2.3 Impact Significance

The overall significance of operational phase road traffic emission impacts was determined as **negligible**. This was based on the predicted impacts at discrete receptor locations and the considerations outlined in Section 3. Further justification is provided in Table 28.

Table 28 Overall Road Traffic Exhaust Emission Impact Significance

Guidance	Comment
Number of properties affected by slight, moderate or substantial air quality impacts and a judgement on the overall balance	Air quality impacts were predicted to be negligible at all sensitive receptors. These represent worst-case locations and therefore it is unlikely that any other receptors would be significantly affected by the proposed development
Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant	Pollutant concentrations across the site were assessed and results indicate that future users will not be exposed to elevated NO_2 or PM_{10} levels
The magnitude of changes and the descriptions of the impacts at the receptors	Imperceptible changes were predicted at all sensitive receptor locations in NO_2 and PM_{10} concentrations. As such, the resultant impacts were negligible
Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased	There were exceedences of the annual mean AQO for NO_2 within non-sensitive areas of the local highway network for scenarios considered. The area of exceedence is not predicted to substantially increase as a result of the development
Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced	There were exceedences of the annual mean AQO for NO_2 within non-sensitive areas of the local highway network for scenarios considered. The area of exceedence will not be removed or reduced as a result of the development
The extent to which an objective or limit value is exceeded e.g. an annual mean NO_2 concentration of $41\mu g/m^3$ should attract less significance than an annual mean of $51\mu g/m^3$	There were no predicted AQO exceedences at any sensitive location in either scenario for NO_2 or PM_{10}

6.0 CONCLUSION

REC Ltd was commissioned by Countryside Properties (UK) Ltd to undertake an Air Quality Assessment in support of a planning application for a residential development at the Former Gateacre Community Comprehensive School off Grange Lane in Gateacre, Liverpool.

The proposals comprise 202 residential units and associated infrastructure.

The site is located in an area identified by LCC as experiencing elevated pollutant concentrations and subsequently there are concerns that the proposals will introduce future users into an area of poor air quality. Additionally, the development has the potential to cause air quality impacts at sensitive locations. These may include fugitive dust emissions from construction works and road vehicle exhaust emissions associated with traffic generated by the site during the operational phase. As such, an Air Quality Assessment was required to quantify pollution levels across the site, consider its suitability for the proposed use and assess potential impacts as a result of the development.

During the construction phase of the development there is the potential for air quality impacts as a result of fugitive dust emissions from the site. These were assessed in accordance with the IAQM methodology. Assuming good practice dust control measures are implemented, the residual significance of potential air quality impacts from dust generated by earthworks, construction and trackout activities was predicted to be **negligible**.

Dispersion modelling was undertaken in order to quantify pollutant concentrations at the site and to predict air quality impacts as a result of road vehicle exhaust emissions associated with traffic generated by the development. Results were subsequently verified using monitoring results obtained from LCC.

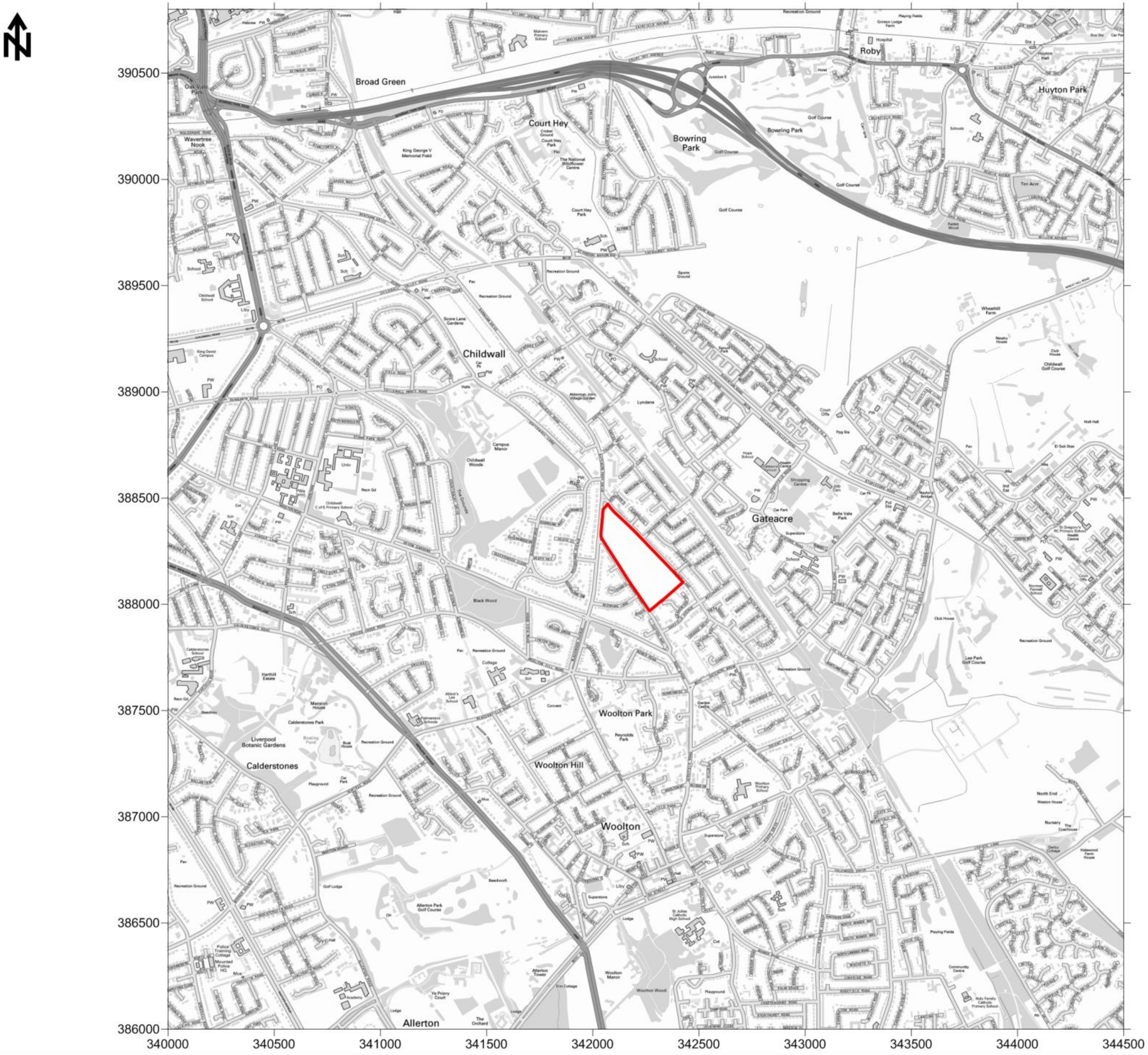
The dispersion modelling results indicated that pollution levels at the development were below the relevant AQOs. The location is therefore considered suitable for residential use without the inclusion of mitigation methods to protect future users from poor air quality. Predicted impacts on NO_2 and PM_{10} concentrations as a result of operational phase exhaust emissions were predicted to be **negligible** at all sensitive receptor locations within the vicinity of the site. The overall significance of potential impacts was determined to be **negligible**, in accordance with the EPUK guidance.

Based on the assessment results, air quality is not considered a constraint to planning consent for the proposed development.

7.0 ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADM	Atmospheric Dispersion Modelling
AQAP	Air Quality Action Plan
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objectives
AQS	Air Quality Strategy
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMP	Dust Management Plan
DMRB	Design Manual for Roads and Bridges
EPUK	Environmental Protection UK
EU	European Union
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LA	Local Authority
LAQM	Local Air Quality Management
LCC	Liverpool City Council
NGR	National Grid Reference
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5µm
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10µm
REC	Resource and Environmental Consultants
UDP	Unitary Development Plan
z_0	Roughness Length

APPENDIX I FIGURES



Legend

Site Boundary

Title

Figure 1

Site Location

Project

Air Quality Assessment
Former Gateacre Community
Comprehensive School
Grange Lane, Liverpool

Project Number

34190

Client

Countryside Properties (UK) Ltd

REC
Resource & Environmental Consultants Ltd
Resource and Environmental Consultants Ltd
Osprey House, Broadway, Manchester M50 2UE

Tel – 0161 868 1300 Fax – 0161 868 1301
www.recltd.co.uk

Legend

Site Boundary

Title

Figure 2

Site Layout

Project

Air Quality Assessment
Former Gateacre Community
Comprehensive School
Grange Lane, Liverpool

Project Number

34190

Client

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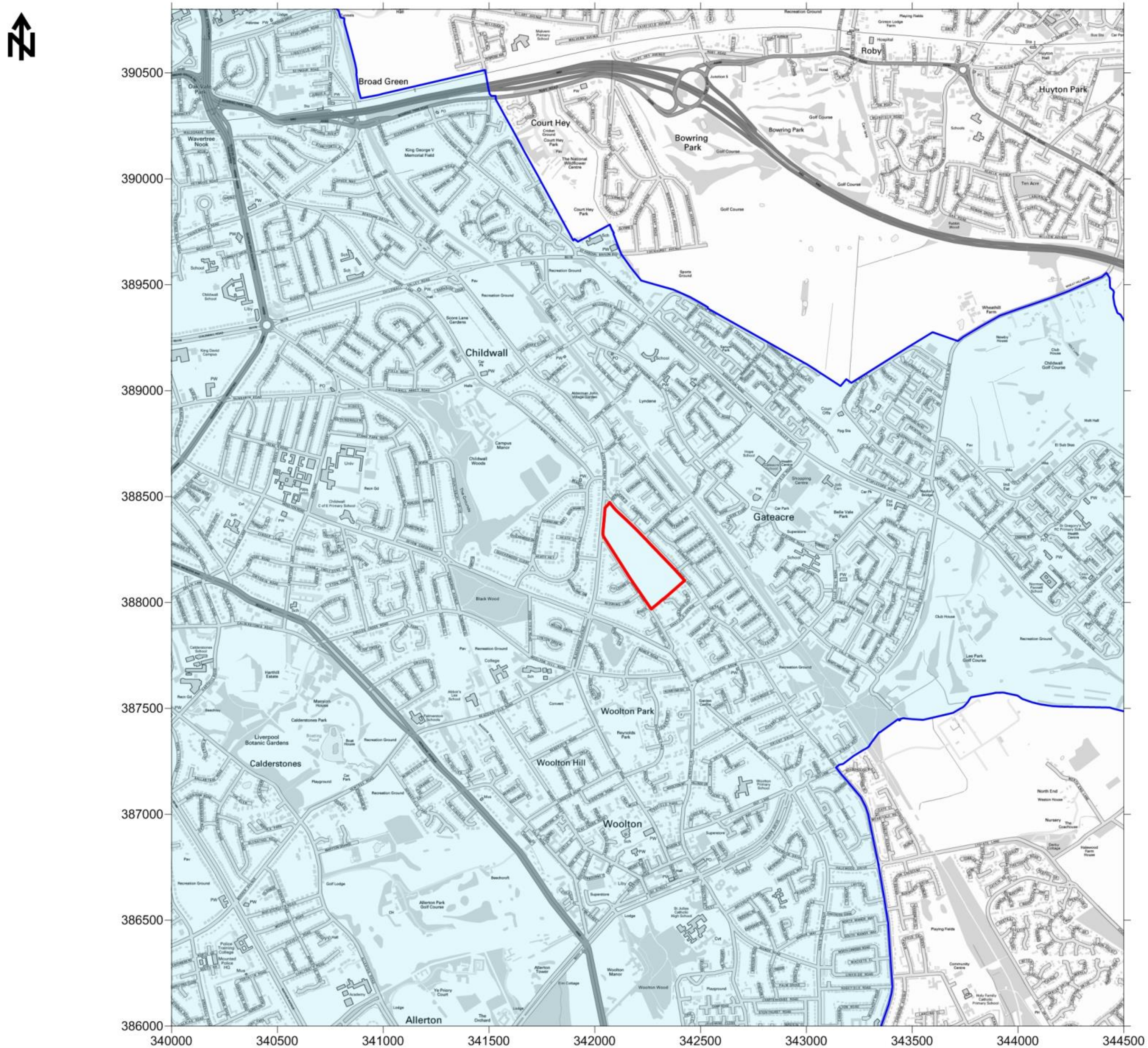

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Site Boundary

Liverpool City AQMA

Title

Figure 3

Liverpool City AQMA

Project

Air Quality Assessment
Former Gateacre Community
Comprehensive School
Grange Lane, Liverpool

Project Number

34190

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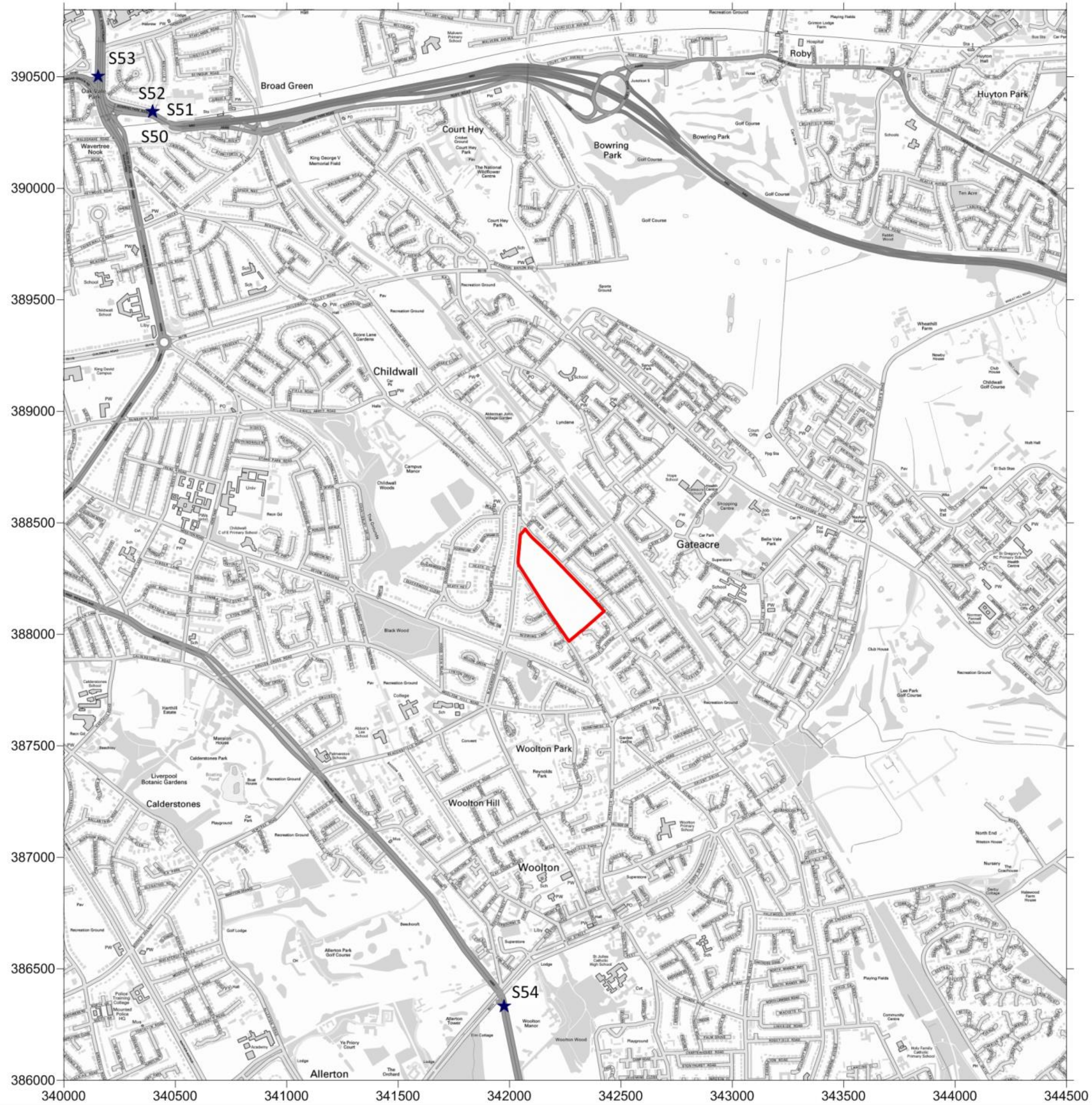

Legend

Site Boundary

Diffusion Tube Monitoring Location

Title

Figure 4

Diffusion Tube Monitoring Locations

Project

Air Quality Assessment
Former Gateacre Community Comprehensive School
Grange Lane, Liverpool

Project Number

34190

Client

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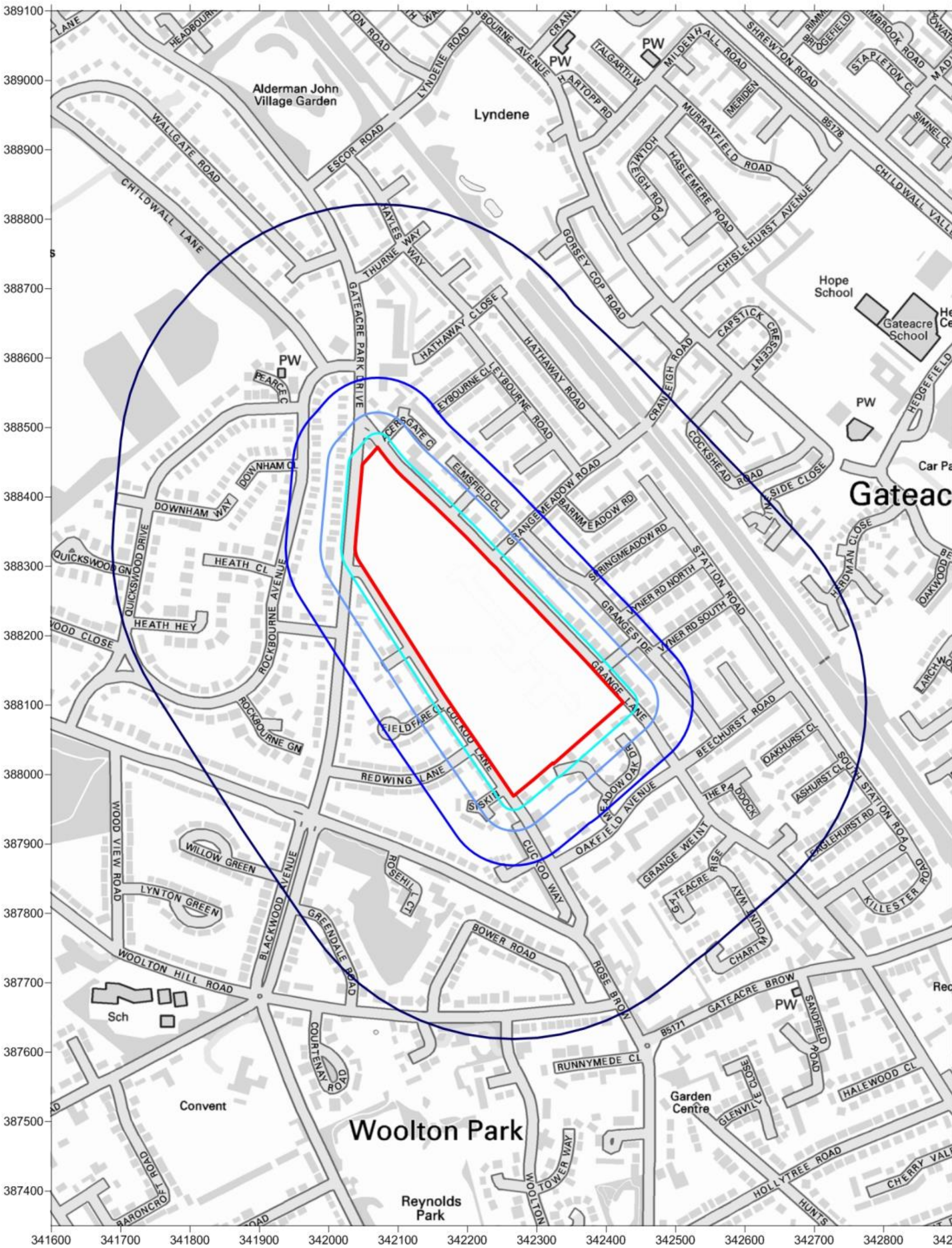

Legend

Site Boundary

20m from Site Boundary

50m from Site Boundary

100m from Site Boundary

350m from Site Boundary

Title

Figure 5

Earthworks and Construction Dust Buffer Zones

Project

Air Quality Assessment
Former Gateacre Community Comprehensive School
Grange Lane, Liverpool

Project Number

34190

Client

Countryside Properties (UK) Ltd

REC
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Legend

Site Boundary

20m from Site Access Point

50m from Site Access Point

100m from Site Access Point

Title

Figure 6

Trackout Dust Buffer Zones

Project

Air Quality Assessment
Former Gateacre Community Comprehensive School
Grange Lane, Liverpool

Project Number

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Countryside Properties (UK) Ltd

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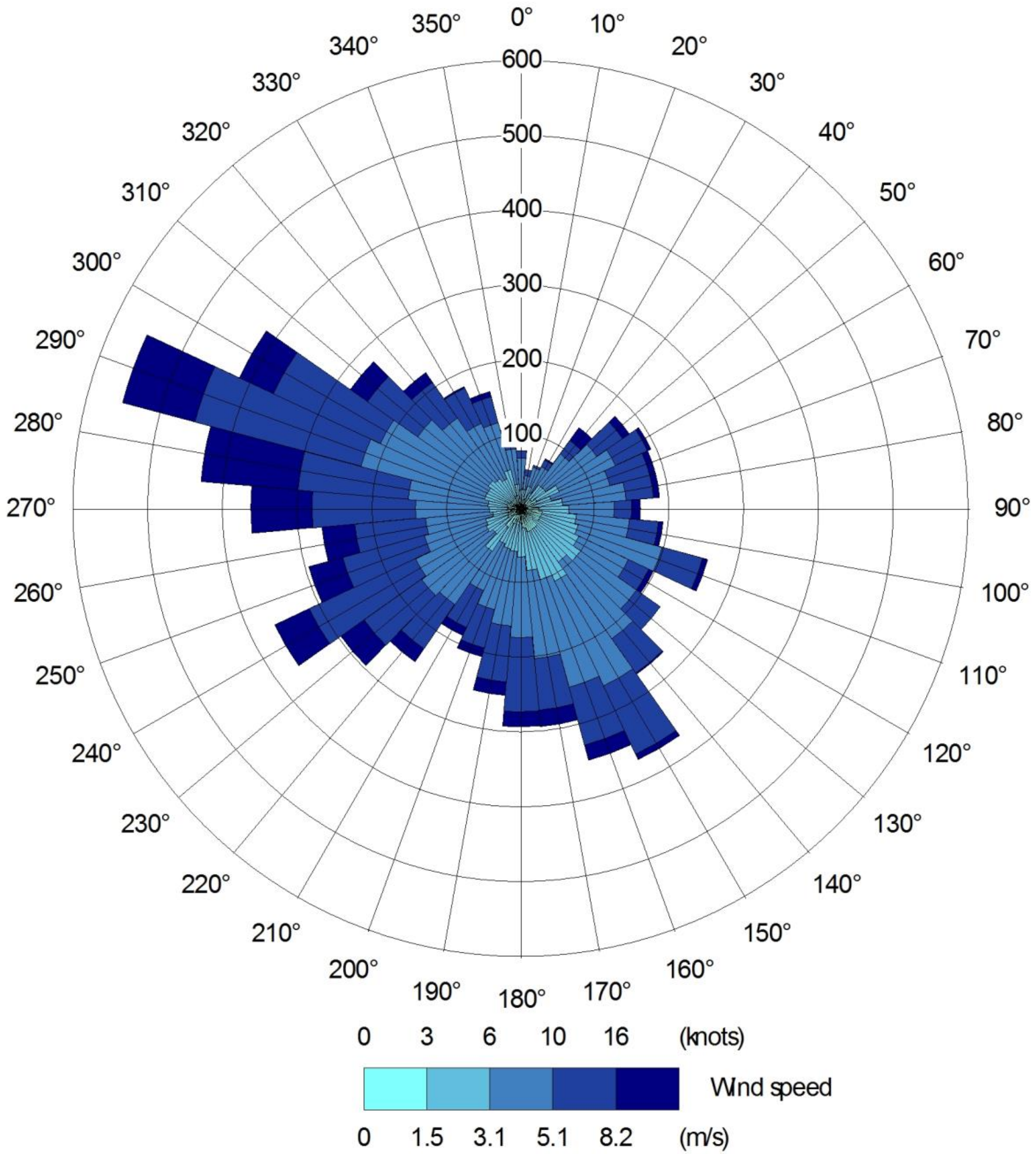

Title

Figure 7

2012 Windrose
Liverpool Airport Meteorological Station

Project

Air Quality Assessment
Former Gateacre Community
Comprehensive School
Grange Lane, Liverpool

Project Number

34190

Client

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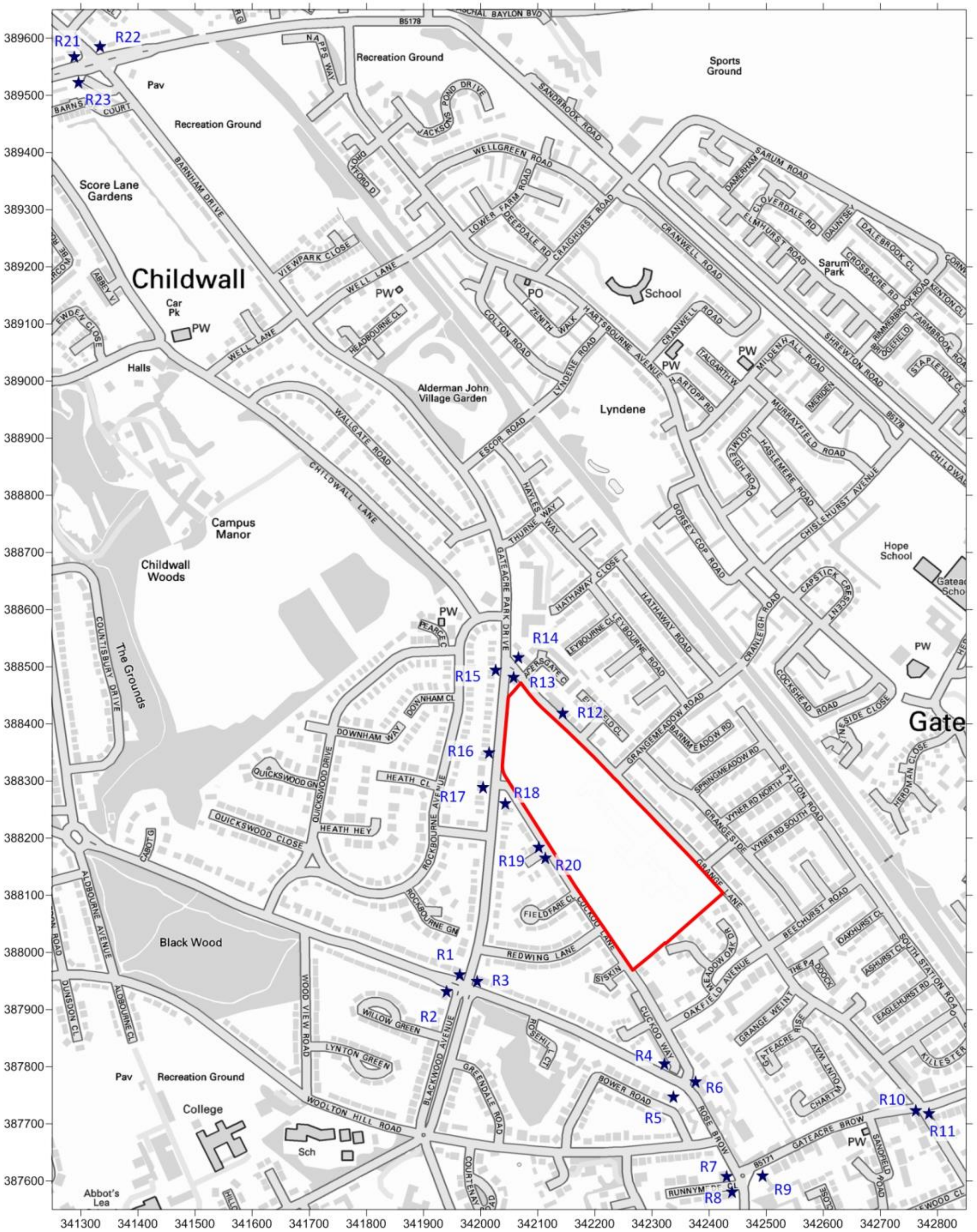

Legend

Site Boundary

Sensitive Receptor Location

Title

Figure 8

Traffic Exhaust Emissions
Sensitive Receptor Locations

Project

Air Quality Assessment
Former Gateacre Community Comprehensive School
Grange Lane, Liverpool

Project Number

34190

Client

Countryside Properties (UK) Ltd

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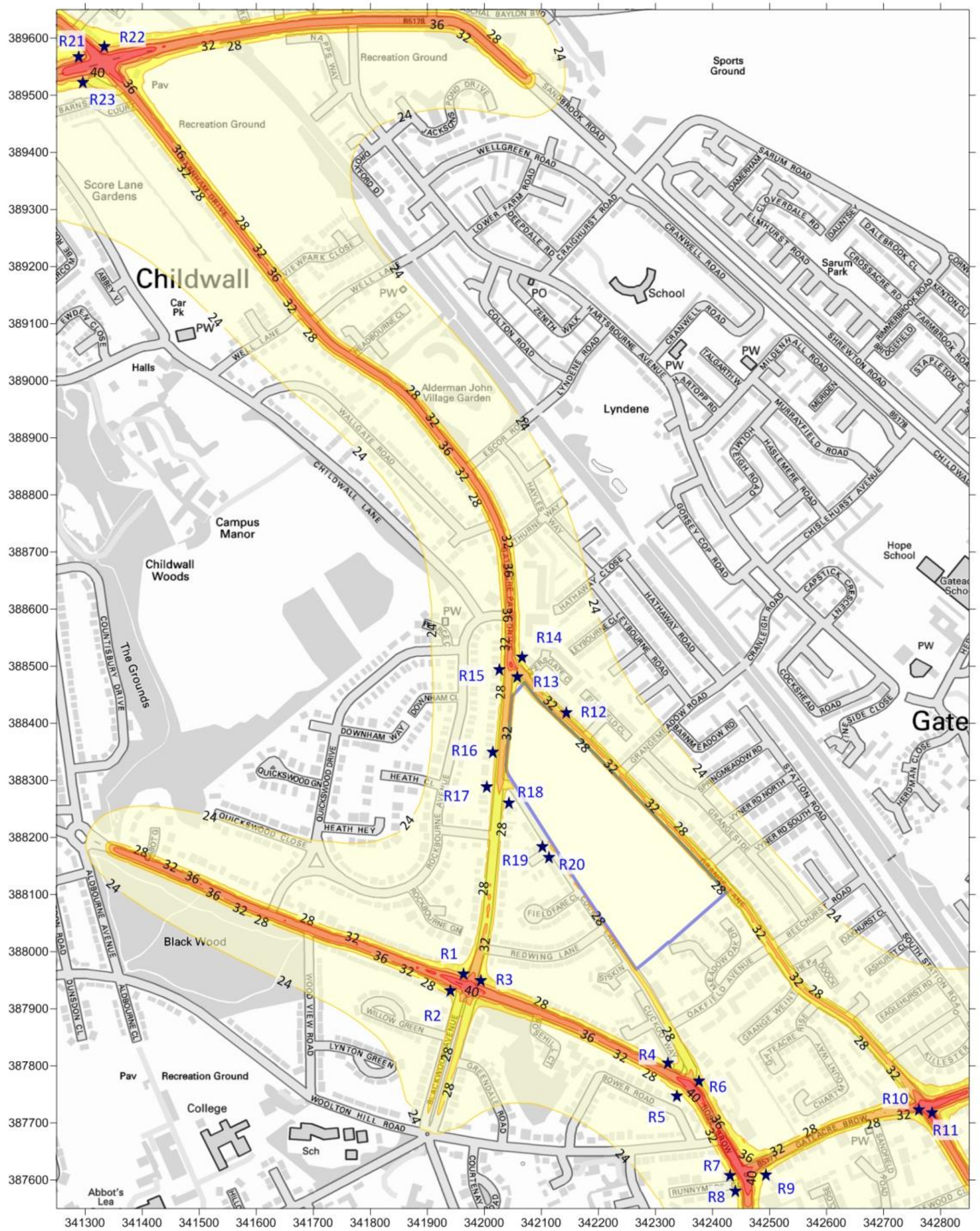

Legend

Site Boundary

Sensitive Receptor Location

Predicted Annual Mean NO_2 Concentration (µg/m³)

40

36

32

28

24

Title

Figure 9

Predicted Annual Mean NO_2 Concentrations (µg/m³) 2019 DM

Project

Air Quality Assessment
Former Gateacre Community Comprehensive School
Grange Lane, Liverpool

Project Number

34190

Client

Countryside Properties (UK) Ltd

REC Resource & Environmental Consultants Ltd

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Osprey House, Broadway, Manchester M50 2UE

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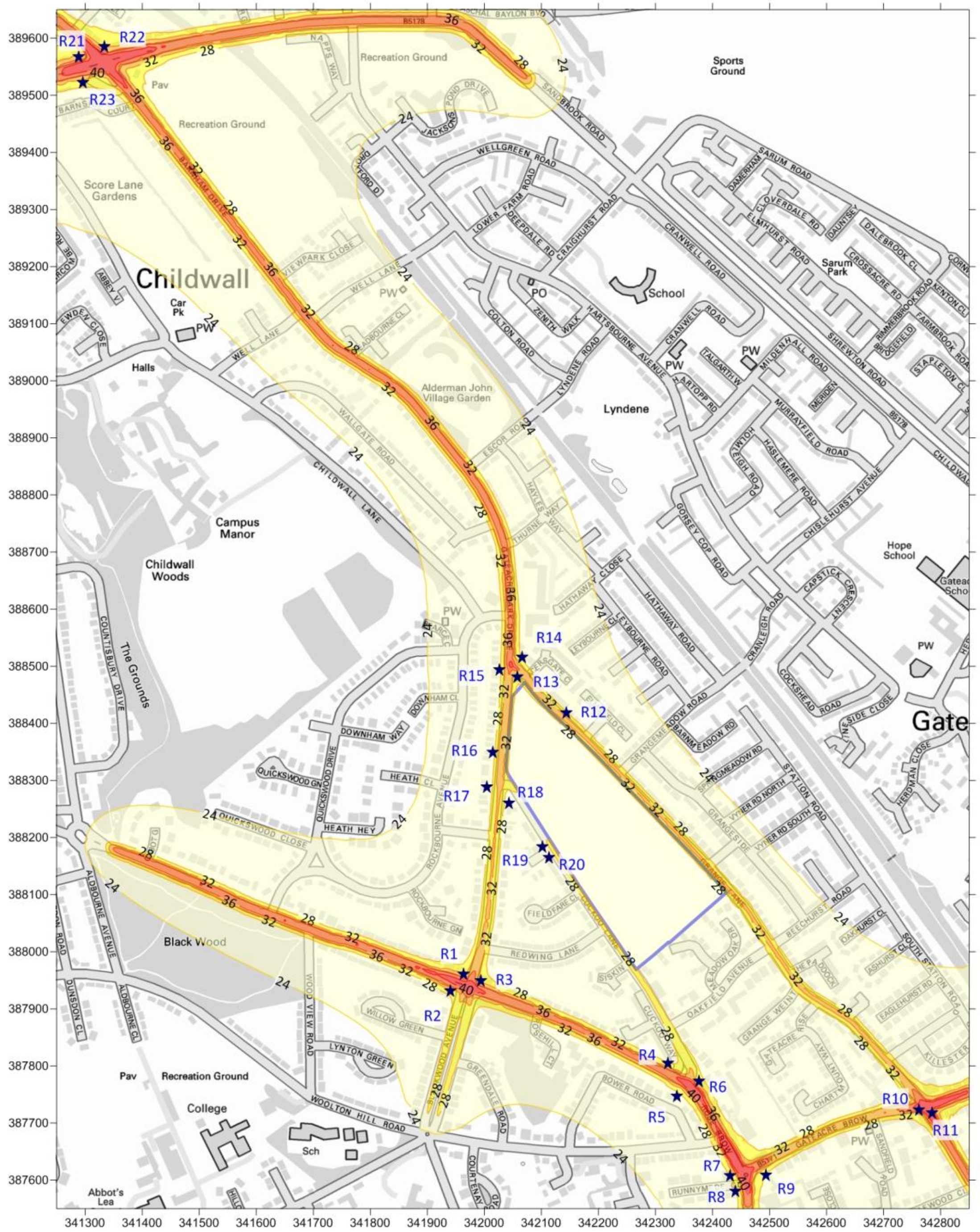

Legend

Site Boundary

Sensitive Receptor Location

Predicted Annual Mean NO_2 Concentration (µg/m^3)

40
36
32
28
24

Title

Figure 10

Predicted Annual Mean NO_2 Concentrations (µg/m^3) 2019 DS

Project

Air Quality Assessment
Former Gateacre Community Comprehensive School
Grange Lane, Liverpool

Project Number

34190

Client

Countryside Properties (UK) Ltd

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Resource and Environmental Consultants Ltd
Osprey House, Broadway, Manchester M50 2UE

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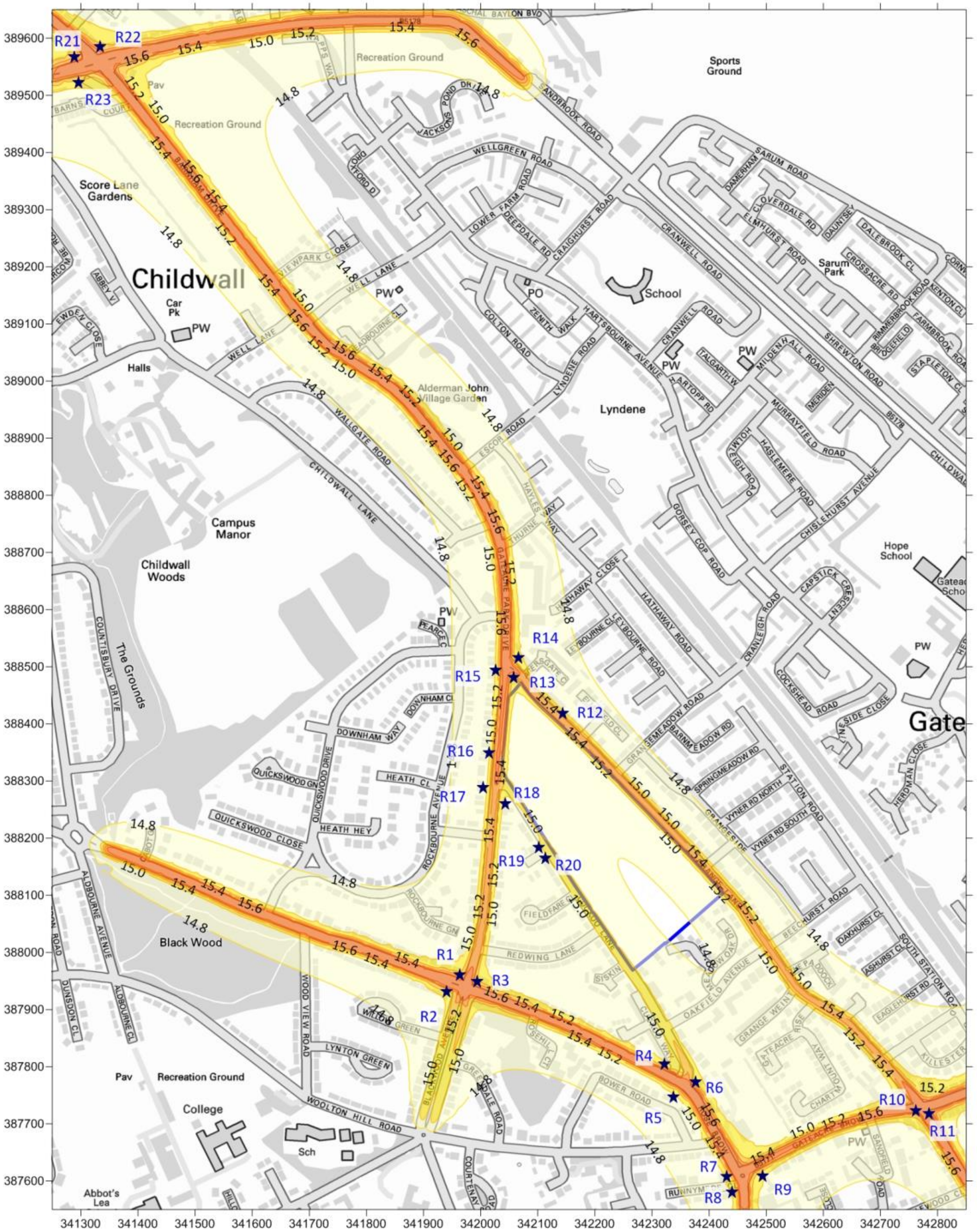

Legend

Site Boundary

Sensitive Receptor Location

Predicted Annual Mean PM_{10} Concentration (µg/m³)

15.6
15.4
15.2
15.0
14.8

Title

Figure 11
Predicted Annual Mean PM_{10} Concentrations (µg/m³) 2019 DM

Project

Air Quality Assessment
Former Gateacre Community Comprehensive School
Grange Lane, Liverpool

Project Number

34190

Client

Countryside Properties (UK) Ltd

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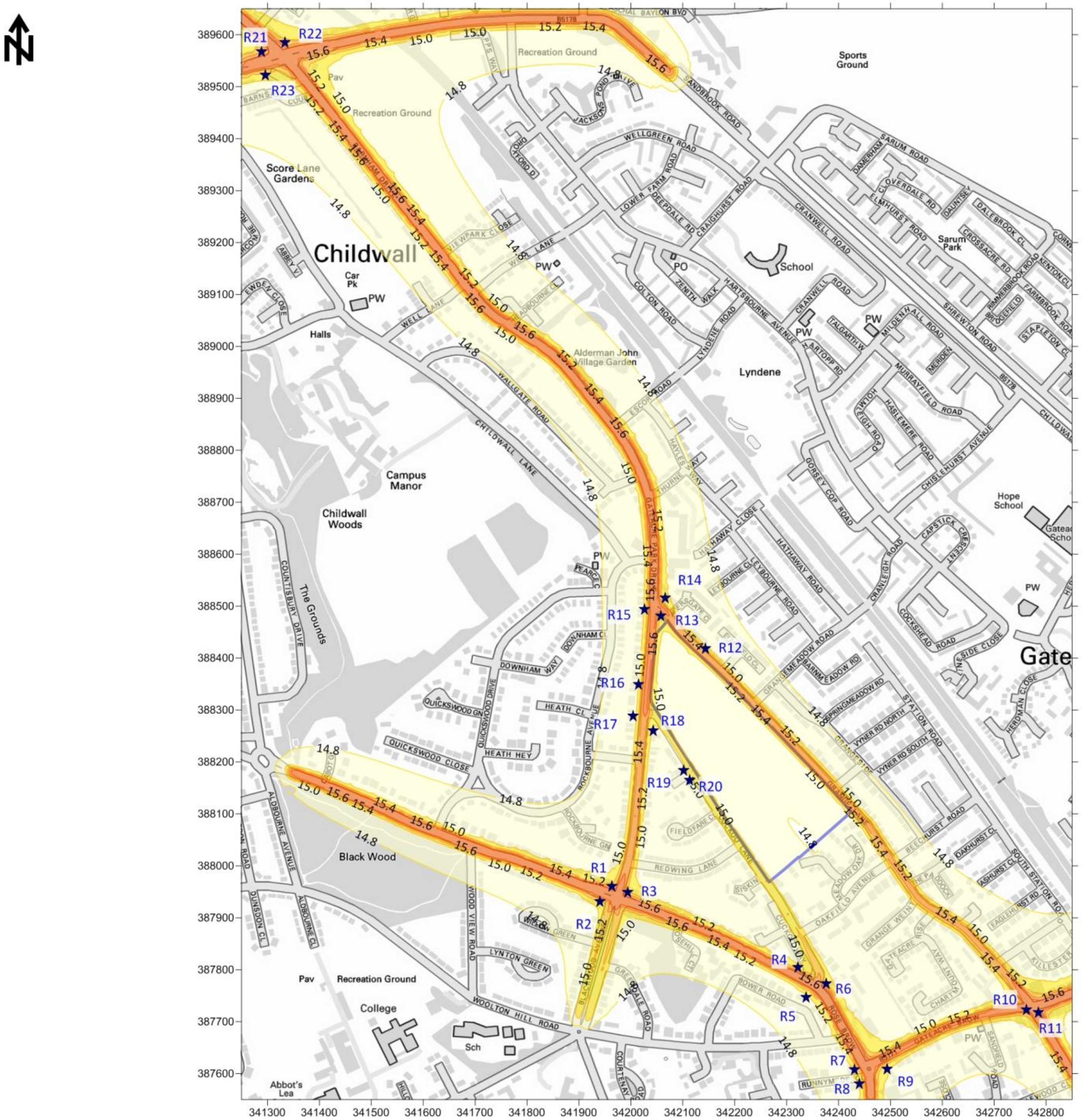

Legend

Site Boundary

Sensitive Receptor Location

15.6
15.4
15.2
15.0
14.8

Predicted Annual Mean PM_{10} Concentration (μg/m³)

Title

Figure 12

Predicted Annual Mean PM_{10} Concentrations (μg/m³) 2019 DS

Project

Air Quality Assessment
Former Gateacre Community Comprehensive School
Grange Lane, Liverpool

Project Number

34190

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Legend

Site Boundary

Modelled Road Link

Cartesian Grid

Sensitive Receptor Location

Diffusion Tube Monitoring Location

Title

Figure 13

ADMS-Roads Input

Project

Air Quality Assessment
Former Gateacre Community Comprehensive School
Grange Lane, Liverpool

Project Number

34190

Client

Countryside Properties (UK) Ltd

REC Resource & Environmental Consultants Ltd

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APPENDIX II ASSESSMENT INPUT DATA

ASSESSMENT INPUTS

Vehicle trips associated with the development have the potential to result in air quality impacts as a result of increased traffic exhaust emissions. Additionally, the site is located within an AQMA and the development may result in exposure of future users to elevated pollution levels. Dispersion modelling using ADMS-Roads was therefore undertaken to predict NO_2 and PM_{10} concentrations at sensitive locations both with and without the development in order to consider potential changes as a result of the proposals.

The dispersion model requires input data that details the following parameters:

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

Assessment inputs are described in the following subsections.

Dispersion Model

Dispersion modelling was undertaken using the ADMS Roads dispersion model (version 3.2). ADMS Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

Assessment Area

Ambient concentrations were predicted over the area NGR: 341250, 387550 to 342850, 389650. One Cartesian grid at a height of 1.5m was used within the model to produce data suitable for contour plotting using the Surfer software package.

Reference should be made to Figure 13 for a graphical representation of the assessment grid extents.

Traffic Flow Data

Traffic data for use in the assessment, including 24-hour Annual Average Daily Traffic (AADT) flows and fleet composition as HDV proportion, was provided by CBO Transport, the Transport Consultants for the project. Additional traffic data for the surrounding road network was downloaded from the Department for Transport (DfT) Matrix[17] for links not provided by the

[17] www.dft.gov.uk/matrix.

Transport Consultants. This web tool enables the user to view and download traffic flows on every link of the 'A' road and motorway network in Great Britain for the years 1999 to 2013. It should be noted that the DfT matrix is referenced in DEFRA guidance LAQM.TG(09)[18] as being a suitable source of data for air quality assessments and is therefore considered to provide a reasonable representation of traffic flows in the vicinity of the site.

Road widths were estimated from aerial photography and UK highway design standards. Reference should be made to Figure 13 for a graphical representation of the road link locations. A summary of the traffic data used in the verification scenarios is provided in Table AII.1.

Table AII.1 2013 Traffic Data

Road Link		Road Width (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
1	A5080 West of Queens Drive	20.0	43,607	2.97	40
2	A5080 West of Queens Drive Junction Approach	30.0	43,607	2.97	25
3	Queens Drive North of Thomas Drive	20.0	37,820	3.68	40
4	Queens Drive South of Glendevon Road	20.0	37,820	3.68	40
5	Queens Drive Fly-over	25.0	37,820	3.68	40
6	A5080 East of Queens Drive	22.0	63,960	4.69	30
7	A5080 East of Queens Drive Junction Approach	30.0	63,960	4.69	25
8	South of M62 Junction	7.3	13,239	3.49	40
9	M62 East of A5080	24.0	59,771	4.96	50
10	A5058/Childwall Valley Road Roundabout	8.0	37,820	3.68	20
11	Childwall Valley Road West of Bentham Drive	10.0	12,673	5.29	40
12	Childwall Valley Road West of Bentham Drive Junction Approach	16.6	12,673	5.29	20
13	Bentham Drive North of Childwall Valley Road Junction Approach	8.5	14,151	0.85	25
14	Bentham Drive North of Childwall Valley Road	7.6	14,151	0.85	40
15	Childwall Valley Road East of Bentham Drive Junction Approach	14.0	12,254	5.63	25
16	Childwall Valley Road East of Bentham Drive	10.1	12,254	5.63	40

18 Local Air Quality Management Guidance LAQM.TG(09), DEFRA, 2009.

Road Link		Road Width (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
17	Barnham Drive South of Childwall Valley Road Junction Approach	10.2	13,656	0.98	25
18	Barnham Drive South of Childwall Valley Road	7.3	13,656	0.98	40
19	Gateacre Park Drive North of Grange Lane	7.3	14,141	1.07	40
20	Grange Lane South of Gateacre Park Drive Junction Approach	7.6	7,089	1.57	25
21	Grange Lane South of Gateacre Park Drive	7.3	7,089	1.57	40
22	Site Access from Grange Lane	7.3	0	0.00	25
23	Gateacre Park Drive South of Grange Lane	7.3	10,516	0.61	40
24	Site Access from Gateacre Park Drive	7.3	0	0.00	25
25	Gateacre Park Drive North of Cuckoo Lane	7.3	10,495	0.43	40
26	Cuckoo Lane East of Gateacre Park Drive Junction Approach	7.6	2,092	0.00	25
27	Cuckoo Lane East of Gateacre Park Drive	7.3	2,092	0.00	40
28	Cuckoo Lane North of Rose Brow	7.3	4,064	0.16	40
29	Cuckoo Lane North of Rose Brow Junction Approach	7.6	4,064	0.16	25
30	Gateacre Park Drive South of Cuckoo Lane	7.6	8,678	0.51	40
31	Gateacre Park Drive North of Woolton Road	7.6	8,545	0.45	25
32	Woolton Road East of Gateacre Park Drive	10.2	11,338	3.88	30
33	Blackwood Avenue South of Woolton Road	13.0	8,442	0.88	25
34	Blackwood Avenue South of Woolton Road North-bound	6.8	4,221	0.88	40
35	Blackwood Avenue South of Woolton Road South-bound	6.8	4,221	0.88	40
36	Woolton Road West of Gateacre Park Drive Junction Approach	12.2	12,732	3.75	25
37	Woolton Road West of Gateacre Park Drive	7.3	12,732	3.75	40
38	Woolton Road West of Cuckoo Lane	7.3	11,243	3.79	40
39	Woolton Road West of Cuckoo Lane Junction Approach	10.0	11,243	3.79	25
40	Woolton Road East of Cuckoo Lane Junction Approach	10.0	14,093	3.07	25

Road Link		Road Width (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
41	Woolton Road East of Cuckoo Lane	8.2	14,093	3.07	40
42	Rose Brow North of Gateacre Bow	8.2	17,998	2.39	25
43	Gateacre Bow East of Rose Bow Junction Approach	7.5	10,483	1.54	25
44	Gateacre Bow East of Rose Bow	7.3	10,483	1.54	40
45	Gateacre Bow West of Grange Lane	7.3	10,882	1.34	40
46	Gateacre Bow West of Grange Lane Junction Approach	7.3	10,882	1.34	25
47	Grange Lane North of Gateacre Bow Junction Approach	8.0	7,682	1.56	25
48	Grange Lane North of Gateacre	7.3	7,682	1.56	40
49	Belle Vale Road West of Grange Lane Junction Approach	7.3	16,396	2.68	40
50	Belle Vale Road West of Grange Lane	8.2	16,396	2.68	40
51	Halewood Road South of Belle Vale Road Junction Approach	7.3	12,731	2.21	25
52	Halewood Road South of Belle Vale Road	7.3	12,731	2.21	40
53	Acrefield Road South of Gateacre Bow Junction Approach	8.0	13,453	3.48	25
54	Acrefield Road South of Gateacre Bow	7.3	13,453	3.48	40
55	Site Access from Cuckoo Lane	7.3	0	0.00	30

The road width and mean vehicle speed shown in Table AII.1 remained the same for the DM and DS scenarios. A summary of the 2019 traffic data is shown in Table AII.2.

Table AII.2 2019 Traffic Data

Road Link		DM		DS	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
1	A5080 West of Queens Drive	45,142	2.97	45,142	2.97
2	A5080 West of Queens Drive Junction Approach	45,142	2.97	45,142	2.97
3	Queens Drive North of Thomas Drive	39,151	3.68	39,151	3.68
4	Queens Drive South of Glendevon Road	39,151	3.68	39,151	3.68
5	Queens Drive Fly-over	39,151	3.68	39,151	3.68

Road Link		DM		DS	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
6	A5080 East of Queens Drive	66,211	4.69	66,211	4.69
7	A5080 East of Queens Drive Junction Approach	66,211	4.69	66,211	4.69
8	South of M62 Junction	13,705	3.49	13,705	3.49
9	M62 East of A5080	61,875	4.96	61,875	4.96
10	A5058/Childwall Valley Road Roundabout	39,151	3.68	39,151	3.68
11	Childwall Valley Road West of Bentham Drive	13,647	5.29	13,885	5.20
12	Childwall Valley Road West of Bentham Drive Junction Approach	13,647	5.29	13,885	5.20
13	Bentham Drive North of Childwall Valley Road Junction Approach	15,465	0.85	15,794	0.83
14	Bentham Drive North of Childwall Valley Road	15,465	0.85	15,794	0.83
15	Childwall Valley Road East of Bentham Drive Junction Approach	13,173	5.63	13,251	5.59
16	Childwall Valley Road East of Bentham Drive	13,173	5.63	13,251	5.59
17	Barnham Drive South of Childwall Valley Road Junction Approach	15,000	0.98	15,658	0.94
18	Barnham Drive South of Childwall Valley Road	15,000	0.98	15,658	0.94
19	Gateacre Park Drive North of Grange Lane	15,860	1.07	16,518	1.03
20	Grange Lane South of Gateacre Park Drive Junction Approach	7,877	1.57	8,292	1.49
21	Grange Lane South of Gateacre Park Drive	7,877	1.57	8,292	1.49
22	Site Access from Grange Lane	0	0.00	594	0.00
23	Gateacre Park Drive South of Grange Lane	11,712	0.61	12,292	0.58
24	Site Access from Gateacre Park Drive	0	0.00	369	0.00
25	Gateacre Park Drive North of Cuckoo Lane	11,687	0.43	12,224	0.41
26	Cuckoo Lane East of Gateacre Park Drive Junction Approach	2,308	0.00	2,683	0.00
27	Cuckoo Lane East of Gateacre Park Drive	2,308	0.00	2,683	0.00
28	Cuckoo Lane North of Rose Brow	4,428	0.16	4,755	0.15

Road Link		DM		DS	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
29	Cuckoo Lane North of Rose Brow Junction Approach	4,428	0.16	4,755	0.15
30	Gateacre Park Drive South of Cuckoo Lane	9,668	0.51	10,168	0.49
31	Gateacre Park Drive North of Woolton Road	9,525	0.45	10,026	0.42
32	Woolton Road East of Gateacre Park Drive	12,175	3.88	12,175	3.88
33	Blackwood Avenue South of Woolton Road	9,336	0.88	9,505	0.87
34	Blackwood Avenue South of Woolton Road North-bound	4,668	0.88	4,752	0.87
35	Blackwood Avenue South of Woolton Road South-bound	4,668	0.88	4,752	0.87
36	Woolton Road West of Gateacre Park Drive Junction Approach	13,732	3.75	14,054	3.66
37	Woolton Road West of Gateacre Park Drive	13,732	3.75	14,054	3.66
38	Woolton Road West of Cuckoo Lane	12,069	3.79	12,069	3.79
39	Woolton Road West of Cuckoo Lane Junction Approach	12,069	3.79	12,069	3.79
40	Woolton Road East of Cuckoo Lane Junction Approach	15,194	3.07	15,513	3.01
41	Woolton Road East of Cuckoo Lane	15,194	3.07	15,513	3.01
42	Rose Brow North of Gateacre Bow	19,396	2.39	19,715	2.35
43	Gateacre Bow East of Rose Bow Junction Approach	11,257	1.54	11,479	1.51
44	Gateacre Bow East of Rose Bow	11,257	1.54	11,479	1.51
45	Gateacre Bow West of Grange Lane	11,683	1.34	11,907	1.31
46	Gateacre Bow West of Grange Lane Junction Approach	11,683	1.34	11,907	1.31
47	Grange Lane North of Gateacre Bow Junction Approach	8,497	1.56	8,670	1.53
48	Grange Lane North of Gateacre	8,497	1.56	8,670	1.53
49	Belle Vale Road West of Grange Lane Junction Approach	17,673	2.68	17,839	2.65
50	Belle Vale Road West of Grange Lane	17,673	2.68	17,839	2.65
51	Halewood Road South of Belle Vale Road Junction Approach	13,859	2.21	13,951	2.20
52	Halewood Road South of Belle Vale Road	13,859	2.21	13,951	2.20
53	Acrefield Road South of Gateacre Bow Junction Approach	14,510	3.48	14,741	3.43

Road Link		DM		DS	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
54	Acrefield Road South of Gateacre Bow	14,510	3.48	14,741	3.43
55	Site Access from Cuckoo Lane	0	0.00	701	0.00

Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 6.0.1) released in June 2014, which incorporates updated COPERT4v10 vehicle emissions factors for NO_x and vehicle fleet information.

There is current uncertainty over NO_2 concentrations within the UK, with roadside levels not reducing as previously expected due to the implementation of new vehicle emission standards. Therefore, 2013 emission factors have been utilised for the prediction of pollution levels for all scenarios in preference to the development opening year in order to provide a robust assessment.

Meteorological Data

Meteorological data used in the assessment was taken from Liverpool meteorological station over the period 1st January 2013 to 31st December 2013 (inclusive). Liverpool observation station is located at NGR: 343488, 381791 which is approximately 6.5km south of the proposed development. DEFRA guidance LAQM.TG(09)[19] recommends meteorological stations within 30km of an assessment area as being suitable for detailed modelling.

All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 7 for a wind rose of utilised meteorological data.

Roughness Length

A roughness length (z_0) of 1m was used in the dispersion modelling study. This value of z_0 is considered appropriate for the morphology of the dispersion modelling assessment area and is suggested within ADMS-Roads as being suitable for 'cities, woodlands'.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m was used in the dispersion modelling study. This value is considered appropriate for the nature of the assessment area and is suggested within ADMS-Roads as being suitable for 'cities and large towns'.

19 Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.

Background Concentrations

The annual mean NO_2 concentration monitored at the Speke automatic analyser during 2013, as displayed in Table AII.3, was used in the dispersion modelling assessment to represent existing pollutant levels in the vicinity of the site. The concentrations monitored at the Speke automatic analyser were higher than the background data available from DEFRA and was therefore utilised in order to provide a worst case scenario.

Table AII.3 Automatic Monitoring Results

Site	Annual Mean NO_2 Concentration (µg/m^3) 2013
Liverpool - Speke	23.00

The 2013 annual mean PM_{10} concentration predicted by DEFRA was 18.35µg/m^3. As such, it was higher than the value recorded at the Speke monitoring site during 2013 and was therefore utilised within the assessment in order to provide a worst case scenario.

Similarly to emission factors, background concentrations for 2013 were utilised in preference to the development opening year. This provided a robust assessment and is likely to overestimate actual pollutant concentrations during the operation of the proposal.

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO_2 concentrations using the spreadsheet provided by DEFRA, which is the method detailed within LAQM.TG(09).

Verification

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

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

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

For the purpose of the assessment model verification was undertaken for 2013, using traffic data, meteorological data and monitoring results from this year.

LCC undertakes monitoring of NO_2 concentrations at a number of locations within the vicinity of the site. Diffusion tube S54 is located at the Hillfoot Road/Allerton Road junction. Traffic data was not available along Hillfoot Road and Allerton Road. As such, due to the lack of source information for the links closest to the monitoring location, the result was removed from the verification process.

The road contribution to total NO_x concentration was calculated from the monitored NO_2 results at the remaining diffusion tubes for use in the verification process. This was undertaken following the methodology contained within DEFRA guidance LAQM.TG(09)[20]. The monitored annual mean NO_2 concentrations and calculated roadside NO_x concentrations are summarised in Table AII.4.

Table AII.4 2013 Monitoring Results

Monitoring Location	Monitored NO_2 Concentration (µg/m^3)	Calculated Roadside NO_x Concentration (µg/m^3)
Renville Road/Bowring Park Road (Triplicate Tubes)	57.00	86.67
S53, Bowring Park Road on Give Way sign	51.00	68.22

The dispersion model was run with the traffic input data previously detailed for 2013 to predict the NO_x concentration at the monitoring locations. The results are shown in Table AII.5.

Table AII.5 Verification Results

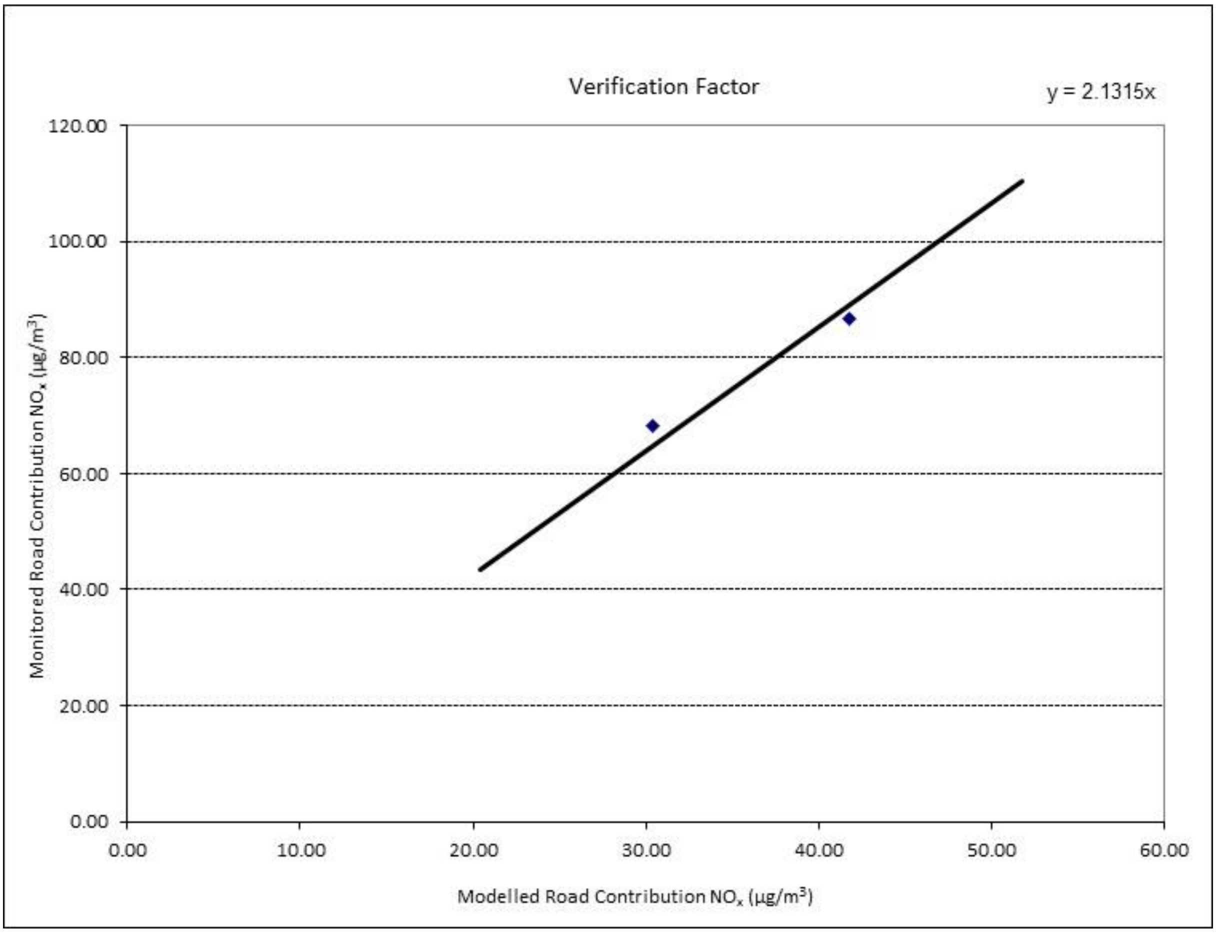
Monitoring Location	Modelled Roadside NO_x Concentration (µg/m^3)
Renville Road/Bowring Park Road	41.82
Bowring Park Road on Give Way sign	30.40

The monitored and modelled NO_x road contribution concentrations were graphed and the equation of the trendline based on the linear progression through zero calculated, as shown in Graph 1. This indicated a verification factor of **2.1315** was required to be applied to all modelling results.

As PM_{10} monitoring is not undertaken within the assessment extents, a verification factor of **2.1315** was also used to adjust model predictions of this pollutant in accordance with the guidance provided within LAQM.TG(09)[21].

[20] Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.
[21] Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.

Graph 1 Verification Factor



APPENDIX III ASSESSOR'S CURRICULUM VITAE

GABOR ANTONY

Senior Air Quality Consultant

MSc, MIAQM, MIEnvSc,

KEY EXPERIENCE:

Consultant with specialist experience in the air quality and odour sector. His key capabilities include:

- Advanced atmospheric air dispersion modelling of road vehicle and industrial emissions using ADMS-ROADS, ADMS-5, AERMOD-PRIME and BREEZE-ROADS.
- Preparation of factual and interpretative Air Quality Assessment reports and Air Quality Environmental Statement chapters in the vicinity of proposed schemes and developments in accordance with DEFRA, Environment Agency and EPUK methodologies.
- Management and delivery of project work on key, land development and urban regeneration projects.
- Multi-source industrial air emissions and stack emissions assessments using AERMOD-PRIME modelling software for IPPC Permit applications and stand-alone technical reports.
- Co-ordination and management of different emission and immission related measurements, and various monitoring programmes including construction dust; diffusion tube surveys and odour assessments in accordance with DEFRA and Environment Agency guidance.

SELECT PROJECTS SUMMARY:

Residential Developments

Boorley Green - EIA undertaken for mixed use scheme.

Vauxhall - AQA for mixed use scheme within AQMA in London.

Mapplewell - AQA for residential development.

Catford Stadium - Low Emission Transport Strategy for mixed use development in London

Lambeth Road - AQA for mixed use scheme in AQMA in London.

Thurmaston NEoLSUE - EIA for Suburban extension.

Westferry Print works - EIA for large mixed use development.

Grange Farm, Doncaster - AQA for residential development.

Wadi Al Asla - AQA as part of EIA for proposed urban extension in Saudi Arabia.

Horndean - AQA for residential development adjacent to A3.

Derby - Fire and Smoke assessment for residential development.

Kirkby Muxloe - AQA for residential development adjacent to M1.

Ushaw Moor - AQA for residential development in proximity of AQMA.

Commercial and Retail Developments

Horfield, Bristol - EIA for Mixed- use development in AQMA.

Nottingham - Biomass boiler assessment for retail facility.

South Woodham Ferrers - Biomass boiler and road traffic assessment.

Widnes - AQA for Shopping Centre Extension, adjacent to AQMA.

Lancaster Science Park - AQA for commercial development in proximity of AQMA.

Haymarket - AQA for Bus Station Redevelopment.

Bath Western Riverside East - AQA as part of EIA for mixed use development.

Irvine, North Ayrshire - AQA for Hospital redevelopment

Derby - biomass boiler emission assessment.

Bristol & Bath Science Park - AQA as part of EIA for commercial development.

Sheffield Superstore - AQA in support of new food superstore.

Nuneaton - AQA for mixed use development with biomass boiler.

Thorp Arch, - EIA for Urban extension.

Reading Station - AQA Highway Implementation Scheme.

Ebbsfleet International Railway Station - AQA for mixed use development.

M4 Junction 11 - AQA for Motorway Scheme.

Hook - Biomass Boiler and road transport assessment for proposed food store.

Industrial Developments

Sedalcol - Environmental Permit Application for Alcohol and Starch production facility.

Southampton - AQA for Sulphur Plant.

Cotesbach - AQA for Fully enclosed Waste composting Facility.

Wagg Foods - Environmental Permit application.

Beddington - AQA for Energy from Waste Plant.

Thakeham - AQA for mushroom production facility.

Partington - EIA for Liquid Natural Gas storage site demolition works in Trafford.

South View Farm - Ammonia dispersion modelling of broiler farm.

Blackwater - AQA for Asphalt plant Permit Application.

JETHRO REDMORE

Associate Director

BEng (Hons), MSc, MIAQM, MIEnvSc, AIEMA, CEnv

KEY EXPERIENCE:

Jethro is a Chartered Environmentalist with specialist experience in the air quality sector. His key capabilities include:

- Production and management of Air Quality and Odour Assessments to DEFRA, Environment Agency and EPUK methodologies for a wide-range of clients from the retail, residential, infrastructure, commercial and industrial sectors.
- Significant proportion of assessments produced as part of over-arching Environmental Statements (ES) for large developments throughout the UK and internationally.
- Detailed dispersion modelling of road vehicle and industrial emissions using ADMS-Roads, ADMS-5, AERMOD-PRIME and BREEZE-ROADS. Studies have included impact assessment of ground level pollutant and odour concentrations and assessment of suitability of development sites for proposed end-use.
- Project management and co-ordination of EIAs and scoping reports for developments throughout the UK.
- Design and project management of pollutant monitoring campaigns to define baseline conditions and inform future assessment in accordance with DEFRA and Environment Agency guidance.
- Co-ordination and management of large-scale multi-disciplinary projects and submissions.
- Production and co-ordination of Environmental Permit applications for a variety of industrial sectors.
- Provision of expert advice to local government and international environmental bodies.

SELECT PROJECTS SUMMARY:

Residential Developments

Wood St Mill, Bury - residential development adjacent to scrap metal yard.

Church Way Doncaster - mixed use scheme adjacent to AQMA.

North Wharf Gardens, London - peer review of EIA undertaken for residential development.

Mill Street, Crewe - residential development in proximity of 2-AQMAs.

Wheatstone House, London - mixed use scheme in AQMA.

Elephant and Castle Leisure Centre - baseline AQA for redevelopment.

Carr Lodge, Doncaster - EIA for large residential development.

Poplar Business Park, Tower Hamlets - AQA for residential development.

Queensland Road, Highbury - residential scheme including CHP.

Bicester Ecotown - dispersion modelling of energy centre for EIA.

Castleford Growth Delivery Plan - baseline air quality constraints assessment for town redevelopment.

York St, Bury - residential development adjacent to AQMA.

Temple Point Leeds - residential development adjacent to M1.

Currock Yard, Carlisle - residential development adjacent to rail line.

Commercial and Retail Developments

Pleasington Lakes, Blackburn - EIA for holiday village adjacent to M65.

Wakefield College - redevelopment of city centre campus in AQMA.

Pleckgate School, Blackburn - biomass boiler and odour assessment.

Deptford Terrace, Sunderland - AQA for mixed use development.

Pakeezah Gourmet, Bradford - AQA including DMRB for new food store.

Witton Park School, Blackburn - AQA for school redevelopment close to AQMA.

Manchester Airport Cargo Shed - commercial development.

New Crown Wood School, Greenwich - biomass boiler emission assessment.

Morton District Shopping Centre, Carlisle - air quality EIA for commercial development.

Manchester Airport Apron Extension - EIA including aircraft emission modelling.

Industrial Developments

Tatweer Petroleum - dispersion modelling of Bahrain oil field.

Doha South Sewage Treatment Works - AQA for works extension in Qatar.

IRIS Environmental Appraisal Report Reviews, Isle of Man Government - odour assessment reviews.

Newport Docks Bulk Drying, Pelleting and CHP Facility - air quality EIA for gas CHP.

Agrivert - dispersion modelling of AD plant.

James Cropper Paper Mill, Cumbria - air quality EIA, Environmental Permit Variation and Human Health Risk Assessment for new biomass boiler adjacent to SSSI.

Blue Star Fibres, Grimsby - fibre manufacturing plant adjacent to SPA.

Maesgwyn Biomass Plant - AQA including ecological assessment.

Lynchford Lane Waste Transfer Station - biomass facility energy recovery plant.

Barnes Wallis Heat and Power, Cobham - biomass facility adjacent to AQMA.

Countrystyle Biomass Plant, Kent - EIA for biomass facility.

Beddington Heat and Power, London - biomass energy recovery plant.

Fleetwood Transfer Station - dispersion modelling of energy recovery plant.

Brook Bridge Poultry Farm - Ammonia dispersion modelling of quail farm.