e3p

AIR QUALITY IMPACT ASSESSMENT

Former Walton Hospital
Rice Lane
Liverpool
L9 1AE

Prepared for:
Mulbury Homes

MULBURY HOMES

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APPENDICES

1. INTRODUCTION

1.1 Background

E3P Ltd was commissioned by Mulbury Homes Ltd to undertake an Air Quality Assessment in support of the planning application for a proposed mixed use development and associated facilities on land off Rice Lane, Liverpool.

The proposed development has the potential to cause air quality impacts as a result of construction and operational phase activities. An Air Quality Assessment was therefore undertaken to assess potential effects at sensitive locations in the vicinity of the site.

1.2 Site Location and Context

The proposed development is located on land off Rice Lane, Liverpool, at National Grid Reference (NGR): 335815, 395425. Reference should be made to Figure 1 for a map of the site and surrounding area.

The predominant land use in the vicinity of the site is residential with areas of commercial and retail space, as well as the recently completed Clock View mental health hospital. The site has been cleared and is currently occupied by areas of scrub and hardstanding.

The proposals comprise a mixed use development consisting of approximately 195 residential units, an Aldi foodstore and associated infrastructure.

The development has the potential to cause air quality impacts at sensitive locations during the construction and operational phases. These may include:

- Fugitive dust emissions associated with construction works; and,
- Road traffic exhaust emissions associated with vehicles travelling to and from the site during the operational phase.

The above impacts have therefore been assessed within the following report.

2. LEGISLATION AND POLICY

2.1 European Policy

European Union (EU) air quality legislation is consolidated under 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. The consolidated Directives include:

- **Directive 99/30/EC -** the First Air Quality "Daughter" Directive - sets ambient Air Quality Limit Values (AQLVs) for nitrogen dioxide (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 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 Air Quality Objectives (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 the determination of compliance vary slightly.

Table 1 (overleaf) 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/m³)	**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 (below) 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	All locations where the annual mean objective would apply, together with hotels Gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24 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 be expected to spend one hour or longer	Kerbside sites where the public would not be expected to have regular access

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

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 comparing present and likely future pollutant concentrations against the AQOs. If it is predicted that levels at locations of relevant exposure, as summarised in Table 2, are likely to be exceeded, the LA is required to declare an Air Quality Management Area (AQMA). For each AQMA the LA is required to produce an Air Quality Action Plan, the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.4 National Planning Policy

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 the proposed development:

"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 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?

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

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.

2.6 Local Planning Policy

The local planning policy currently adopted by Liverpool City Council (LCC) is detailed within the Unitary Development Plan[5] (UDP), a statutory document which is one of the documents that sits within the Local Plan. The UDP will gradually be replaced when the Liverpool Local Plan and the Joint Merseyside and Halton Waste Local Plan are adopted and until this time the UDP policies are used to determine planning applications.

A review of the UDP was undertaken in order to identify any planning policies relevant to the assessment. This indicated the following:
"Environmental Protection

GEN 8

The Plan aims to protect and enhance Liverpool's environment by:

[…]

ii. Controlling uses which can contribute to the incidence of land, air, water pollution and light spillage;

[…]"

"Pollution

EP11

1. *Planning permission will not be granted for development which has the potential to create unacceptable air, water, noise or other pollution or nuisance.*

2. *Where existing uses adversely affect the environment through noise, vibration, soot, grit, dust, smoke, fumes, smell, vehicle obstruction or other environmental problems, the City Council will:*

    i. *Seek to reduce the problem on site;*

    ii. *Refuse planning permission for development which would result in a consolidation or expansion of uses giving rise to environmental problems;*

[5] Liverpool Unitary Development Plan, LCC, 2002.

iii. Impose appropriate conditions on any permission which may be granted and/or obtain legal agreements in relation to such a permission, in order to regulate uses;

iv. Take enforcement action where appropriate; and

v. In appropriate circumstances, compulsorily acquire the premises whilst endeavouring to assist in the relocation of the firm, where resources permit.

3. In the case of new development close to existing uses which are authorised or licensed under pollution control legislation, and which are a potential nuisance to the proposed development, planning permission will not be granted unless the City Council is satisfied that sufficient measures can and will be taken to protect amenity and environmental health."

Reference has been made to these policies throughout the undertaking of the Air Quality Assessment.

3. METHODOLOGY

The proposed development has the potential to cause air quality impacts during the construction and operational phases. These have been assessed in accordance with the following methodology, which was agreed with Paul Farrell, Principal Officer, Environmental Protection Unit at LCC, on 16th March 2015.

3.1 Construction Phase Assessment

There is the potential for fugitive dust emissions to occur throughout the construction phase of the proposed development. 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 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 in the following sub-sections.

3.1.1 Step 1

Step 1 screened the requirement for a detailed assessment. If there are human receptors within 350m of the site boundary or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment proceeds to Step 2. Similarly, if there are ecological receptors within 50m of the boundary or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment also proceeds 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 assessed the risk of potential dust impacts. A site is allocated a risk category based on two factors:

- The scale and nature of the works, which determines the magnitude of dust arising as: small, medium or large (Step 2A); and,

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

- The sensitivity of the area to dust impacts, which can defined as low, medium or high sensitivity (Step 2B).

The two factors combine 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
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 Construction Dust - Examples of Factors Defining Sensitivity of an Area

RECEPTOR 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
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 criteria for determining the sensitivity of the area to dust soiling effects on people and property is summarised in Table 5.

Table 5 Construction Dust - 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 criteria for determining the sensitivity of the area to human health impacts.

Table 6 Construction Dust - Sensitivity of the Area to Human Health Impacts

RECEPT. SENS.	ANNUAL MEAN PM_{10} CONC	NO. OF RECEPT.	DISTANCE FROM THE SOURCE (M)				
			Less than 20	Less than 50	Less than 100	Less than 200	Less than 350
High	Greater than 32µg/m³	More than 100	High	High	High	Medium	Low
		10 - 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 - 32µg/m³	More than 100	High	Medium	Low	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 - 28µg/m³	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/m³	More than 100	High	Medium	Low	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	Medium	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 criteria for determining the sensitivity of the area to ecological impacts.

Table 7 Construction Dust - 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 Construction Dust - Dust Risk Category from Earthworks and Construction

RECEPTOR SENSITIVITY	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 activities.

Table 9 Construction Dust - Dust Risk Category from Trackout

RECEPTOR SENSITIVITY	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[7] 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 in order to provide continuity between assessment terminologies.

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

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.

3.2 Operational Phase Assessment

The development has the potential to affect existing air quality as a result of road traffic exhaust emissions associated with vehicles travelling to and from the site. Potential impacts have been defined by predicting pollutant concentrations at sensitive locations using dispersion modelling for the following scenarios:

- Verification;
- Opening year do-minimum (predicted traffic flows in 2020 including committed developments should the proposals not proceed); and,
- Opening year do-something (predicted traffic flows in 2020 including committed developments should the proposals be completed).

Reference should be made to Appendix 1 for assessment input data and details of the verification process.

Locations sensitive to potential changes in NO_2 concentrations were identified within 200m of the 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. The criteria provided within DEFRA guidance LAQM.TG(09)[9] on where the AQOs apply, as summarised in Table 2, was utilised to determine appropriate receptor positions.

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

RECEPTOR SENSITIVITY	DESCRIPTION
Very high	Pollutant levels above environmental assessment criteria e.g. • NO_2 annual mean greater than 40µg/m^3
High	Pollutant levels between 90% and 100% of environmental assessment criteria e.g. • NO_2 annual mean 36 - 40µg/m^3
Medium	Pollutant levels between 75% and 90% of environmental assessment criteria e.g. • NO_2 annual mean 30 - 36µg/m^3
Low	Pollutant levels below 75% of environmental assessment criteria e.g. • NO_2 annual mean below 30µg/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.

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

RECEPTOR 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;
- 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,

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.

- 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.

4. 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 has indicated that annual mean concentrations of NO_2 are above the AQO within the city. As such, one AQMA has been declared which are described as:

"An area encompassing the whole of the City of Liverpool."

The development is located within the AQMA. As such, there is the potential for air quality impacts within this sensitive area as a result of the proposals. This has been considered throughout the assessment.

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

4.2 Air Quality Monitoring

Monitoring of pollutant concentrations is undertaken by LCC using continuous and periodic methods throughout their area of jurisdiction. Recent results from sites in the vicinity of the development are shown in Table 13.

Table 13 Monitoring Results

MONITORING SITE		2013 ANNUAL MEAN NO_2 CONCENTRATION ($\mu g/m^3$)
N68	Lamp post J 3268 outside 324-328 Rice Lane L9	56
N69	Queens Drive Monitoring Station	39
N70	Queens Drive Monitoring Station	40
N71	Queens Drive Monitoring Station	39

As shown in Table 13, the annual mean AQO for NO_2 of $40\mu g/m^3$ was exceeded at the Rice Lane monitoring site and was close to exceedence at Queens Drive. As the diffusion tubes are located at roadside locations within an AQMA elevated concentrations would be expected. Reference should be made to Figure 2 for a map of the monitoring sites.

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: 335500, 395500. Data for this location was downloaded from the DEFRA website[13] for the purpose of this assessment and is summarised in Table 14 (overleaf).

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

Table 14 Background Pollutant Concentration Predictions

POLLUTANT	PREDICTED BACKGROUND CONCENTRATION (µg/m^3)	
	2013	2015
NO_2	22.98	21.98
NO_x	34.10	32.18
PM_{10}	16.03	15.57

As shown in Table 14, predicted background pollutant concentrations are significantly below the relevant AQOs at the development site.

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.

4.4.1 Construction Dust 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 15 (below).

Table 15 Earthworks and Construction Dust Sensitive Receptors

DISTANCE FROM SITE BOUNDARY (M)	APPROXIMATE NUMBER OF RESIDENTIAL RECEPTORS	APPROXIMATE NUMBER OF ECOLOGICAL RECEPTORS
Less than 20	10 - 100	0
20 - 50	10 - 100	0
50 - 100	More than 100	-
100 - 350	More than 100	-

Reference should be made to Figure 3 for a graphical representation of earthworks and construction dust receptors. The proposed development is located within a built-up urban area with residential properties to the immediate north and south of the site boundary.

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 16. 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 Rice Lane. This ensured the maximum potential trackout distance was considered.

Table 16 Trackout Dust Sensitive Receptors

DISTANCE FROM SITE ACCESS ROUTE (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 4 for a graphical representation of trackout dust sensitive receptor locations.

Ecological receptors were not identified within 50m of the site boundary or access route. As such, ecological impacts have not been assessed further within this report.

A number of additional factors were considered when determining the sensitivity of the surrounding area. These are summarised in Table 17 below.

Table 17 Additional Dust Sensitivity Factors

FACTOR	COMMENT
Whether there is any history of dust generating activities in the area	The site is located adjacent to the recently completed Clock View mental health hospital. There is likely to have been some level of fugitive dust generation during the construction phase of the facility
The likelihood of concurrent dust generating activity on nearby sites	A review of the area around the site did not indicate any proposed large scale development. As such, significant concurrent dust generation is considered unlikely
Pre-existing screening between the source and the receptors	There is vegetation and fencing along some of the site boundaries. This will act as screening for receptors in these directions
Conclusions drawn from analysing local meteorological data which accurately represent the area: and if relevant the season during which works will take place	As shown in Figure 5, the predominant wind direction at the site is from the north-west. As such, receptors to the south-east of the site are most likely to be affected by dust releases
Conclusions drawn from local topography	The terrain in the vicinity of the site is predominantly flat. As such, there are no topographical constraints to dust dispersion
Duration of the potential impact, as a receptor may become more sensitive over time	The construction phase of the development is likely to extend over multiple years. However, activities will move around the site and it is therefore considered unlikely that receptors will become more sensitive to potential impacts
Any known specific receptor sensitivities which go beyond the classifications given in the document	The desktop study did not indicate any specific receptor sensitivities beyond those already noted

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 Table 5 and Table 6, is shown in Table 18.

Table 18 Sensitivity of the Area to Specific Dust Impacts

POTENTIAL IMPACT	SENSITIVITY		
	Earthworks	Construction	Trackout
Dust Soiling	High	High	High
Human Health	Low	Low	Medium

4.4.2 Operational Road Vehicle Exhaust Emission 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 19.

Table 19 Operational Phase Sensitive Receptors

SENSITIVE RECEPTOR		NGR (M)	
		X	Y
R1	Residential - Genista Close	336015.0	395346.7
R2	Residential - Genista Close	336029.3	395351.9
R3	Residential - Anglesea Road	335931.4	395189.4
R4	Residential - Rice Lane	335911.8	395193.7
R5	Residential - Rice Lane	335914.1	395101.8
R6	Residential - Rice Lane	336137.5	395573.2
R7	Residential - Rice Lane	336168.2	395587.3
R8	Residential - Rice Lane	336219.6	395759.3
R9	Residential - Rice Lane	336210.6	396067.2
R10	Residential - Rice Lane	336219.6	396001.7
R11	Rice Lane Junior School	336171.7	396218.7

The sensitive receptors identified in Table 19 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 6 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 2020. These are detailed within Table 20.

Table 20 Operational Phase Receptor Sensitivity

SENSITIVE RECEPTOR		PREDICTED ANNUAL MEAN NO_2 CONCENTRATION ($\mu g/m^3$)	SENSITIVITY
R1	Residential - Genista Close	34.82	Medium
R2	Residential - Genista Close	33.06	Medium
R3	Residential - Anglesea Road	42.24	Very High
R4	Residential - Rice Lane	38.94	High
R5	Residential - Rice Lane	41.99	Very High
R6	Residential - Rice Lane	37.63	High
R7	Residential - Rice Lane	37.60	High
R8	Residential - Rice Lane	36.10	High
R9	Residential - Rice Lane	48.99	Very High
R10	Residential - Rice Lane	39.71	High
R11	Rice Lane Junior School	34.49	Medium

As indicated in Table 20, receptor sensitivity to changes in annual mean NO_2 concentrations was medium at three locations, high at five locations and very high at three locations.

5. ASSESSMENT

There is the potential for air quality impacts as a result of the construction and operation of the proposed development. These 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 18 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 18 indicates the sensitivity of the area to human health is **low**. In accordance with the criteria outlined in Table 8, the development is considered to be a **low** 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 18 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 18 indicates the sensitivity of the area to human health is **low**. In accordance with the criteria outlined in Table 8, the development is considered to be a **low** 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 and existing hard standing provision, it is anticipated that the unpaved road length is likely to be between 50m and 100m. In accordance with the criteria outlined in Table 3, the magnitude of potential dust emissions from trackout is therefore **medium**.

Table 18 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 **medium** risk site for dust soiling as a result of trackout activities.

Table 18 indicates the sensitivity of the area to human health is **low**. In accordance within the criteria outlined in Table 9, the development is considered to be a **low** 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 21.

Table 21 Summary of Potential Unmitigated Dust Risks

POTENTIAL IMPACT	RISK		
	Earthworks	Construction	Trackout
Dust Soiling	High	High	Medium
Human Health	Low	Low	Low

As indicated in Table 21, the potential risk of dust soiling is **high** from earthworks and construction activities and **medium** from trackout. The potential risk of human health impacts is **low** 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[14] provides potential mitigation measures to reduce impacts as a result of fugitive dust emissions during the construction phase. These have been adapted for the development site as summarised in Table 22. These may be reviewed prior to the commencement of construction works and incorporated into a Construction Environmental Management Plan if required by the LA.

Table 22 Fugitive Dust Emission Mitigation Measures

ISSUE	CONTROL MEASURE
Communications	• Develop and implement a stakeholder communications plan that includes community engagement before work commences on site • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager • Display the head or regional office contact information • Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the LA
Site management	• Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken • Make the complaints log available to the LA upon request • Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book • Hold regular liaison meetings with any other high risk construction sites within 500m of the boundary, to ensure plans are co-ordinated and dust and emissions are minimised
Monitoring	• Undertake daily on-site and off-site inspection to monitor dust, record inspection results, and make the log available to the LA upon request. This should include regular dust soiling checks of surfaces within 100m of site boundary, with cleaning to be provided if necessary • Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the LA upon request • Increase the frequency of site inspections when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions
Site preparation	• 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 they are active for an extensive period • Avoid site runoff of water or mud • Keep site fencing, barriers and scaffolding clean using wet methods • Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used • Cover, seed or fence stockpiles to prevent wind whipping
Operating vehicle/machinery	• Ensure all vehicles switch off engines when stationary - no idling vehicles • Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable

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

and sustainable travel	• Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas • Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials • Implement a Travel Plan that supports and encourages sustainable travel
Operations	• Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques • Ensure an adequate water supply on the site for effective dust suppression, using non-potable water where possible and appropriate • Use enclosed chutes and conveyors and covered skips • Minimise drop heights and use fine water sprays wherever appropriate • Ensure equipment is available to clean any dry spillages, and clean up spillages as soon as reasonably practicable using wet cleaning methods
Waste management	• Avoid bonfires and burning of waste materials
Earthworks	• Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable • Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil as soon as practicable
Construction	• Avoid scabbling (roughening of concrete surfaces) if possible • Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out • Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos
Trackout	• Use water-assisted dust sweeper on access and local roads • Avoid dry sweeping of large areas • Ensure vehicles entering and leaving site are covered to prevent escape of materials • Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable • Implement a wheel washing system • Access gates to be located at least 10m from receptors where possible

5.1.4 Step 4

Assuming the relevant mitigation measures outlined in Table 22 are implemented, the residual impacts from all dust generating activities is predicted to be **negligible**, in accordance with IAQM guidance[15].

5.2 Operational Phase Assessment

Additional vehicle movements associated with the operation of the proposed development will generate exhaust emissions 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.

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

The assessment considered the following scenarios:

- 2013 - Verification;
- 2020 - Do-minimum; and,
- 2020 - Do-something.

The "do-minimum" (i.e. without development) scenario included baseline traffic data for the relevant assessment year, inclusive of additional vehicle movements associated with committed developments. The "do-something" scenario (i.e. with development) included baseline traffic data for the relevant assessment year, inclusive of additional vehicle movements associated with committed developments, in addition to predicted traffic associated with the operation of the proposals.

For the purpose of this assessment traffic data was supplied for 2020, 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 2020 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 1 for full assessment input details.

5.2.1 Predicted Concentrations

Annual mean NO_2 concentrations were predicted for each scenario and are summarised in Table 23.

Table 23 Predicted NO_2 Concentrations

RECEPTOR		PREDICTED ANNUAL MEAN NO_2 CONCENTRATION ($\mu G/M^3$)		
		Do-minimum	Do-something	Change
R1	Residential - Genista Close	34.48	34.82	0.34
R2	Residential - Genista Close	32.78	33.06	0.28
R3	Residential - Anglesea Road	41.77	42.24	0.47
R4	Residential - Rice Lane	38.55	38.94	0.39
R5	Residential - Rice Lane	41.53	41.99	0.46
R6	Residential - Rice Lane	37.26	37.63	0.37
R7	Residential - Rice Lane	37.23	37.60	0.37
R8	Residential - Rice Lane	35.77	36.10	0.33
R9	Residential - Rice Lane	48.41	48.99	0.58
R10	Residential - Rice Lane	39.29	39.71	0.42
R11	Rice Lane Junior School	34.19	34.49	0.30

As indicated in Table 23, predicted concentrations of NO_2 were above the relevant AQO at three receptors in both the do-minimum and do-something scenarios. This would be anticipated due to the AQMA designation and proximity of residential properties to the kerb along Rice Lane. It should be noted that there were no new exceedences of the AQO predicted as a result of the development.

Reference should be made to Figures 8 and 9 for graphical representations of predicted NO_2 concentrations throughout the assessment extents.

Annual mean NO_2 concentrations were also modelled across the site in order to consider potential exposure of future residents to elevated pollution levels. As shown in Figure 10, the maximum predicted concentration at any residential unit façade was 39.4µg/m^3. This was on the north-eastern corner of the apartment block closest to Rice Lane. Based on the assessment results, future residents are unlikely to be exposed to exceedences of the relevant AQOs. As such, the site is considered appropriate for the proposed use.

5.2.2 Predicted Impacts

Predicted impacts on annual mean NO_2 concentrations at the sensitive receptor locations are summarised in Table 24.

Table 24 Predicted NO_2 Impacts

RECEPTOR		MAGNITUDE OF CHANGE	RECEPTOR SENSITIVITY	SIGNIFICANCE OF IMPACT
R1	Residential - Genista Close	Imperceptible	Medium	Negligible
R2	Residential - Genista Close	Imperceptible	Medium	Negligible
R3	Residential - Anglesea Road	Small	Very High	Slight
R4	Residential - Rice Lane	Imperceptible	High	Negligible
R5	Residential - Rice Lane	Small	Very High	Slight
R6	Residential - Rice Lane	Imperceptible	High	Negligible
R7	Residential - Rice Lane	Imperceptible	High	Negligible
R8	Residential - Rice Lane	Imperceptible	High	Negligible
R9	Residential - Rice Lane	Small	Very High	Slight
R10	Residential - Rice Lane	Small	High	Slight
R11	Rice Lane Junior School	Imperceptible	Medium	Negligible

As indicated in Table 24, predicted impacts on annual mean NO_2 concentrations as a result of operational phase road vehicle exhaust emissions were predicted to be **negligible** at seven receptors and **slight adverse** at four locations.

5.2.3 Overall Impact Significance

The overall significance of operational phase road traffic emission impacts was determined as **slight adverse**. This was based on predictions at discrete receptor locations and the considerations outlined previously. Further reasoning is provided in Table 25.

It should be noted that no allowance for improvements in air quality between the verification year of 2013 and the development opening year of 2020 has been made. As such, the results are considered to be worst-case as pollution levels are likely to reduce to some extent over this period.

Table 25 Overall 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 seven receptors and slight adverse at four locations. There are other properties a comparable distance from Rice Lane that may experience similar impacts. However, as the selected positions were worst-case, it is considered unlikely that more significant impacts would be experienced
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	Based on the modelling results and site layout it is not anticipated that any new residents will be exposed to pollutant concentrations above the AQOs
The magnitude of changes and the descriptions of the impacts at the receptors	Imperceptible changes in NO_2 concentrations are predicted at seven receptors and small changes at four locations. As such, the resultant impacts were negligible to slight adverse
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 predicted exceedences of the annual mean AQO for NO_2 in both the do-minimum and do-something scenarios. There were no new exceedences predicted 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 predicted exceedences of the annual mean AQO for NO_2 in both the do-minimum and do-something scenarios. The exceedences were not predicted to be removed 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 41µg/m^3 should attract less significance than an annual mean of 51µg/m^3	There were predicted exceedences of the annual mean AQO for NO_2 in both the do-minimum and do-something scenarios. The maximum predicted concentration was 48.99µg/m^3, which is similar to levels monitored throughout Liverpool

6. MITIGATION

6.1 Construction Phase

Reference should be made to Table 22 for suggested fugitive dust mitigation measures for the construction phase of the development. These are based on the IAQM guidance[16] and as such are considered suitable for proposals of this size and nature.

6.2 Operational Phase

There are a number of air quality mitigation options available to reduce or off-set impacts associated with a development. However, all techniques have financial implications and may therefore affect scheme viability. As such, they should only be included if necessary.

Exhaust emissions from operational phase traffic have the potential to affect local air quality. A **slight adverse** impact was predicted for the development and an aim for the operational phase should therefore be to reduce vehicle trips to and from the site or help to reduce pollution levels in sensitive areas through funding of sustainable transport measures.

The following methods have been suggested in order to help reduce air quality impacts:

- Inclusion of vegetative screening on site boundaries to reduce pollutant dispersion and increase absorption;
- Provision of cycle parking facilities at the retail development;
- Inclusion of controlled pedestrian crossing facilities on the site access roads to encourage walking;
- Inclusion of a footway/cycle connection in the south-western corner of the site to provide a non-vehicular connection to Breeze Lane;
- Provision of a lower number of parking spaces for the retail scheme than permitted by LCC;
- Implementation of a Travel Plan for the retail element of the proposals. Reference should be made to the Interim Travel Plan submitted as part of the Transport Assessment for further details
- Retail deliveries outside of peak hours as far as possible; and,
- Production of a Travel Plan for the residential element of the proposals to include information on the following:
    - Local walking routes and groups;
    - Local cycling facilities, clubs and bike shops;
    - Bus routes including time tables and bus stop locations;
    - Local rail services and how these can be accessed;
    - Car sharing;
    - Home shopping services; and,
    - Local taxi firms.

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

Implementation of a variety of these methods should help limit vehicle trips and minimise air quality impacts throughout the operational phase.

7. CONCLUSIONS

E3P Ltd was commissioned by Mulbury Homes Ltd to undertake an Air Quality Assessment in support of the planning application for a proposed mixed use development and associated facilities on land off Rice Lane, Liverpool.

The proposals have the potential to cause air quality impacts as a result of construction and operational phase activities. An Air Quality Assessment was therefore undertaken to assess potential effects at sensitive locations in the vicinity of the site.

Baseline air quality conditions were defined and potential impacts during the construction and operational phase identified and assessed, as appropriate.

During the construction phase of the development there is 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**.

Potential impacts during the operational phase of the proposed development may occur due to road traffic exhaust emissions associated with vehicles travelling to and from the site. An assessment was therefore undertaken using detailed dispersion modelling to quantify NO_2 concentrations both with and without the proposals.

Impacts on NO_2 concentrations as a result of operational phase road vehicle exhaust emissions were predicted to be **negligible** at all but three sensitive receptor locations, where **slight adverse** impacts were predicted. The overall significance of potential impacts was determined to be **slight adverse**, in accordance with the EPUK guidance. As worst-case assumptions were made throughout the assessment, it is anticipated that the magnitude of future impacts are likely to be smaller than those predicted.

END OF REPORT

APPENDIX I
MODEL INPUT DATA

Input Data

Additional vehicle trips associated with future users travelling to and from the site have the potential to result in air quality impacts at sensitive receptor locations as a result of increased traffic exhaust emissions. Dispersion modelling using ADMS-Roads was therefore undertaken to predict pollutant concentrations 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 3.4.2.0). 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.

Traffic Flow Data

Traffic data for use in the assessment, including 24-hour Annual Average Daily Traffic (AADT) flows and fleet composition, was provided by Cameron Rose, the Transport Consultants for the project.

Information for a number of links was not available from Cameron Rose as they were outside the extents of the Transport Assessment study area. As such, additional data was obtained from the Department for Transport (DfT)[17]. The DfT 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 estimate of traffic flows in the vicinity of the site.

A summary of the traffic data used in the assessment is provided in Table A1.1.

17 http://www.dft.gov.uk/traffic-counts/.
18 Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.

Table A1.1 Traffic Data

ROAD LINK		24-HOUR AADT FLOW			HDV PROPORTION (%)		
		2013	**2019 Do-min**	**2019 Do-some**	**2013**	**2019 Do-min**	**2019 Do-some**
L1	Site access	867	1,146	3,482	1.05	0.87	0.63
L2	Cavendish Drive	10,490	11,287	11,287	1.05	1.05	1.05
L3a	Rice Lane north of site (northbound)	11,418	12,301	12,736	3.80	3.79	3.68
L3b	Rice Lane north of site (south bound)	10,478	11,307	11,774	4.02	4.00	3.87
L4	Rice Lane north of Stalmine Road	21,897	23,608	24,510	3.90	3.89	3.77
L5	Rice Lane south of Hornby Road junction	21,897	23,608	24,510	3.90	3.89	3.77
L6a	Rice Lane north of Hornby Road junction (north bound)	11,303	12,181	12,515	4.00	4.00	4.00
L6b	Rice Lane north of Hornby Road junction (south bound)	11,303	12,181	12,515	4.00	4.00	4.00
L7	Rice Lane	22,606	24,362	25,030	4.00	4.00	4.00
L8	Hornby Road east of Rice Lane junction	10,527	11,345	12,013	5.82	5.82	5.82
L9	Hornby Road	10,527	11,345	12,013	5.82	5.82	5.82
L10a	Rice Lane south of site (northbound)	12,814	13,845	14,318	3.38	3.36	3.27
L10b	Rice Lane south of site (south bound)	11,617	12,514	13,034	3.60	3.59	3.47
L11	Rice Lane south of Gladstone Road	24,431	26,359	27,352	3.49	3.47	3.37
L12a	Rice Lane roundabout approach (south bound)	12,215	13,179	13,676	3.49	3.47	3.37
L12b	Rice Lane roundabout approach (north bound)	12,215	13,179	13,676	3.49	3.47	3.37
R1	Roundabout	25,315	27,289	28,105	5.82	5.82	5.82
L13	County Road	13,492	14,540	15,297	5.82	5.82	5.82
L14	Queens Drive	31,669	34,129	34,885	7.53	7.53	7.53

Details of the road widths and vehicle speeds used in the model are provided in Table A1.2.

Table A1.2 Road Parameters

ROAD LINK		ROAD WIDTH (M)	MEAN VEHICLE SPEED (KM/H)
L1	Site access	13.3	10
L2	Cavendish Drive	13.3	20
L3a	Rice Lane north of site (north bound)	7.3	25
L3b	Rice Lane north of site (south bound)	11.7	25
L4	Rice Lane north of Stalmine Road	9.7	40
L5	Rice Lane south of Hornby Road junction	10.2	5
L6a	Rice Lane north of Hornby Road junction (north bound)	8.1	5
L6b	Rice Lane north of Hornby Road junction (south bound)	8.3	5
L7	Rice Lane	17.9	35
L8	Hornby Road east of Rice Lane junction	13.8	5
L9	Hornby Road	13.8	35
L10a	Rice Lane south of site (north bound)	10.3	25
L10b	Rice Lane south of site (south bound)	7.1	25
L11	Rice Lane south of Gladstone Road	9.9	40
L12a	Rice Lane roundabout approach (south bound)	8.0	10
L12b	Rice Lane roundabout approach (north bound)	7.1	10
R1	Roundabout	8.3	25
L13	County Road	15.3	10
L14	Queens Drive	15.5	25

Reference should be made to Figure 7 for a graphical representation of the modelled road links.

Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 6.0.2). This has been produced by DEFRA and 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 the implementation of new vehicle emission standards not resulting in the previously expected reduction in roadside levels. Therefore, 2013 emission factors were utilised in preference to the development opening year of 2020 in order to provide robust concentration predictions. As predictions for 2013 were verified, it is considered results are a robust indication of worst case concentrations for the future year.

Meteorological Data

Meteorological data used in this assessment was taken from Liverpool John Lennon Airport meteorological station over the period 1st January 2013 to 31st December 2013 (inclusive). Liverpool John Lennon Airport is located at NGR: 343488, 381791, which is approximately 15.7km south-east of the proposed development. DEFRA guidance LAQM.TG(09) 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 5 for a wind rose of utilised meteorological data.

Roughness Length

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

A z_0 of 0.02m was used to describe the meteorological site. This value of z_0 is considered appropriate for the morphology of the area and is suggested within ADMS-Roads as being suitable for 'open grassland'.

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 this 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 'mixed urban/ industrial'.

Background Concentrations

A review of DEFRA data and local monitoring results was undertaken in order to identify an appropriate background value for use in the assessment. This indicated the annual mean NO_2 concentration recorded at the Liverpool Speke analyser during 2013 was 23.18µg/m^3, slightly higher than the DEFRA background of 22.98µg/m^3. As such, the monitoring result was used in order to provide worst-case predictions.

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

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations were converted to NO_2 concentrations using the spreadsheet (version 4.1) provided by DEFRA, which is the method detailed within DEFRA guidance LAQM.TG(09)[19].

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

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

LCC undertakes diffusion tube monitoring of NO_2 concentrations at two locations within the modelling extents. Results were obtained and the road contribution to total NO_x concentration calculated following the methodology contained within DEFRA guidance LAQM.TG(09)[20]. The monitored annual mean NO_2 concentrations and calculated road NO_x concentrations are summarised in Table A1.3.

Table A1.3 Monitoring Results

MONITORING LOCATION		MONITORED NO_2 CONCENTRATION (µG/M^3)	CALCULATED NO_X CONCENTRATION (µG/M^3)
N68	Lamp post J 3268 outside 324-328 Rice Lane L9	56.0	83.02
N69/70/71	Queens Drive Monitoring Station	39.3[(a)]	36.13

Note: (a) Mean of triplicate results.

The annual mean roadside NO_x concentrations predicted from the dispersion model and the 2013 monitoring results are summarised in Table A1.4.

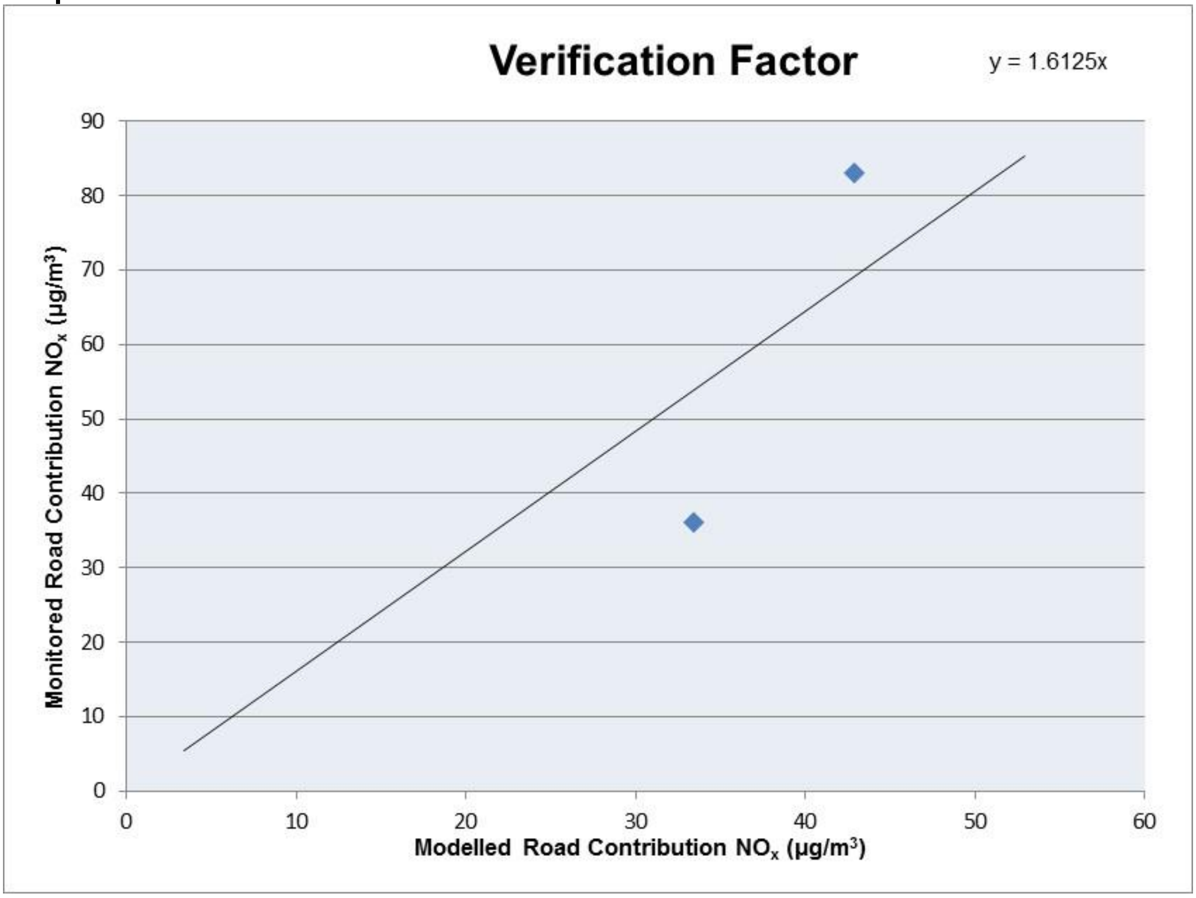
Table A1.4 Verification Results

MONITORING LOCATION		CALCULATED NO_X CONCENTRATION (µG/M^3)	MODELLED ROADSIDE NO_X CONCENTRATION (µG/M^3)
N68	Lamp post J 3268 outside 324-328 Rice Lane L9	83.02	42.93
N69/70/71	Queens Drive Monitoring Station	36.13	33.40

The monitored and modelled NO_x road contribution concentrations were graphed and the equation of the trendline based on linear progression though zero calculated. This indicated that a verification factor of 1.6125 was required to be applied to all modelling results, as shown in Graph 1.

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

Graph 1 Verification Factor



APPENDIX II
FIGURES

Legend

Site Boundary

Title

Figure 1 - Site Location Plan

Project

Air Quality Assessment
Rice Lane, Liverpool

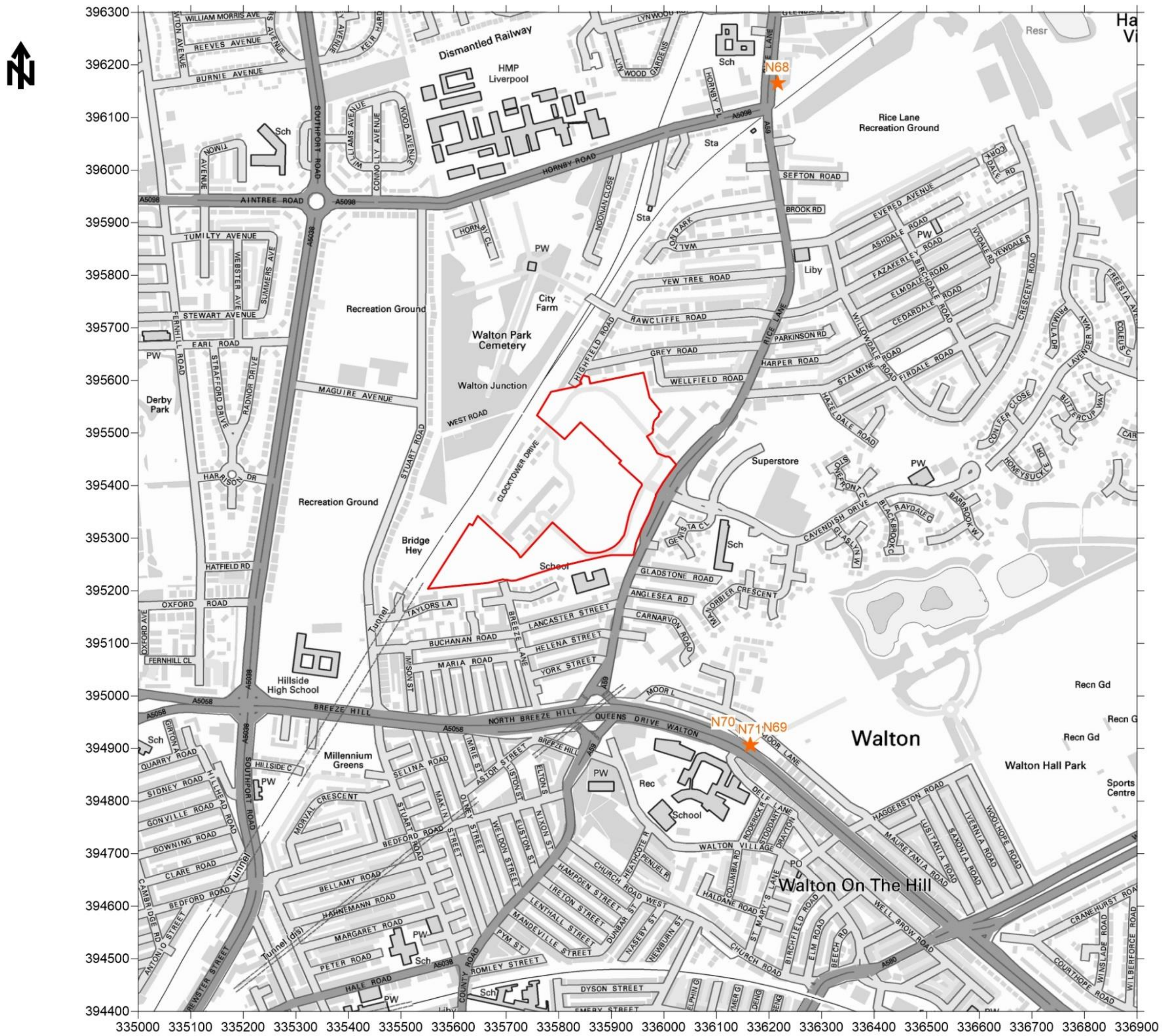
Project Number

10-216

Client

Mulbury Homes

e3p



Legend

Site Boundary

Monitoring Location

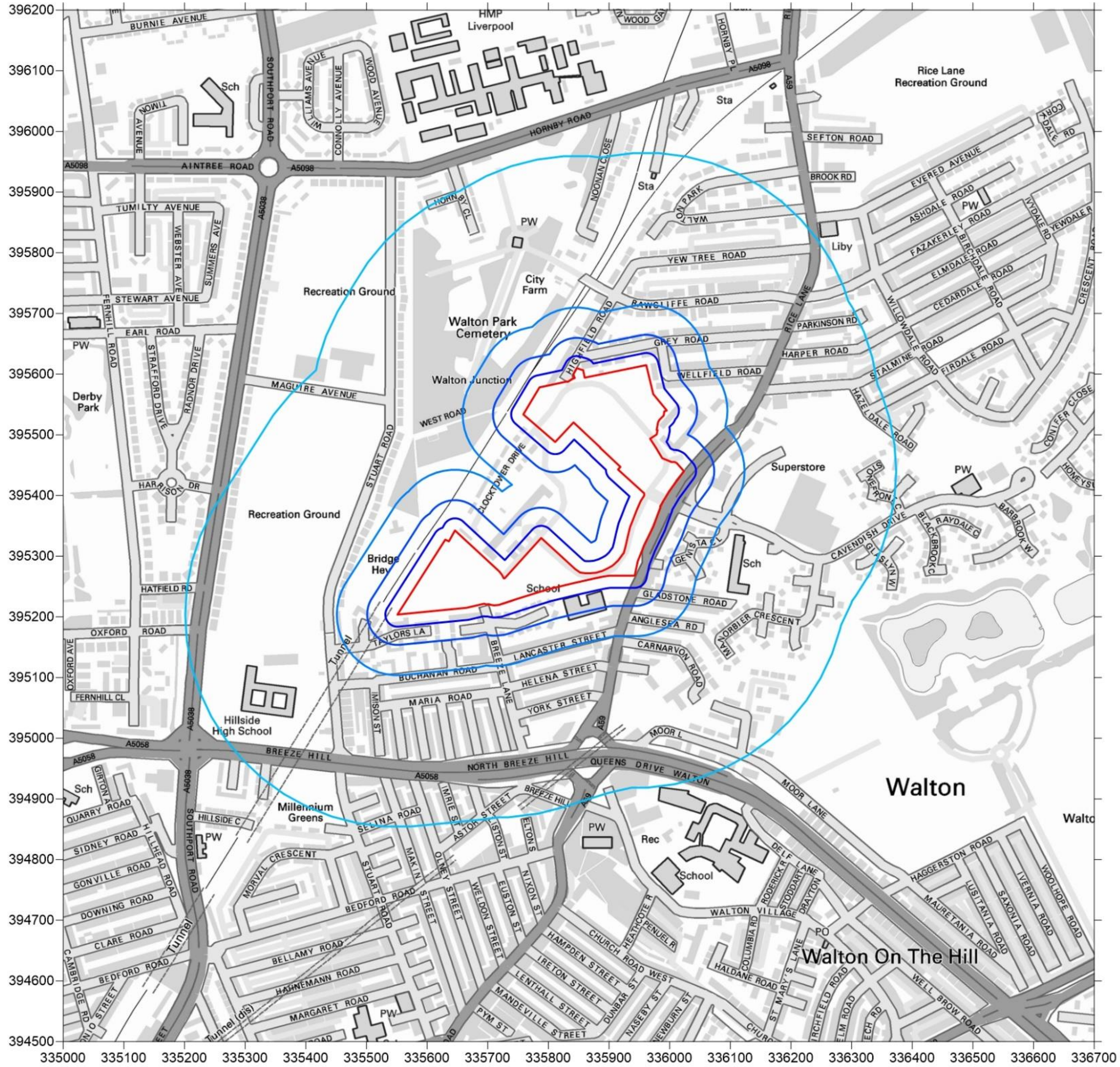
Title
Figure 2 - Monitoring Locations

Project
Air Quality Assessment
Rice Lane, Liverpool

Project Number
10-216

Client
Mulbury Homes

e3p



Legend

Site Boundary

20m from Site Boundary

50m from Site Boundary

100m from Site Boundary

350m from Site Boundary

Title

Figure 3 - Dust Buffer Zones

Project

Air Quality Assessment
Rice Lane, Liverpool

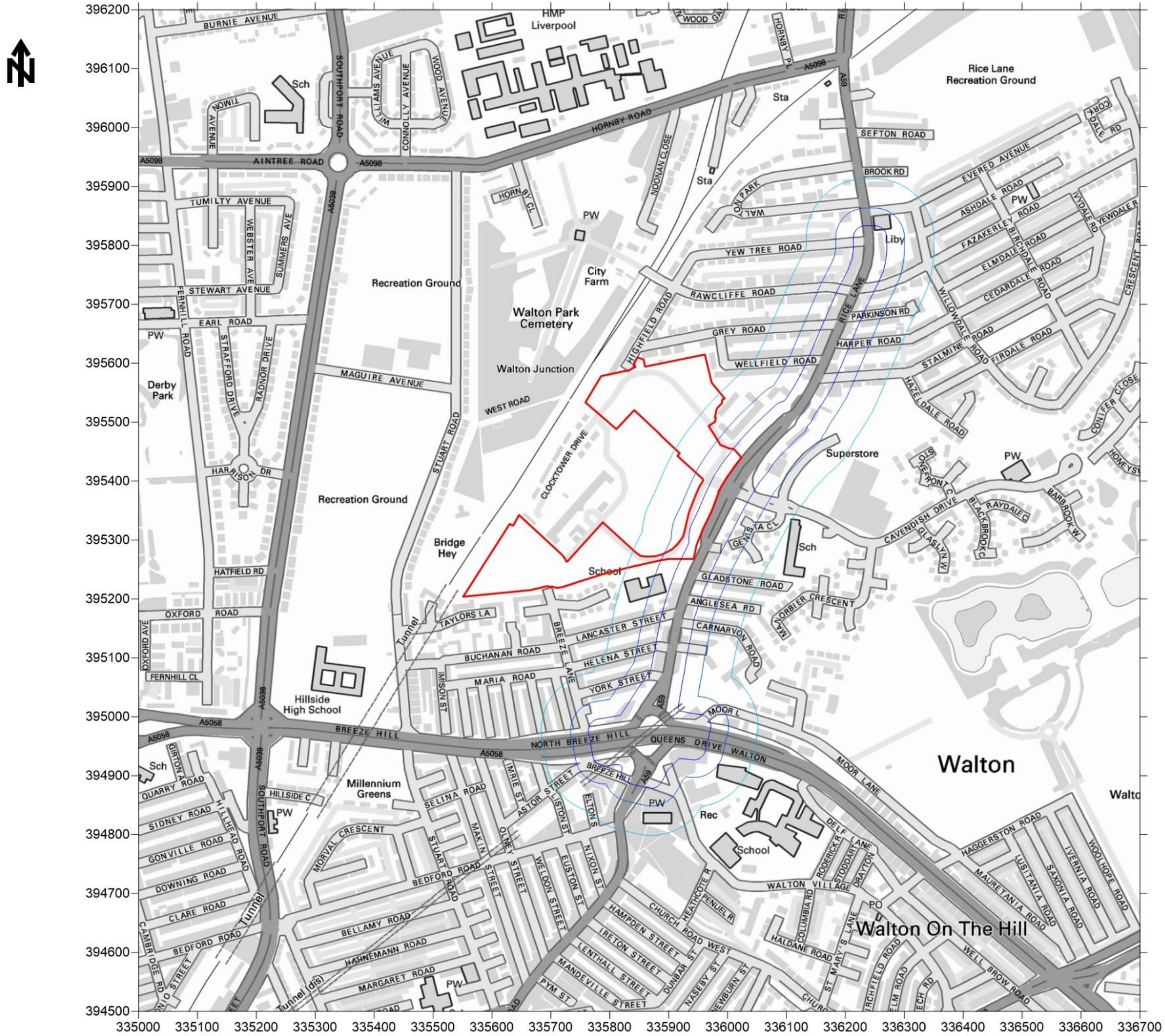
Project Number

10-216

Client

Mulbury Homes

e3p



Legend

Site Boundary

20m from Site Access

50m from Site Access

100m from Site Access

Title

Figure 4 - Trackout Dust Buffer Zones

Project

Air Quality Assessment
Rice Lane, Liverpool

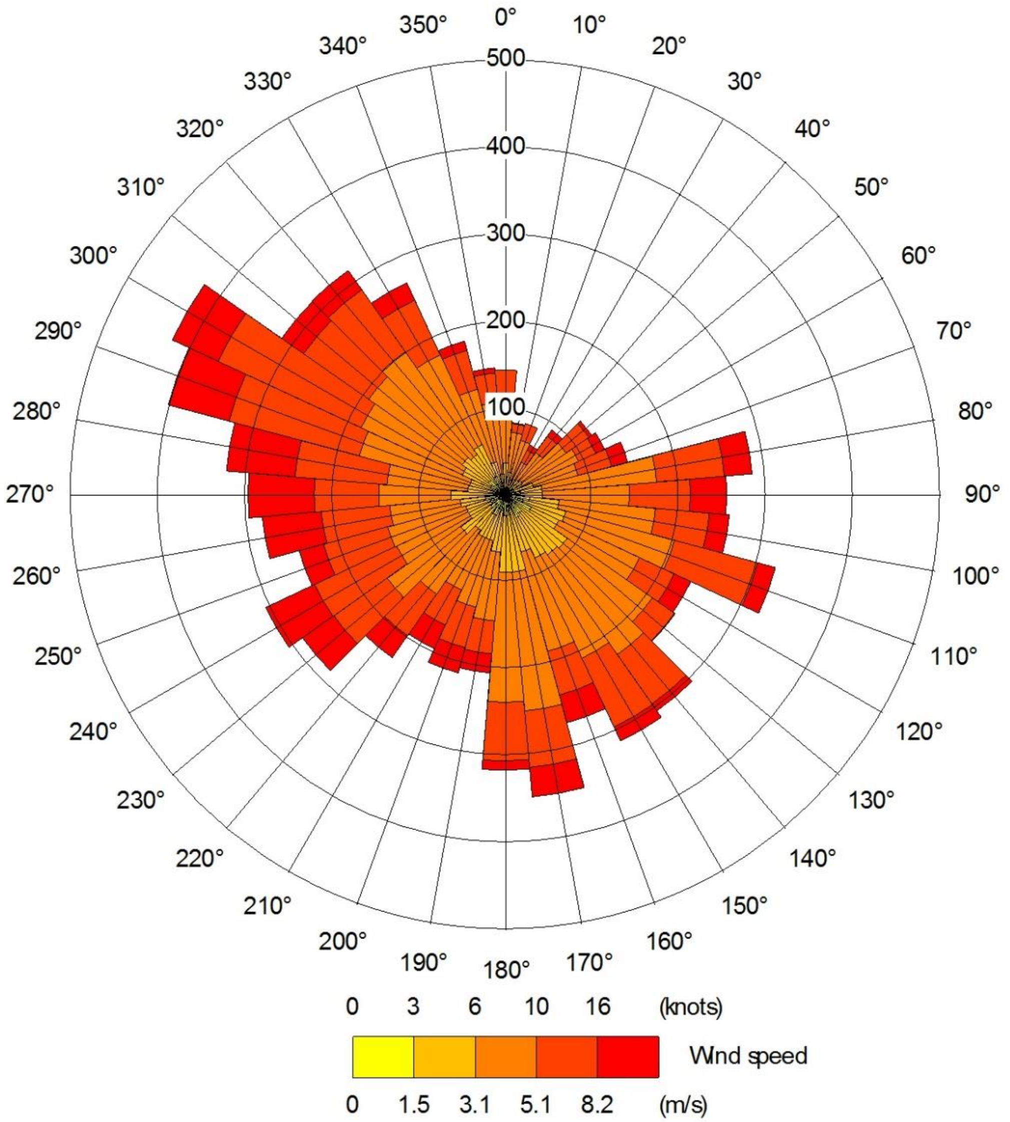
Project Number

10-216

Client

Mulbury Homes

e3p



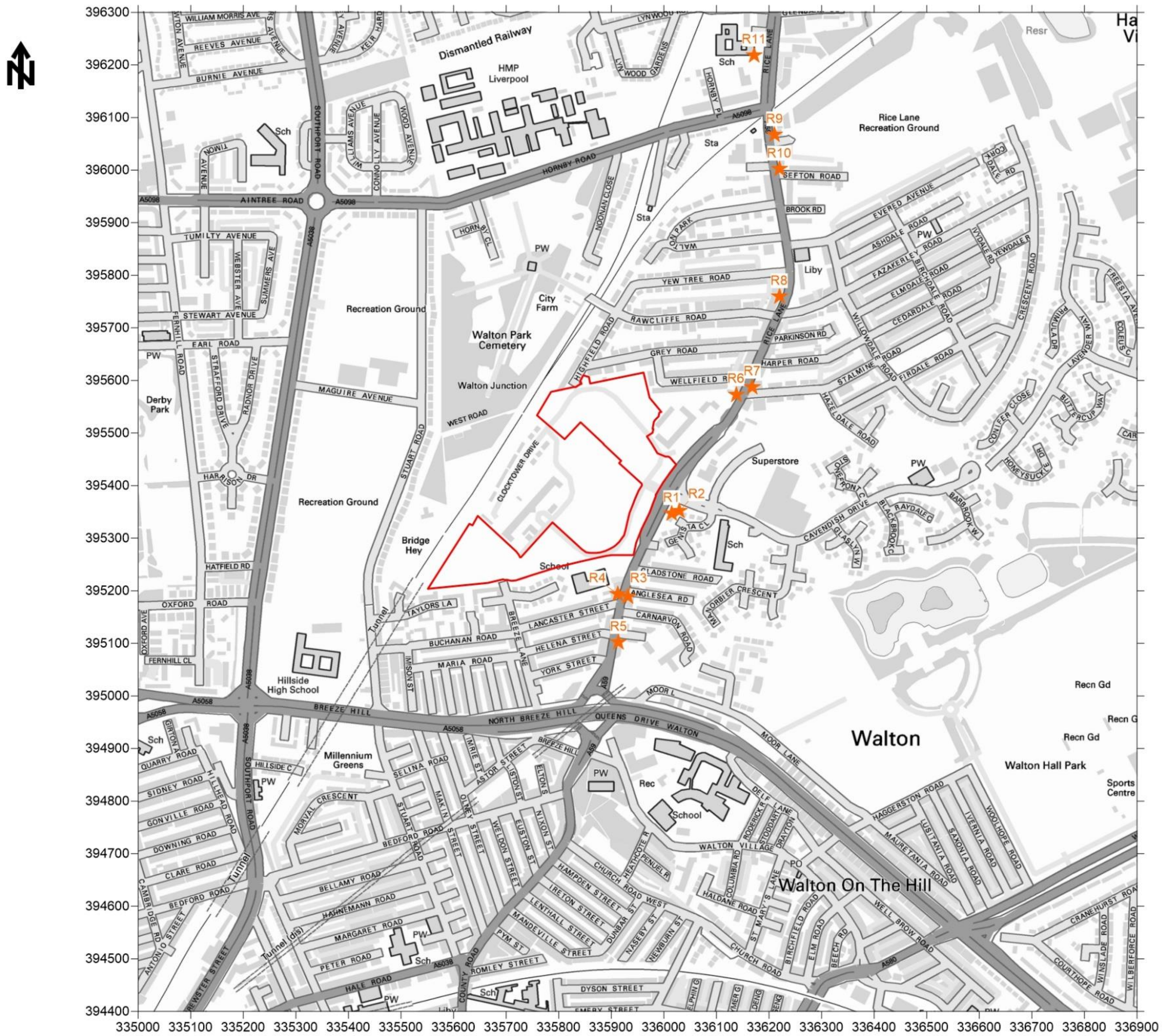
Legend

Title
Figure 5 - Wind Rose of 2013 Liverpool Airport Meteorological Data

Project
Air Quality Assessment
Rice Lane, Liverpool

Project Number
10-216

Client
Mulbury Homes



Legend

Site Boundary

Sensitive Receptor

Title

Figure 6 - Road Vehicle Exhaust Emission Receptor Locations

Project

Air Quality Assessment
Rice Lane, Liverpool

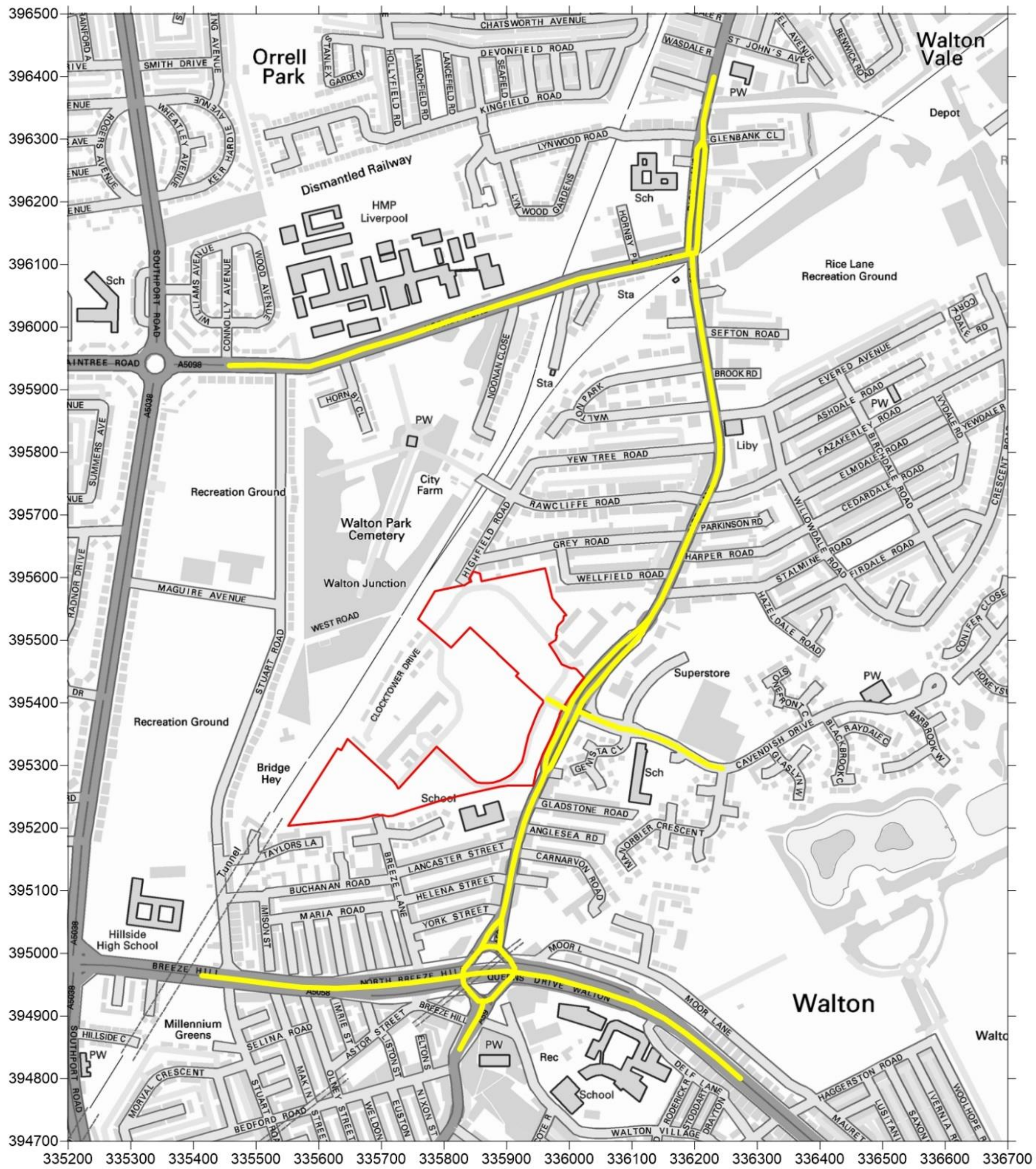
Project Number

10-216

Client

Mulbury Homes

e3p



N

Legend

Site Boundary

Modelled Road Link

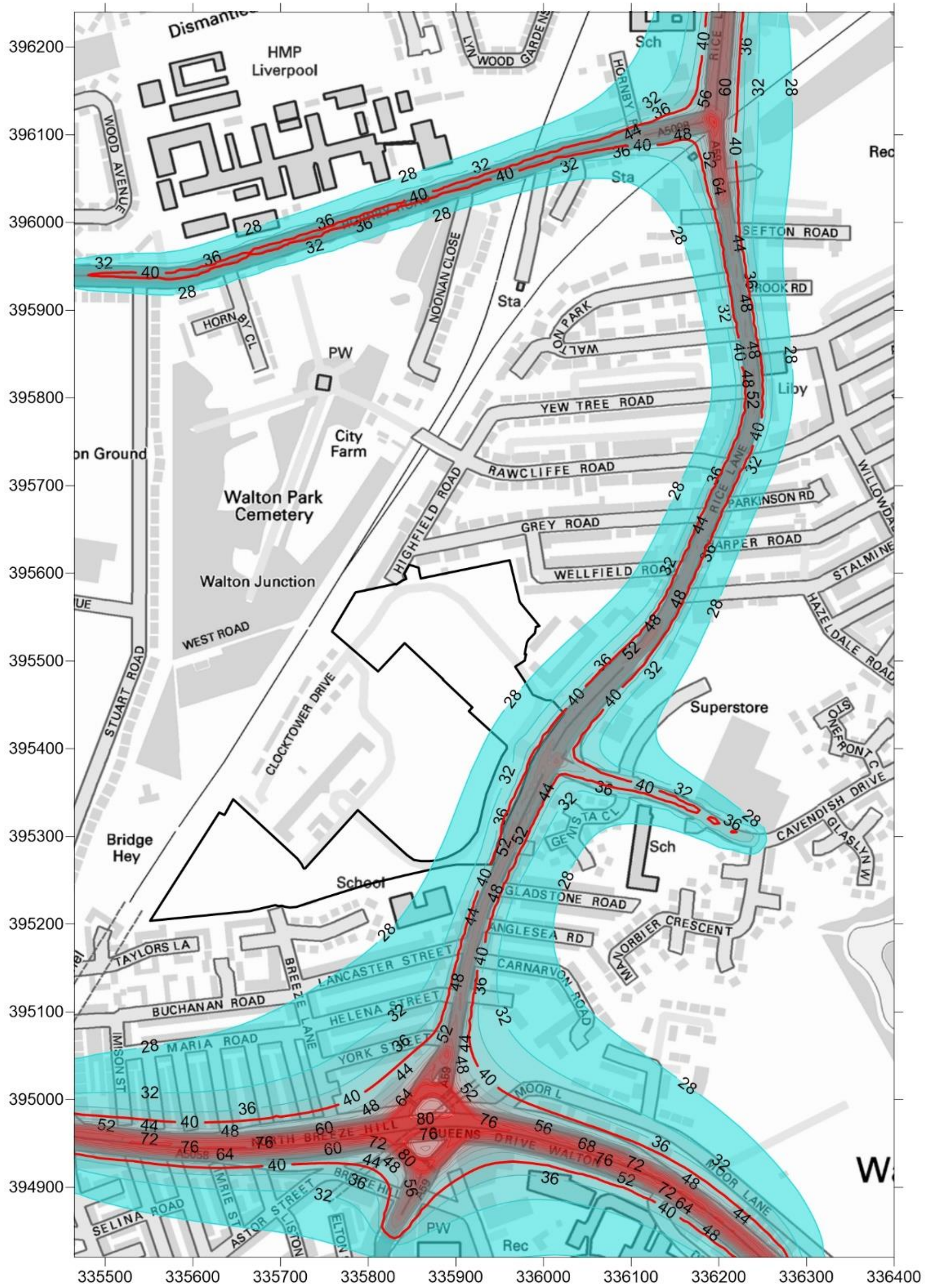
Title
Figure 7 - ADMS Roads Inputs

Project
Air Quality Assessment
Rice Lane, Liverpool

Project Number
10-216

Client
Mulbury Homes

e3p



Legend

Site Boundary

Predicted Annual Mean NO_2 Concentration ($\mu g/m^3$)

80, 76, 72, 68, 64, 60, 56, 52, 48, 44, 40, 36, 32, 28

Title

Figure 8 - Predicted Annual Mean NO_2 Concentrations - Do-Minimum ($\mu g/m^3$)

Project

Air Quality Assessment
Rice Lane, Liverpool

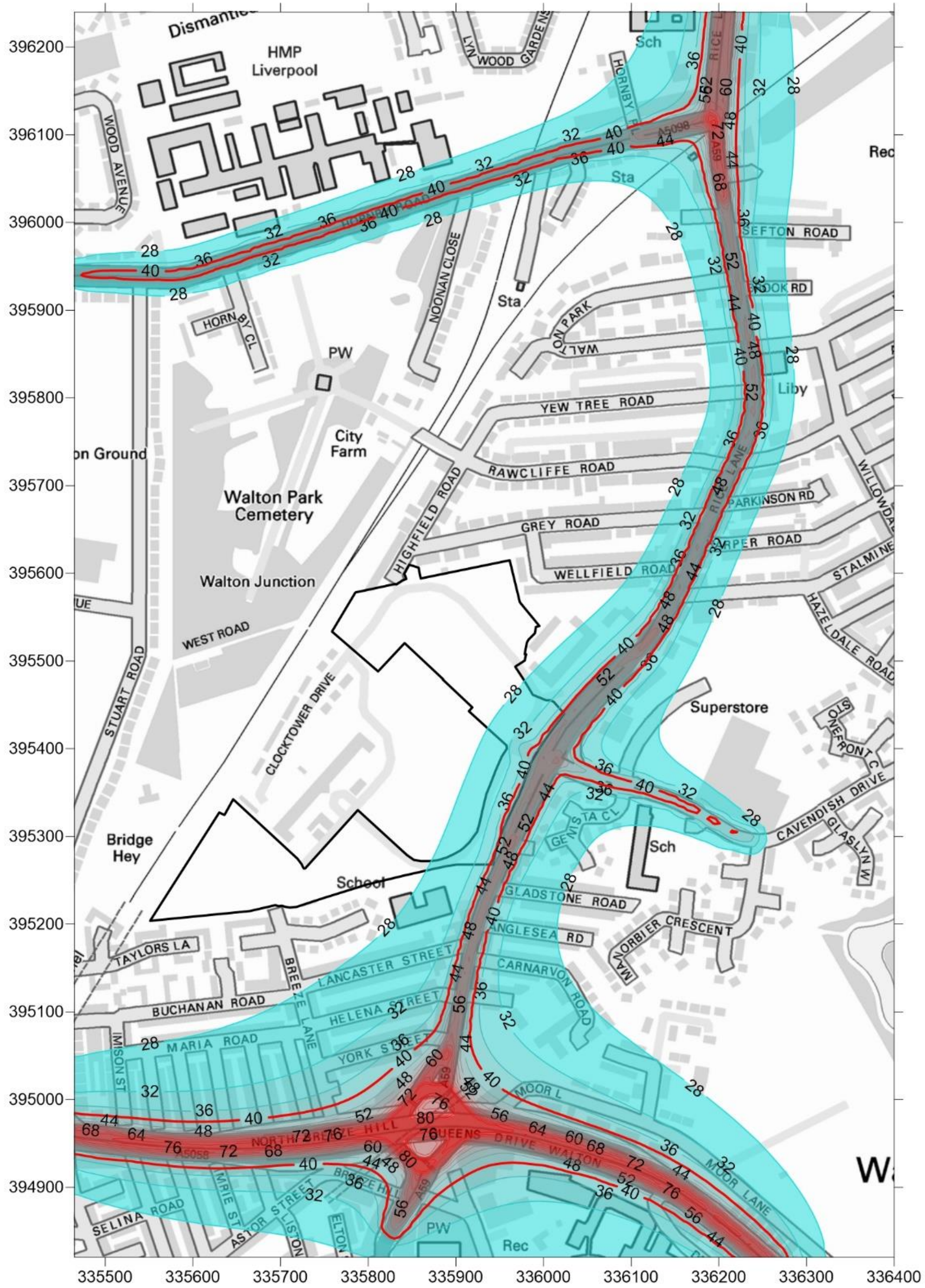
Project Number

10-216

Client

Mulbury Homes

e3p



Legend

Site Boundary

Predicted Annual Mean NO_2 Concentration ($\mu g/m^3$)

80, 76, 72, 68, 64, 60, 56, 52, 48, 44, 40, 36, 32, 28

Title

Figure 9 - Predicted Annual Mean NO_2 Concentrations - Do-Something ($\mu g/m^3$)

Project

Air Quality Assessment
Rice Lane, Liverpool

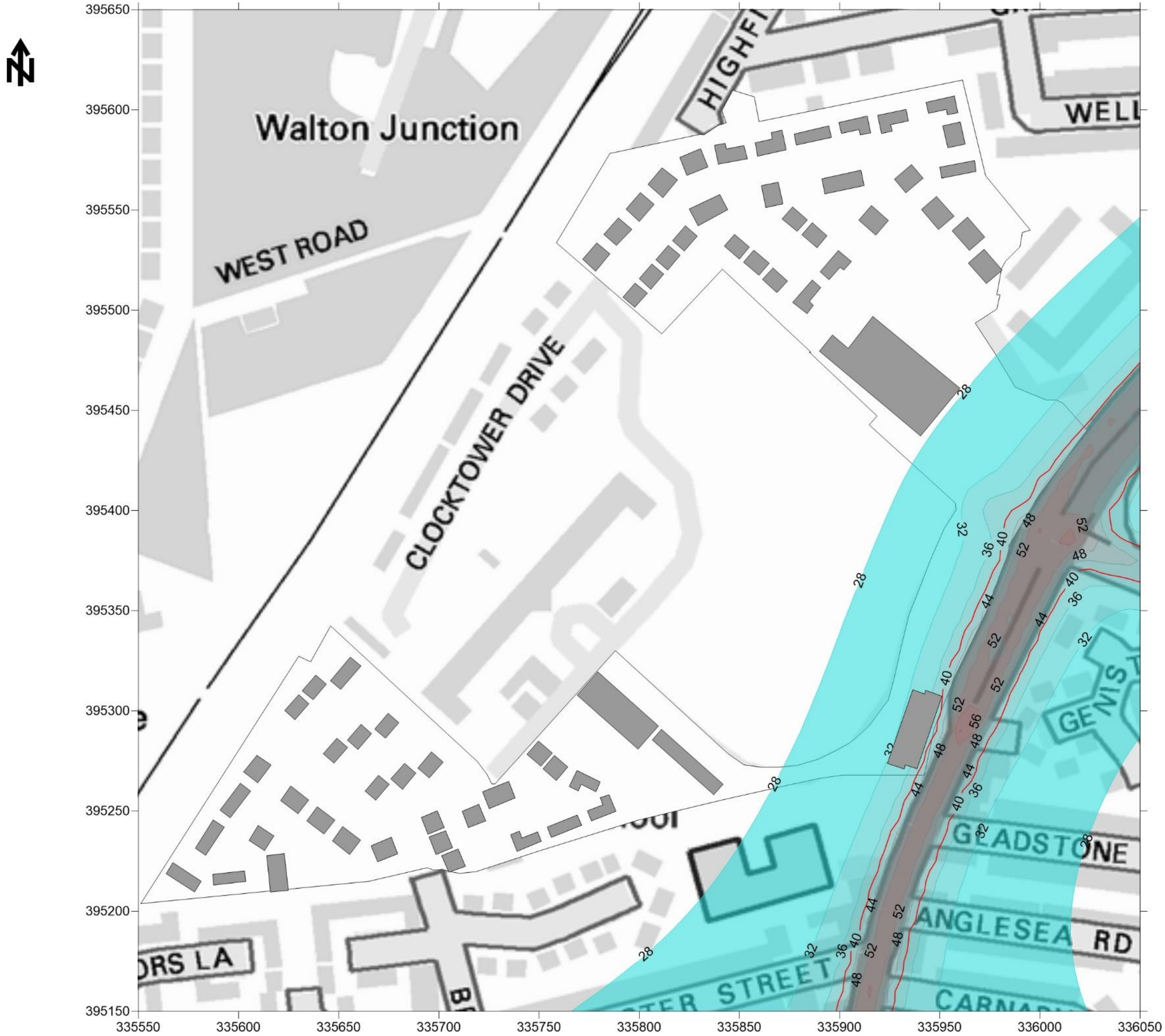
Project Number

10-216

Client

Mulbury Homes

e3p



Legend

Building Location

Predicted Annual Mean NO_2 Concentration ($\mu g/m^3$)

80, 76, 72, 68, 64, 60, 56, 52, 48, 44, 40, 36, 32, 28

Title

Figure 10 - Predicted Annual Mean NO_2 Concentrations - Do-Something ($\mu g/m^3$) Site Location

Project

Air Quality Assessment
Rice Lane, Liverpool

Project Number

10-216

Client

Mulbury Homes