

Wakefield Road Bus Depot, Barnsley

Air Quality Report

**Planning Application by
Yorkshire Traction Co Ltd and
Harworth Estates Ltd (UK Coal
Mining Ltd)**

**Environmental Planning &
Assessment Limited**

June 2011



Contents

Contents.....	1
1.0 Introduction.....	1
1.1 Preamble.....	1
1.2 The Report Content and Structure.....	1
2.0 Overview of the Site and Proposed Development.....	3
3.0 Review of Policy and Legislative Context.....	5
3.1 National Legislation.....	5
3.2 National Planning Policy.....	7
3.3 Local and Regional Planning Policy.....	8
4.0 Air Quality Assessment Methods and Significance Criteria.....	12
4.1 Introduction.....	12
4.2 Assessment of the Effects of Traffic Related Emissions.....	13
4.3 Significance Criteria.....	15
5.0 Review of Baseline Conditions.....	19
5.1 Introduction.....	19
5.2 Review of the Baseline Data.....	22
6.0 Results and Discussion.....	25
6.1 Results of ADMS Model Simulations.....	25
6.2 Assessment of the Significance of the Changes in Air Quality.....	25
6.3 Layout of the Development and Air Quality.....	28
6.4 Mitigation Measures.....	28
7.0 Summary and Conclusions.....	33
Appendix A: Air Quality Model.....	35
A.1 Introduction.....	36
A.2 Traffic Flow Data.....	36
A.3 Scenarios Modelled.....	38
A.4 Treatment of Emissions due to Stationary Sources.....	38
A.5 Pollutant Background Data.....	39
Meteorological Data.....	40
Model Data Processing.....	40
References.....	41

1.0 Introduction

1.1 Preamble

Environmental Planning & Assessment Limited (EPAL) has been commissioned by Stagecoach (Yorkshire) Ltd to undertake an air quality assessment of a proposed extension of the bus depot on Wakefield Road (the “Development”). The proposals would accommodate additional parking spaces for 32 buses, 2 light goods/public carrier vehicles, 2 motorcycles and 5 cycles. The Applicant is the Yorkshire Traction Co Ltd and Harworth Estates Ltd (UK Coal Mining Ltd).

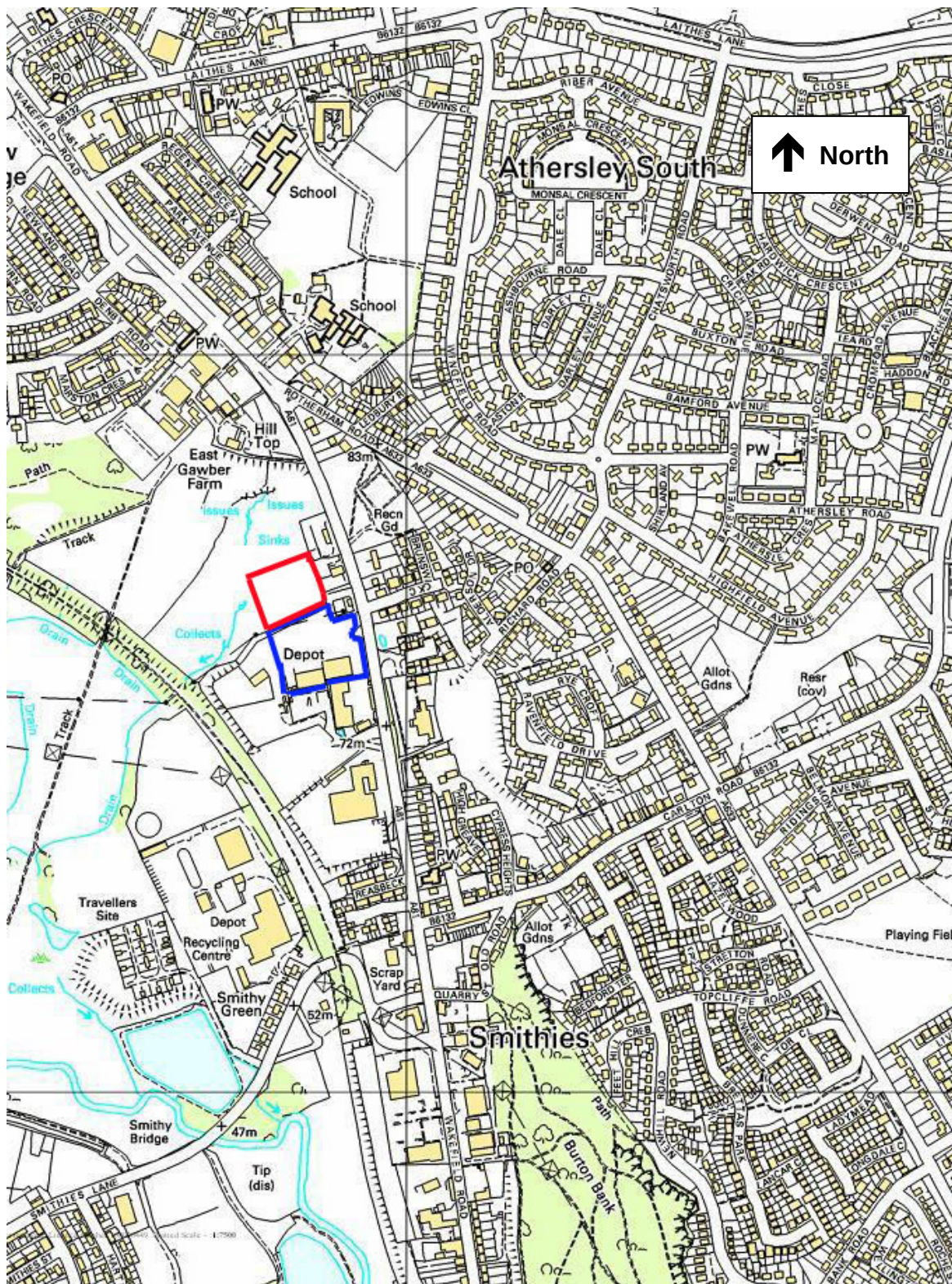
The development site (the “Site”) occupies land directly abutting the existing bus depot on Wakefield Road. Currently the site is vacant land to the north of Wakefield Road Bus Depot, Wakefield Road, Barnsley, South Yorkshire, S71 1NU

1.2 The Report Content and Structure

The Report is structured as follows:

- Section 2 provides a brief description of the Development;
- Section 3 gives a review the UK Regulations, EU Directives, government planning policy guidance, and regional and local planning policy relating to air quality;
- Section 4 describes the methods of assessment adopted and the significance criteria used to assess and evaluate the significance of changes in air quality resulting from the operation of the completed Development and its traffic.
- Section 5 briefly reviews the baseline air quality of this part of Barnsley;
- Section 6 presents the results of the air quality modelling and assesses the significance of the results in the context of the significance criteria set out in Section 4;
- Section 7 provides a summary of the assessment and its conclusions

Figure 1: The Development Site



Reproduced from the Ordnance Survey Map with permission of the Controller of Her Majesty's Stationary Office Crown Copyright rights reserved Licence number 100046510

Stagecoach (Yorkshire) Ltd.

Wakefield Road Bus Depot, Barnsley

Page 2

2.0 Overview of the Site and Proposed Development

This development site is 0.63 hectares in area and is adjacent to the existing bus depot on Wakefield Road. The land is currently vacant.

The development comprises the formation of a new parking area for buses and cars, and associated works. Table 2.1 summarises the proposed parking to be provided at the extended depot.

Table 2.1 Schedule of Parking Proposed

Type of Vehicle	Total Existing	Total Proposed (including spaces retained)	Difference in spaces
Car	57	57	0
Light goods / public carrier vehicles	2	4	2
Motorcycles	3	5	2
Disability spaces	3	3	0
Cycle spaces	5	10	5
Bus	98	130	32

The hours of operation of the depot are as follows:

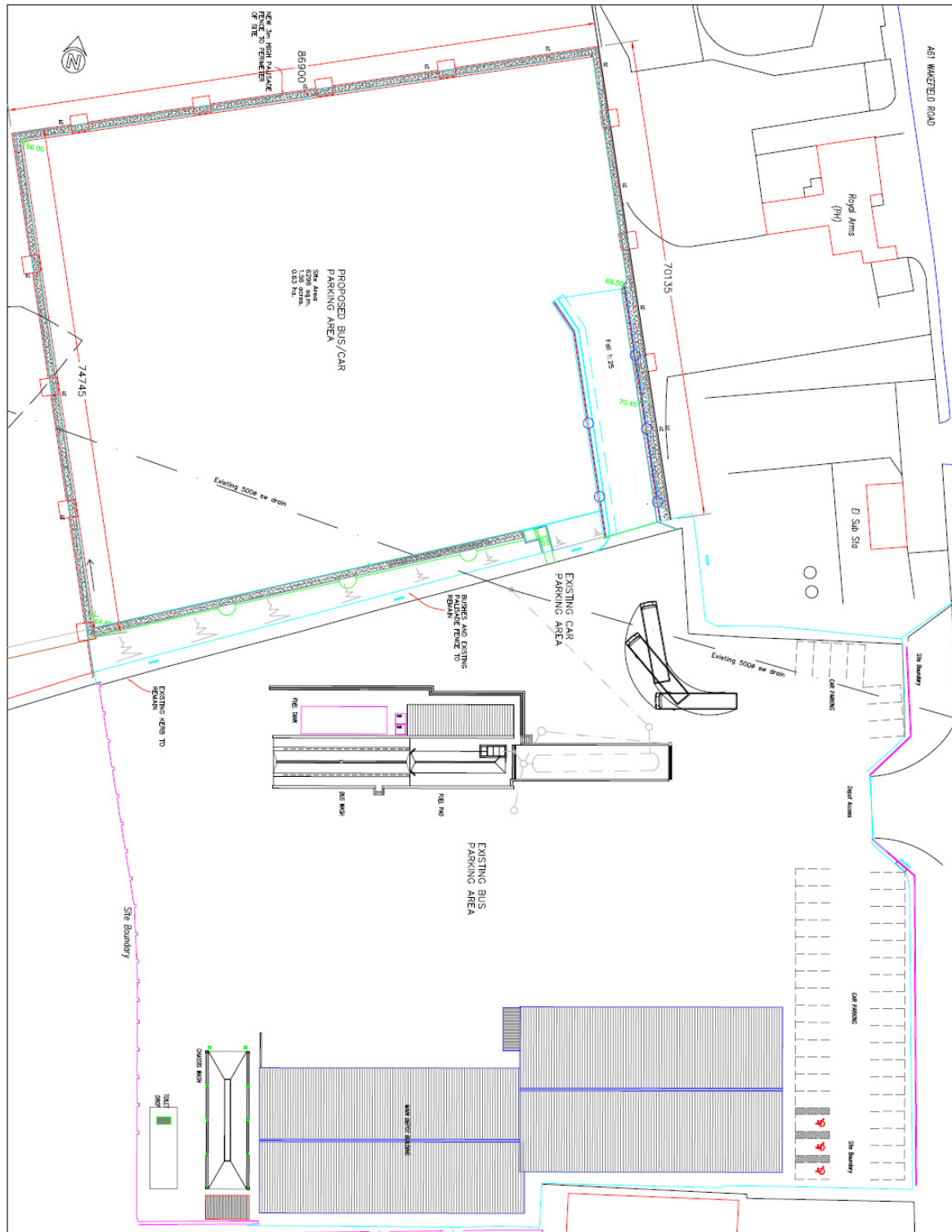
- Monday – Friday: 04.15 – 01.30, with possibility of on-site movements until 02.00
- Saturday: 04.30 – 01.30
- Sunday and B/H: 07.00 – 01.00

A staff bus is scheduled to leave at 02:00 am. The first staff bus (collection of early drivers) is due to leave the depot at 03:20 am, to collect workers from various parts of Barnsley/South Yorkshire. The bus collects drivers who operate on the early services. The bus is used so that drivers do not need to use their cars. This forms a part of the Stagecoach Green Travel Plan and aims to reduce on site parking.

The proposals involve no new or altered vehicle or pedestrian access points. Access from the existing depot to the new area of parking will be gained via a ramp of approximately 35m length with a 1:25 fall. The proposed boundary treatment adopts a 3.0m high steel palisade fence and landscaping. Lighting will be provided on 10m high lighting columns. The hard standing for the bus and car parking areas will be formed from reinforced

concrete. A 150 m³ storm attenuation tank is to be provided as part of the sustainable urban drainage strategy.

Figure 2: Plan of the Development



3.0 Review of Policy and Legislative Context

3.1 National Legislation

European Union (EU) air quality policy sets the scene for national policy. The air quality 'framework' Directive¹ on Ambient Air Quality Assessment and Management came into force in September 1996 and is intended as a strategic framework for tackling air quality consistently, through setting Europe-wide air quality limit values in a series of daughter directives, superseding and extending existing European legislation². The daughter directives have been transposed into national legislation.

The Environment Act 1995³ provides for the creation of a system of local air quality management, which requires local authorities to undertake an assessment of air quality in their areas and to take action where statutory objectives are not being met. These statutory objectives are now incorporated into the Air Quality (England) Regulations 2007 (SI 2007/64)⁴, which set out the current targets for air quality in local areas. Air quality objectives are given for ten pollutants, including benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, sulphur dioxide, particulate matter (PM₁₀ and PM_{2.5}) and ozone. These are set as a result of the effect of the pollutants on human health, although the effect upon the wider environment is also a material consideration. Where any of the statutory objectives are not likely to be met during the specified period, the local authority must designate the area as an Air Quality Management Area (AQMA) and prepare an action plan.

The first National Air Quality Strategy (NAQS) was published in 1997⁵ and subsequently reviewed at various stages. In July 2007 the government published a further fourth revision of the National Air Quality Strategy (NAQS)⁶.

¹ Council Directive 96/62/EC of 27 September 1996 on Ambient Air Quality Assessment and Management. Official Journal L 1996, 21/11/1996 P. 0055 - 0063

² Council Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air. Official Journal L 163, 29/06/1999 P. 0041 – 0060

³ HMSO (1995) The Environment Act 1995, Part IV Air Quality

⁴ TSO (2007) The Air Quality (England) Regulations 2007. Statutory Instrument 2007 No. 64

⁵ Department of Environment (DoE) (1997) 'The UK National Air Quality Strategy, CM3587'. HMSO, London.

⁶ DEFRA in association with Scottish Executive, Welsh Assembly Government and DoE Northern Ireland (2007) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland* (July 2007), 54pp. TSO

Table 3.1 summarises the currently applicable air quality objectives in relation to nitrogen dioxide and PM₁₀, which are those most likely to be exceeded in England. The current NAQS⁸ revises the approach to the control and reduction of PM₁₀ concentrations (see footnote to Table 3.1). These changes reflect European obligations⁷, and are based upon a reduction of exposure to PM_{2.5} – a sub-fraction of the PM₁₀ with an aerodynamic diameter of less than 2.5µgm⁻³. Those air quality objectives which are limit values required by EU Daughter Directives on Air Quality have been transposed into UK law through the Air Quality Standards Regulations 2010⁸, which came into force on 11th June 2010. These regulations include the PM_{2.5} concentration objective.

Table 2.1: UK Air Quality Standards for Nitrogen Dioxide and Particulate Matter

Pollutant	Air Quality Objective		
	Averaging Period	Concentration	Year for Compliance
Nitrogen Dioxide	1 hour mean	200µgm ⁻³ (105ppb) not to be exceeded more than 18 times per year	31 Dec 2005
	Annual mean	40µgm ⁻³ (21ppb)	31 Dec 2005
Particulate Matter (PM ₁₀) (gravimetric)	24 hour mean	50µgm ⁻³ not to be exceeded more than 35 times per year	31 Dec 2004
	Annual mean	40µgm ⁻³	31 Dec 2004
Particulate Matter (PM _{2.5}) (gravimetric)*	Annual mean*	25 µg m ⁻³	1 Jan 2015*
* <i>Margin of tolerance</i> 20% on 11 th June 2008, decreasing on the next 1 st January and every 12 months thereafter by equal annual percentages to reach 0% by 1 st January 2015			

The UK air quality objectives and EU limits relate to external ambient air where members of the public are regularly present and may be exposed over the averaging period of the objective. Guidance on the typical locations where the objectives should and should not apply is provided in Local Air Quality Management Technical Guidance (LAQM. TG09)⁹ published in January 2009. A summary of this guidance is provided below in Table 3.2.

⁷ Directive 2008/50/EC on ambient air quality and cleaner air for Europe 21st May 2008 OJ L152/1 11/6/2008.

⁸ TSO (2010) Environmental Protection The Air Quality Standards Regulations 2010 SI 2010 No.1001.

⁹ DEFRA, 2009. 'Environment Act 1995, Local Air Quality Management, Technical Guidance LAQM. TG(09)'.

Table 3.2: Typical Locations where the Air Quality Objectives Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, libraries care homes etc.	Building facades 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 hour mean objectives apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably expected to spend 1-hour or more. Any outdoor locations to which the public might reasonably expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.2 National Planning Policy

PPG 13: Transport¹⁰ mentions air quality in that it refers to local authorities being required under Part IV of the Environment Act 1995 to review and assess air quality in their areas, and to designate air quality management areas (AQMAs) and draw up action plans where

¹⁰ DETR, 2001. 'Planning Policy Guidance 13 (PPG13): Transport', HMSO, London.

national policies and instruments alone appear unlikely to deliver the Government's health-based national air quality objectives. Furthermore paragraph 14 mentions the use of alternative fuels and technologies now available that can offer air quality and climate change benefits compared to conventional petrol and diesel.

PPS 23: Planning and Pollution Control¹¹ addresses air quality in Annex 1: Pollution Control, Air and Water Quality. Paragraph 1.19 addresses industrial processes, which are not of particular relevance to the proposal Site. Paragraph 1.20 addresses air quality standards for smoke and sulphur dioxide, lead and nitrogen dioxide, which have been prescribed in European Community (EC) directives and implementing regulations. The Government has a number of air quality monitoring networks, which are supplemented by monitoring undertaken by individual local authorities, described for Barnsley below.

3.3 Local and Regional Planning Policy

The Unitary Development Plan (UDP) adopted in December 2000 is still the statutory development plan for the borough. The current policies on environment were retained after September 2007, when a small number of UDP policies were deleted by the Government Office of Yorkshire and the Humber. The UDP policies dealing with air pollution are general in character. The principal policy ES1 (pollution) states that:

"The council will refuse proposals for development which are Likely to result in harm to the environment through excessive levels of pollution arising either within the site to be developed or occasioned elsewhere by the proposed development. The council will in particular resist development which is likely to result in housing, schools, hospitals or other sensitive land uses being subjected to excessive levels of air, noise or other pollution."

Where development is permitted the council will seek to ensure that resulting pollution is avoided or minimised."

Paragraph 3.188 of the supporting text refers to PPG23 Planning and Pollution Control (see above). This recognises that the planning system has a role of determining the location of potentially polluting development, which complements the role of pollution control permitting legislation in regulating the operation of a development once consented. The supporting text states that it is the responsibility of applicants to ensure

¹¹ Office of the Deputy Prime Minister (ODPM) (2004) 'Planning Policy Statement 23 (PPS23): Planning and Pollution Control'. HMSO, London.

that sufficient information is provided with a planning application to allow a proper assessment to be made of the potential for pollution. Paragraph 3.189 states that new development should be located so that sensitive uses are not subjected to unacceptable levels of air pollution and other forms of pollution or nuisance.

Barnsley MBC has consulted on its draft Local Development Framework (LDF) Core Strategy, which will replace the UDP, during the past year. The Barnsley Local Development Framework Core Strategy was published February 2010. Two of the core strategy policies relate to air quality and air pollution.

Policy CSP 40 Pollution Control and Protection, which broadly follows the approach of UDP policy ES1, states that:

“Development will be expected to demonstrate that it is not likely to result, directly or indirectly, in an increase in air, surface water and groundwater, noise, smell, dust, vibration, light or other pollution which would unacceptably affect or cause a nuisance to the natural and built environment or to people.

We will not allow development of new housing or other environmentally sensitive development where existing air pollution, noise, smell, dust, vibration, light or other pollution levels are unacceptable and there is no reasonable prospect that these can be mitigated against.

Developers will be expected to minimise the effects of any possible pollution and provide mitigation measures where appropriate.”

Policy CSP 41 Development in Air Quality Management Areas is far more specifically tailored to deal with air quality, and states that:

“Development in air quality management areas will be expected to demonstrate that it will not have a harmful effect on the health or living conditions of any future users of the development in terms of air quality (including residents, employees, visitors and customers), or that any such harmful effects can be mitigated against.

We will only allow residential development in air quality management areas, where the developer provides an assessment that shows living conditions will be acceptable for future residents.

Air Quality Report

We will only allow development in air quality management areas which could cause more air pollution, where the developer provides an assessment that shows there will not be a significantly harmful effect on air quality.

The Barnsley MBC Air Quality Progress Report of 2010¹² notes that, “in assessing the significance of the air quality impact of proposed developments, the Council will continue to use the Environmental Protection UK guidance regarding development control and air quality (now updated). In light of this, there are no current plans for Barnsley MBC to develop its own supplementary planning documents relating to air quality”.

Barnsley Metropolitan Borough Council Review and Assessment of Air Quality

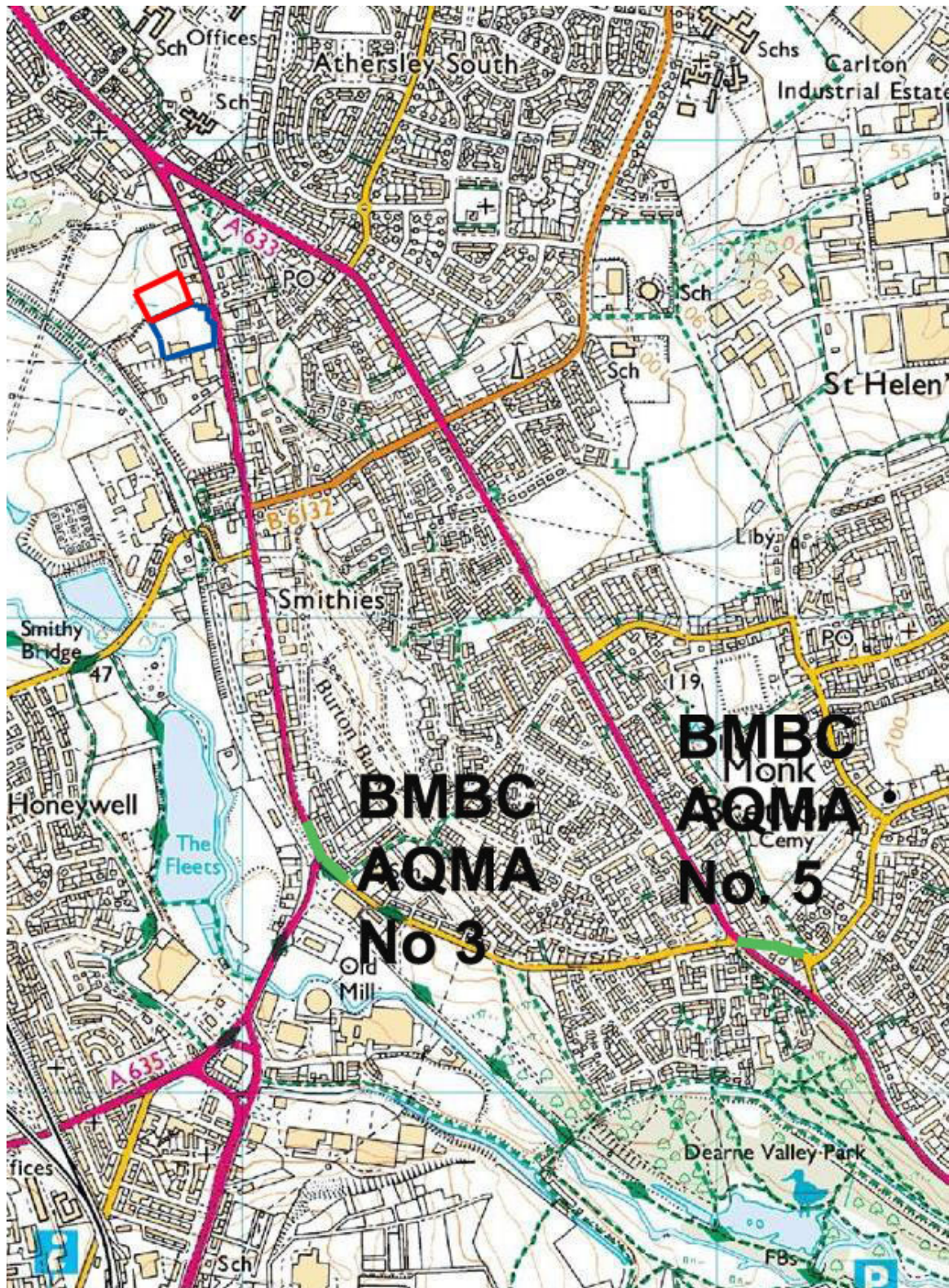
Barnsley MBC has carried out a detailed review of the area and has subsequently declared a number Air Quality Management Areas (AQMAs). Two of these AQMAs are within 2km of the proposed development site (numbers 3 and 5). The AQMAs have been declared for nitrogen dioxide (NO₂).

Table 3.4: Air Quality Management Areas in Barnsley

No.	Adjacent roads / junctions	Year declared	Estimated no. of domestic dwellings
1	M1 Motorway, 100 metres either side of the central reservation within the Barnsley Borough	2001	265
2A	A628 Dodworth Road	2005	425
2B	A628 Barnsley Road	2005	
3	Junction of A61 Wakefield Road and Burton Road	2005	30
4	A61 Harborough Hill Road	2008	42
5	Junction of A633 Rotherham Road and Burton Road	2008	16

¹² Barnsley MBC (2010) 2010 Air Quality Progress Report for Barnsley Metropolitan Borough Council, August 2010, 81pp C, Shields.

Figure 3: AQMAs Relative to Application Site



Reproduced from the Ordnance Survey Map with permission of the Controller of Her Majesty's Stationary Office Crown Copyright rights reserved Licence number 100046510

4.0 Air Quality Assessment Methods and Significance Criteria

4.1 Introduction

The assessment methodology has consisted of the following elements:

- A review of relevant baseline air quality information and data from data-collecting stations within Barnsley. The sources of data include the national Automated Urban and Rural Network (AURN) operated on behalf of the Department for Environment, Food and Rural Affairs (DEFRA);
- A review of the Barnsley Metropolitan Borough Council Air Quality Reviews and Assessments¹³ and the declared Air Quality Management Areas¹⁴;
- A review of the adjacent land uses to identify potentially sensitive receptors with respect to air quality;
- Modelling of the existing baseline and future 'with Development' and 'without Development' ambient air quality with the Atmospheric Dispersion Model System (ADMS) Roads 3 model, using predicted traffic data provided by the Department for Transport website¹⁵ and the transport consultants Jacobs;
- Comparison of the air quality modelling results with current and provisional future National Air Quality Objectives (AQOs);
- Comparison of the air quality modelling results for the 'with Development' and 'without Development' future scenarios;

¹³ Barnsley MBC (2003) Part IV Environment Act 1995 - Local Air Quality Management Updating and Screening Assessment for Metropolitan Borough of Barnsley 2003, May 2003, 59pp; Barnsley MBC (2006) Part IV Environment Act 1995 - Local Air Quality Management Updating and Screening Assessment for Metropolitan Borough of Barnsley 2006 April, 2006, 69pp; Barnsley MBC (2009) Part IV Environment Act 1995 - Local Air Quality Management Updating and Screening Assessment for Metropolitan Borough of Barnsley 2009, 44pp plus figures and appendices; and, Barnsley MBC (2010) 2010 Air Quality Progress Report for Barnsley Metropolitan Borough Council, August 2010, 81pp C, Shields.

¹⁴ Barnsley MBC (2010) 2010 Air Quality Progress Report for Barnsley Metropolitan Borough Council, August 2010, 81pp C, Shields.

¹⁵ AADT data available from <http://www.dft.gov.uk/matrix/>

- Discussion of potential mitigation measures; and
- Identification of the resulting residual effects.

4.2 Assessment of the Effects of Traffic Related Emissions

4.2.1 Introduction

Emissions from road traffic are the main influence on air quality in urban areas within the UK. Current national, regional and local policy encourages the use of more sustainable forms of transport, thereby reducing reliance on private cars. The proposed Development would provide bus and car parking facilities relating to the operation of a bus maintenance depot. The Development could result in additional traffic on the local road network, due to movements of buses, servicing vehicles and workforce vehicles to and from the depot.

4.2.2 ADMS Roads 3 Model

Emissions from road traffic are commonly assessed using the Design Manual for Roads and Bridges (DMRB) screening methodology¹⁶. Where air quality standards are predicted to be exceeded or where an air pollution problem is likely, further detailed modelling is recommended. In the light of the scale of development proposed, it was decided to undertake dispersion modelling from the outset. The assessment has used the ADMS Roads 3 dispersion model to assess air quality effects from the traffic associated with the Development.

For assessment purposes, the ADMS model has been used to calculate concentrations of nitrogen dioxide (NO₂), and particulate matter smaller than 10µm (PM₁₀) and 2.5µm (PM_{2.5}). These pollutants are most commonly of concern in urban areas where road traffic is the principal source of emissions. These are also the principal pollutants to which the Barnsley MBC AQMA declaration relate¹⁷. Annual mean concentrations of NO₂, PM₁₀ and PM_{2.5}, as well as daily mean PM₁₀ concentrations, are predicted. Short-term NO₂ concentrations were predicted but as these are generally not of concern in urban areas the results are not discussed in this assessment.

¹⁶ Highways Agency (2003) Part IV of the Design Manual for Roads and Bridges (DMRB) Vol 11 Environmental Assessment Section 3 Environmental Impact Assessment Techniques Part1 Air Quality. 73 pp February 2003

¹⁷ Barnsley MBC (2010) 2010 Air Quality Action Plan 2010-Consultation Draft, 92pp

Annual Average Daily Traffic flows (AADT), percentage heavy goods vehicle (HGV) compositions and average vehicle speeds have been provided by the project's transport consultant, Jacobs, for the local road network for the existing ('without Development') situation and with the completed Development ('with Development'). The data incorporated in the Air Quality model are expressed as 1 hour annual average hourly totals (AAHT). The data used are shown in Appendix A. A daily traffic variation profile has been used in the predictions, reflecting the typical changes of traffic volumes on weekdays and Saturdays and Sundays.

4.2.3 Simulations Undertaken

Simulations have been made for the future case of the Development, based on the traffic data available from the Department for Transport¹⁸ and the assessment carried out by Jacobs¹⁹. The Development is programmed to be complete in less than 1 year and for the purposes of the assessment 2012 has been assumed as the year of opening. The model was run for the following scenarios:

- 2009 existing baseline conditions, to allow comparison with monitored data for model verification (this is the year for which the most recent verified air quality and meteorology data are available), with appropriate growth factors on data using on TEMPRO²⁰ output;
- 2009 baseline condition with the additional traffic generated by the Development.

Further explanation of the assumptions made with respect to traffic data for the above scenarios is provided in Appendix A, which gives the traffic data used.

The ADMS-Roads 3 dispersion model predicts how emissions affect local air quality. It simulates the effects of vehicular sources, defined area sources and up to three point industrial sources. These are used in combination with local background pollution levels, taking account of meteorological conditions, to predict air quality. Further details of the approach to the modelling study are provided in Appendix A. The meteorological data set for the Church Fenton weather station was provided by the Meteorological Office to provide the best representation of conditions in Barnsley. Due to the potential importance

¹⁸ AADT data available from <http://www.dft.gov.uk/matrix/>

¹⁹ Jacobs Transport Planning (2011) Transport Assessment: Wakefield Road Bus Depot

²⁰ Department for Transport TEMPRO Version 6.1 www.tempro.org.uk/

of gradients, the model was used with complex terrain modules. Appropriate digital terrain model data were obtained to create terrain files in ADMS Roads 3.

Background air quality data were obtained from the UK Air Quality Archive (<http://www.airquality.co.uk/archive/>) for the background monitoring station located at Gawber in Barnsley. The National Grid Reference is 432525, 407475 and the site is referred to as an Urban Background location. It measures the following pollutants: ozone (O₃), sulphur dioxide (SO₂) and oxides of nitrogen (NO_x). The monitoring station is about 700 m south west of the Site. The PM₁₀ and PM_{2.5} data used for the background were taken from the Sheffield Centre urban background site (NGR: 386885, 435134), since there are no equivalent background data for Barnsley. The number of exceedences of the 24 hour PM₁₀ objective has been predicted using the annual mean objective and the conversion formulae provided in LAQM.TG(09). A separate background data file was created to represent air quality in 2012, adjusted using the procedures set out in DEFRA guidance document LAQM.TG09²¹.

A further consideration is the fraction of NO_x emissions represented by NO₂ (fNO₂). Adjustments were made manually in the model inputs to adjust the fraction of NO₂ in vehicle emissions in accordance with the advice of the Air Quality Expert Group (2006)²² on nitrogen dioxide trends, which predict increasing fNO₂ despite falling NO_x levels due to improved emissions controls.

4.3 Significance Criteria

Apart from the absolute pollutant concentrations used to define the AQS standards and objectives as given above, there is little formal guidance on the significance to be placed on concentration changes relative to either ambient conditions or the AQS standards and objectives. The Environment Protection UK (formerly the National Society for Clean Air (NSCA)) has also published guidance for planning authorities²³. The key aspects of the guidance suggest that air quality should be considered an overriding consideration where change:

- interferes with or prevents actions within an air quality action plan;

²¹ DEFRA, 2009. 'Environment Act 1995, Local Air Quality Management, Technical Guidance LAQM. TG(09)'

²² Air Quality Expert Group (2006) *Trends in Primary Nitrogen Dioxide in the UK*, 71pp, DEFRA, Scottish Executive, Welsh Assembly Government and DoE Northern Ireland

²³ National Society for Clean Air (2006) *Development Control: Planning for Air Quality* – Updated Guidance from NSCA on dealing with air quality concerns within the development control process; NSCA November 2006.

- leads to a breach or significant worsening of a breach of an EU limit value, or a significant increase in pollutant concentration in the professional opinion of the local authority officer;
- leads to a breach of an AQO or causes a new AQMA to be declared;
- interferes with the implementation of a local air quality strategy; or
- leads to a significant increase in pollutant concentration in the professional opinion of the local authority officer.

Figure 4.1 summarises the guidance approach. The updated guidance also now provides indications of the magnitude of change in air quality that may be significant, which are then related to relatively simple semantic descriptors. The first step is to identify the semantic descriptor of change in ambient concentrations for NO₂ and PM₁₀ (Table 4.1) according to the percentage change in annual mean concentrations (for both NO₂ and PM₁₀) and change in the forecast number of days greater than 50µgm⁻³ for PM₁₀. The descriptor can then be used to assess the impact significance for the two pollutants in relation to changes in the absolute concentration forecast from the modelling with the proposed development in place (Table 4.2).

In the present case the major consideration is the impact of the environment on ambient air quality at the Site. The Development itself will generate limited traffic movements (mainly service vehicles), which would be lower than those of the existing site in full occupation. The assessment criteria have thus been adapted in order to evaluate the incremental effects of local road contributions, in excess of local background levels, to ambient conditions at the Site in the context of the relevant AQOs.

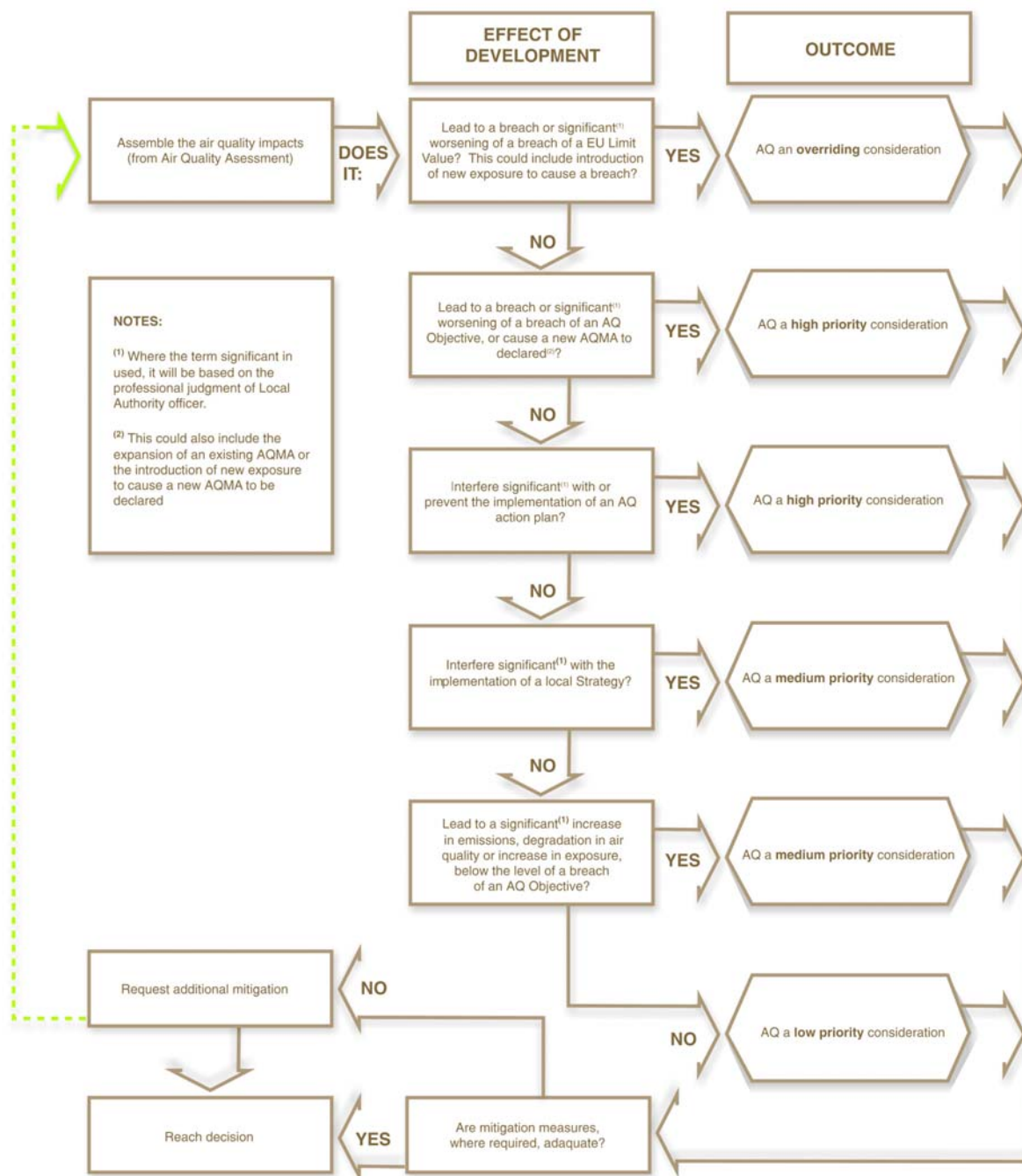
Table 4.1: Descriptors for Changes in ambient Concentrations of NO₂ and PM₁₀
(taken from the NSCA 2006 guidance update)

Magnitude of Change	Annual Mean NO ₂	Days PM10>50 µgm ⁻³
Very large	Increase/decrease > 25%	Increase/decrease > 25 days
Large	Increase/decrease > 15-25%	Increase/decrease > 15 -25 days
Medium	Increase/decrease > 10-15%	Increase/decrease > 10-15 days
Small	Increase/decrease > 5-10%	Increase/decrease > 5-10 days
Very Small	Increase/decrease > 1-5%	Increase/decrease > 1-5 days
Extremely Small	Increase/decrease < 1%	Increase/decrease < 1 days

Table 4.2: Descriptors for impact Significance for NO₂ and PM₁₀ (taken from the NSCA 2006 Guidance Document)

Air Quality at Significance Criteria						
Absolute Concentration in relation to the Standard	Extremely Small	Very Small	Small	Medium	Large	Very Large
Decrease with the Scheme						
Above Standard with scheme	Slight beneficial	Slight beneficial	Substantial beneficial	Substantial beneficial	Very substantial beneficial	Very substantial beneficial
Above Standard without scheme but Below with scheme	Slight beneficial	Moderate beneficial	Substantial beneficial	Substantial beneficial	Very substantial beneficial	Very substantial beneficial
Below Standard without scheme, but not Well Below	Negligible	Slight beneficial	Slight beneficial	Moderate beneficial	Moderate beneficial	Substantial beneficial
Well Below Standard without Scheme	Negligible	Negligible	Slight beneficial	Slight beneficial	Slight beneficial	Moderate beneficial
Increase with the Scheme						
Above Standard without scheme	Slight adverse	Slight adverse	Substantial adverse	Substantial adverse	Very substantial adverse	Very substantial adverse
Below Standard without scheme Above with scheme	Slight adverse	Moderate adverse	Substantial adverse	Substantial adverse	Very substantial adverse	Very substantial adverse
Below Standard with scheme, but not Well Below	Negligible	Slight adverse	Slight adverse	Moderate adverse	Moderate adverse	Substantial adverse
Well Below Standard with scheme	Negligible	Negligible	Slight adverse	Slight adverse	Slight adverse	Moderate adverse
Well Below standard = <75% of the standard level. 'Standard' in the context of this table relates to specific air quality objective or Limit Value in question						

Figure 4.1: Flow Diagram Showing the NSCA Assessment Process



5.0 Review of Baseline Conditions

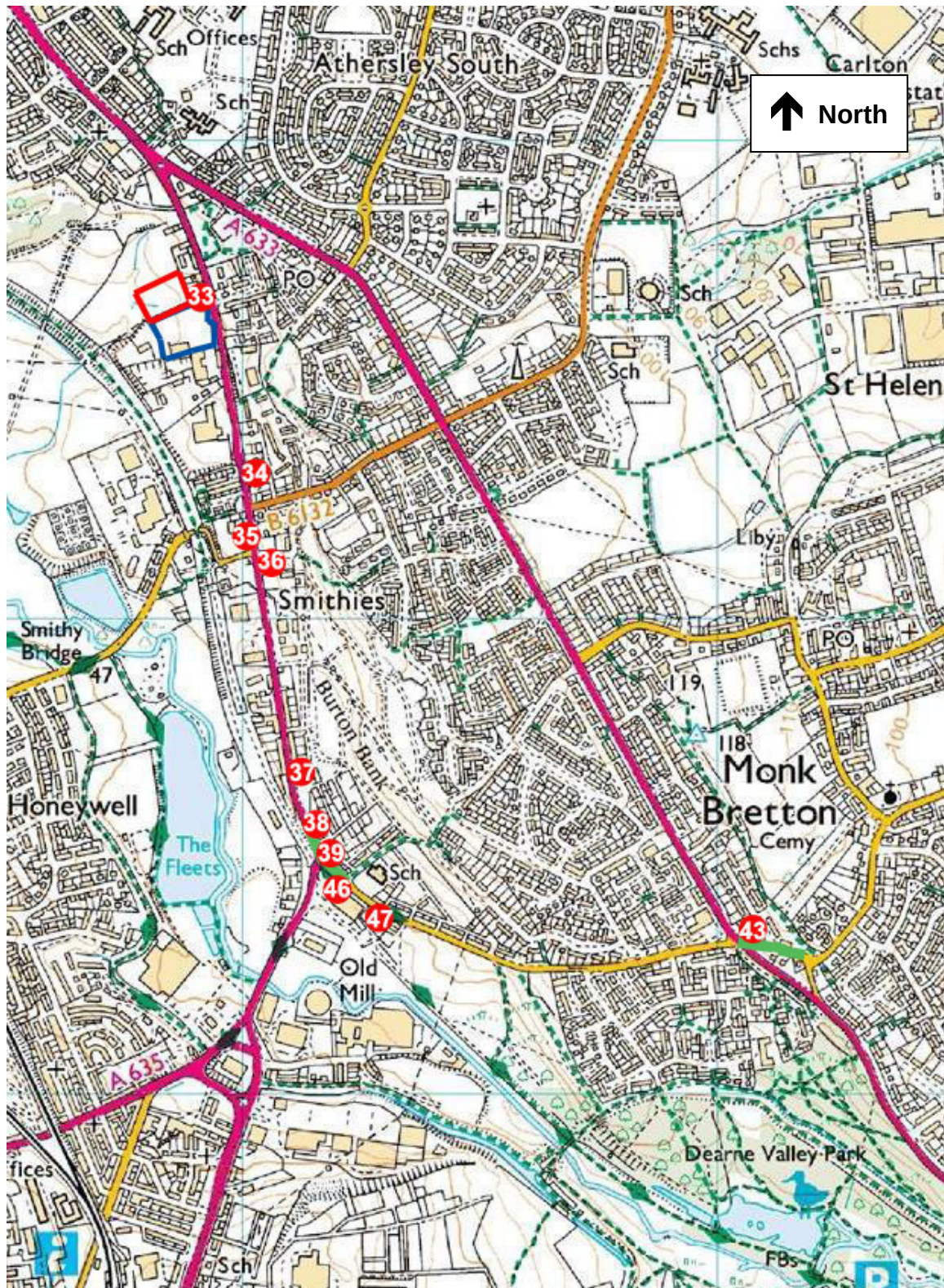
5.1 Introduction

Existing or baseline ambient air quality refers to the concentration of relevant substances that are already present in the environment. These may be derived from a variety of sources, including industrial processes, traffic, commercial and domestic activities, agriculture, and natural sources. This section describes the existing ambient air quality in Barnsley and in the vicinity of the proposed Development. The following data sources have been employed in this assessment:

- A review of automatic monitoring station site locations identified a number of automatic monitoring sites within relatively close proximity to the Site, details of which are given in Table 5.1 below and shown in Figure 5.1.
- In addition, Barnsley MBC also operates a network of diffusion tube monitoring for NO₂ concentrations, and a summary of relevant results for locations close to the Site is provided in Table 5.2 and Figure 5.1.
- A summary of the monitoring results obtained from the automated air quality stations for the period 2005-2009 is given in Table 5.3 below.

As mentioned above, Barnsley MBC uses passive diffusion tubes to monitor concentrations of NO₂ at a number of locations throughout the borough. A review of the NO₂ tube locations indicates that there are three sites within reasonable proximity to the Site. Details of these sites and the monitoring results, for the past three-five years, are given in Table 5.2 below. A bias correction factor has been applied to the original monitoring data by Barnsley MBC to account for the fact that diffusion tubes can under- or over-record NO₂ concentrations quite considerably. The bias correction factors used were applied by Barnsley MBC, on the basis of correlation factors determined from data derived from diffusion tubes co-located with continuous monitoring within the borough.

Figure 5.1: Diffusion Tube Sites Referred to in Text



Reproduced from the Ordnance Survey Map with permission of the Controller of Her Majesty's Stationary Office Crown Copyright rights reserved Licence number 100046510

Table 5.1: Automatic Monitoring Stations

Description of Station Type	Location (NGR): distance and direction from Site	Pollutants Monitored
Urban Background	Barnsley Gawber (NGR 432525 407475): 2.65km south west of Site.	NO ₂ , O ₃ , SO ₂
Roadside	A628 Pogmoor (NGR 432680 406174)): 3.36km south west of Site	NO ₂
Urban Industrial	Royston (NGR 437208 411675): 3.80km north east of the Site	PM ₁₀ , NO ₂ , SO ₂

Table 5.2: Diffusion Tube Monitoring Sites in Close Proximity to the Site and A628

Site ID	Site Name	Site Type	Within AQMA?	Data Capture in 2009 (%)	2005	2006	2007	2008	2009
32	Wakefield Road / Wensley Road	Roadside	No	100	n/a	n/a	29.6	31	27.7
33	Wakefield Road / Brunswick Close	Kerbside	No	92	n/a	n/a	31.4	33.5	33.4
34	Wakefield Road / Carlton Road	Roadside	No	100	n/a	n/a	41.8	42.5	39.5
35	Wakefield Road / Smithies Lane	Roadside	No	100	n/a	n/a	45.3	46.5	45.8
36	Wakefield Road / Smithies Lane	Roadside	No	92	n/a	n/a	44	44.6	42.3
37	Wakefield Rd approach Burton Rd	Kerbside	No	92	n/a	n/a	41.7	40.6	37.5
38	Wakefield Rd approach Burton Rd	Kerbside	No	100	n/a	n/a	40.1	42.2	39.8
39	Wakefield Rd Burton Rd junction	Roadside	Yes (3)	100	52.7	49.8	53.5	50.9	46.9
46	Burton Road	Kerbside	No	100	n/a	n/a	52.1	47.3	44.6
47	Burton Road	Roadside	No	100	n/a	n/a	41.9	38.5	37.1
48	Burton Rd and Rotherham Rd junction	Kerbside	Yes (5)	100	n/a	n/a	50.7	51.7	47.1
n/a – not applicable since no data were collected in that year									

5.2 Review of the Baseline Data

The annual mean NO₂ monitoring results at the A628 roadside continuous monitoring station (see Table 5.3) indicate exceedences of the annual objective of 40µgm⁻³ in recent years. The highest annual mean concentration was recorded in 2004, although there is no unambiguous downward trend between 2004 and 2009. The data for the Gawber urban background site suggest a slight downward trend between 2004 and 2009, and the data for this site indicate good air quality. The data indicate that poor air quality is generally restricted to roadside sites and areas where there is congestion and close to interchanges of heavily trafficked roads.

Table 5.3: Baseline Nitrogen Dioxide (NO₂) and PM₁₀ Data from Continuous Monitoring Stations

Site Location	Year	Annual Mean NO ₂ (µgm ⁻³)	No. of 1 hour means > 200 µgm ⁻³	Annual Mean PM ₁₀ (µgm ⁻³)	No. of 24 hour means > 50 µgm ⁻³
Barnsley Gawber	2004	22	0	NR	NR
	2005	20	0	NR	NR
	2006	19	0	NR	NR
	2007	18	0	NR	NR
	2008	19	2	NR	NR
	2009	19	0	NR	NR
Barnsley A628 roadside	2004	47	Not reported	NR	NR
	2005	44	1	NR	NR
	2006	44	0	NR	NR
	2007	45	5	NR	NR
	2008	46	13	NR	NR
	2009	42	5	NR	NR
Barnsley Royston	2005	23	0	25	10
	2006	26	0	28	27
	2007	25	0	27	19
	2008	21	2	22	20
	2009	Not reported	Not reported	21	8
NR = not recorded					

The NO₂ concentrations recorded at the Royston site are slightly higher than those of the Gawber background site and reflect conditions in this area outside of the centre of Barnsley. The site is related to monitoring of industrial emissions from the Monckton Coke

and Chemical Limited facility, rather than traffic-related emissions. Air quality has readily complied with the NO₂ objective in recent years.

Results for diffusion tube monitoring carried out between 2006 and 2009 are provided in Table 5.2. The time series are of insufficient duration to discern any consistent trends in NO₂ concentrations. At sites within AQMA 3 and AQMA 5 (see Figure 3.1) the annual mean objective of 40µgm⁻³ is exceeded by a substantial margin at the roadside sites (e.g. sites 39 and 46 in Table 5.2). Assessments presented by Barnsley MBC have demonstrated, for other locations outside of the AQMAs, roadside exceedences of the NO₂ annual mean objective at sites do not reflect air quality at nearby locations of relevant public exposure²⁴. Nevertheless, it is apparent that at locations close to the junction of Burton Road, Wakefield Road and Old Mill Lane, concentrations of NO₂ are elevated.

PM₁₀ concentrations are recorded only at the Royston monitoring site operated by Defra, which as noted above is likely to be influenced by industrial emissions. The monitoring station is located approximately 350 metres south west of an authorised Part A1 process operated by the Monckton Coke and Chemical Ltd. It is thought likely that PM₁₀ concentrations would not be higher in the vicinity of the Development Site. The annual average PM₁₀ concentrations were within the annual mean objective limit of 40µgm⁻³. The objective for the number of days when exceedences of a 24 hour average of 50µgm⁻³ occur was also met.

Ozone is a secondary pollutant formed by reactions between other substances, and can be formed in the atmosphere at considerable distance from the source of the reactant pollutants. For this reason it is not included as one of the pollutants for local authority air quality management. The results for the Gawber monitoring site indicate that ozone concentrations meet the objective limits.

The monitoring data for sulphur dioxide demonstrates no exceedences of the 15 minute, one hour or 24 hour mean objectives at any of the monitoring sites. Road traffic is not a major contributor to ambient concentrations of sulphur dioxide.

²⁴ Barnsley MBC (2009) Part IV Environment Act 1995 - Local Air Quality Management Updating and Screening Assessment for Metropolitan Borough of Barnsley 2009, 44pp plus figures and appendices; and, Barnsley MBC (2010) 2010 Air Quality Progress Report for Barnsley Metropolitan Borough Council, August 2010, 81pp C, Shields

Table 5.4 summarises the background data used for the modelling exercise.

Table 5.4: Annual Mean Background Concentrations Used in Modelling

Pollutant	2009
NO _x (µgm ⁻³)	27.8
NO ₂ (µgm ⁻³)	18.7
PM ₁₀ (µgm ⁻³)	15.7
O ₃ (µgm ⁻³)	43.1
SO ₂ (µgm ⁻³)	9.3

6.0 Results and Discussion

6.1 Results of ADMS Model Simulations

The results of the air quality simulations are presented for 11 receptor locations in tabular form. The receptors used are listed below in Table 6.1, and correspond to the diffusion tube locations against which the model was verified. The spatial distribution of these locations is shown in Figure 5.1.

In addition the results are shown graphically as contour plots superimposed on OS maps including the Site. Contour plots of the pollutant concentrations are shown in Figures 6.1-6.4 for the following scenarios:

- 2009 baseline;
- 2009 baseline with scheme.

6.2 Assessment of the Significance of the Changes in Air Quality

The results presented in Tables 6.1 to 6.3 have been evaluated against the criteria set out in Table 4.2. Figures 6.1-6.4 provide contour plots of annual mean NO₂ and PM₁₀ concentrations. Based on these criteria the following assessments can be made.

- The changes in NO₂ concentrations at the diffusion tube/ receptors are in all cases less than 0.6µgm⁻³. The assessment has used considerably increased NO_x emissions when compared with the latest national emissions currently adopted (see Appendix A on verification). These may reflect local conditions, such as high road gradients, and the prevalence of EURO 3 diesel vehicles in the private car and light vehicle fleet in this part of Yorkshire, as indicated in the latest consultation draft of the Air Quality Action Plan²⁵. Additionally the adopted fraction of primary nitrogen dioxide (fNO₂) in emissions, which was derived from the calibration and verification exercise, is high, which may reflect the composition of the vehicle fleet in South Yorkshire. These factors do tend to ensure a conservative approach to the assessment, which would tend to over-predict rather than under-predict impacts.

²⁵ Barnsley MBC (2010) 2010 Air Quality Action Plan 2010-Consultation Draft, 92pp

- The increases indicated in NO₂ concentrations are of the order of 2% or less, which in terms of the criteria set out in Table 4.1 indicates a very small increase. Because the changes in some cases would occur within AQMAs, the effects on air quality would be of **slight adverse** significance within the AQMAs. Outside of the AQMAs, the effects would be of **negligible** significance. However, none of the results indicate that the impact of the traffic generated by the Development would cause a requirement to increase the extent of either AQMA 3 or AQMA 5.
- The effect of road traffic emissions on the number of days that the 24 hour mean PM₁₀ concentration exceeds 50µgm⁻³ would be extremely small, with no increase in the number of days of exceedence of this level. The incremental effect of local road sources on annual mean PM₁₀ concentrations would be extremely small with increases of less than 0.6%. The effects would be **negligible** significance.
- The annual mean levels of PM₁₀ are predicted to be lower than the EU Directive target objective of 25µgm⁻³ for PM_{2.5} as an annual mean (see Table 3.2). Since the latter is a sub-fraction of the PM₁₀ the target criterion for PM_{2.5} would be met.

Table 6.1: Predicted Baseline Nitrogen Dioxide (NO₂) Concentrations

Location Number/ Receptor name	Annual Mean NO ₂ µgm ⁻³		AQS objective Annual Mean
	2009 Baseline	2009 with Development	
32 Wakefield Rd	28.71	28.90	40µgm ⁻³ (Dec 05)
33 Wakefield Rd	33.79	34.18	40µgm ⁻³ (Dec 05)
34 Wakefield Rd	38.51	38.99	40µgm ⁻³ (Dec 05)
35 Wakefield Smithies Lane	43.11	43.76	40µgm ⁻³ (Dec 05)
36 Wakefield Rd	42.81	43.48	40µgm ⁻³ (Dec 05)
37 Wakefield-Burton rd	37.45	37.94	40µgm ⁻³ (Dec 05)
38 Wakefield Rd	36.19	36.59	40µgm ⁻³ (Dec 05)
39 Wakefield Rd	45.63	46.10	40µgm ⁻³ (Dec 05)
46 Burton Rd	44.32	44.54	40µgm ⁻³ (Dec 05)
47 Burton Rd	39.31	39.39	40µgm ⁻³ (Dec 05)
48 Burton Rd Rotherham Rd Junction	42.49	42.50	40µgm ⁻³ (Dec 05)

Table 6.2: Predicted Baseline Particulate Matter (PM₁₀) Concentrations

Location Number/ Receptor name	Annual Mean PM ₁₀ µgm ⁻³		AQS objective Annual Mean of 24 hour means
	2009 Baseline	2009 with Development	
32 Wakefield Rd	16.08	16.08	50µgm ⁻³ (Dec 04)
33 Wakefield Rd	16.31	16.32	50µgm ⁻³ (Dec 04)
34 Wakefield Rd	16.53	16.55	50µgm ⁻³ (Dec 04)
35 Wakefield Smithies Lane	16.75	16.76	50µgm ⁻³ (Dec 04)
36 Wakefield Rd	16.70	16.72	50µgm ⁻³ (Dec 04)
37 Wakefield-Burton rd	16.42	16.44	50µgm ⁻³ (Dec 04)
38 Wakefield Rd	16.36	16.36	50µgm ⁻³ (Dec 04)
39 Wakefield Rd	16.81	16.82	50µgm ⁻³ (Dec 04)
46 Burton Rd	16.76	16.77	50µgm ⁻³ (Dec 04)
47 Burton Rd	16.50	16.50	50µgm ⁻³ (Dec 04)
48 Burton Rd Rotherham Rd Junction	16.66	16.66	50µgm ⁻³ (Dec 04)

Table 6.3: Predicted Baseline Particulate Matter (PM₁₀) Concentrations, Number of Days when PM₁₀ >50µgm⁻³

Location Number/ Receptor name	Number of Days PM ₁₀ > 50µgm ⁻³		AQS objective Number of Days PM ₁₀ > 50µgm ⁻³
	2009 Baseline	2009 with Development	
32 Wakefield Rd	4	4	<35/year (Dec 04)
33 Wakefield Rd	4	4	<35/year (Dec 04)
34 Wakefield Rd	4	4	<35/year (Dec 04)
35 Wakefield Smithies Lane	4	4	<35/year (Dec 04)
36 Wakefield Rd	4	4	<35/year (Dec 04)
37 Wakefield-Burton rd	4	4	<35/year (Dec 04)
38 Wakefield Rd	4	4	<35/year (Dec 04)
39 Wakefield Rd	4	4	<35/year (Dec 04)
46 Burton Rd	4	4	<35/year (Dec 04)
47 Burton Rd	4	4	<35/year (Dec 04)
48 Burton Rd Rotherham Rd Junction	4	4	<35/year (Dec 04)

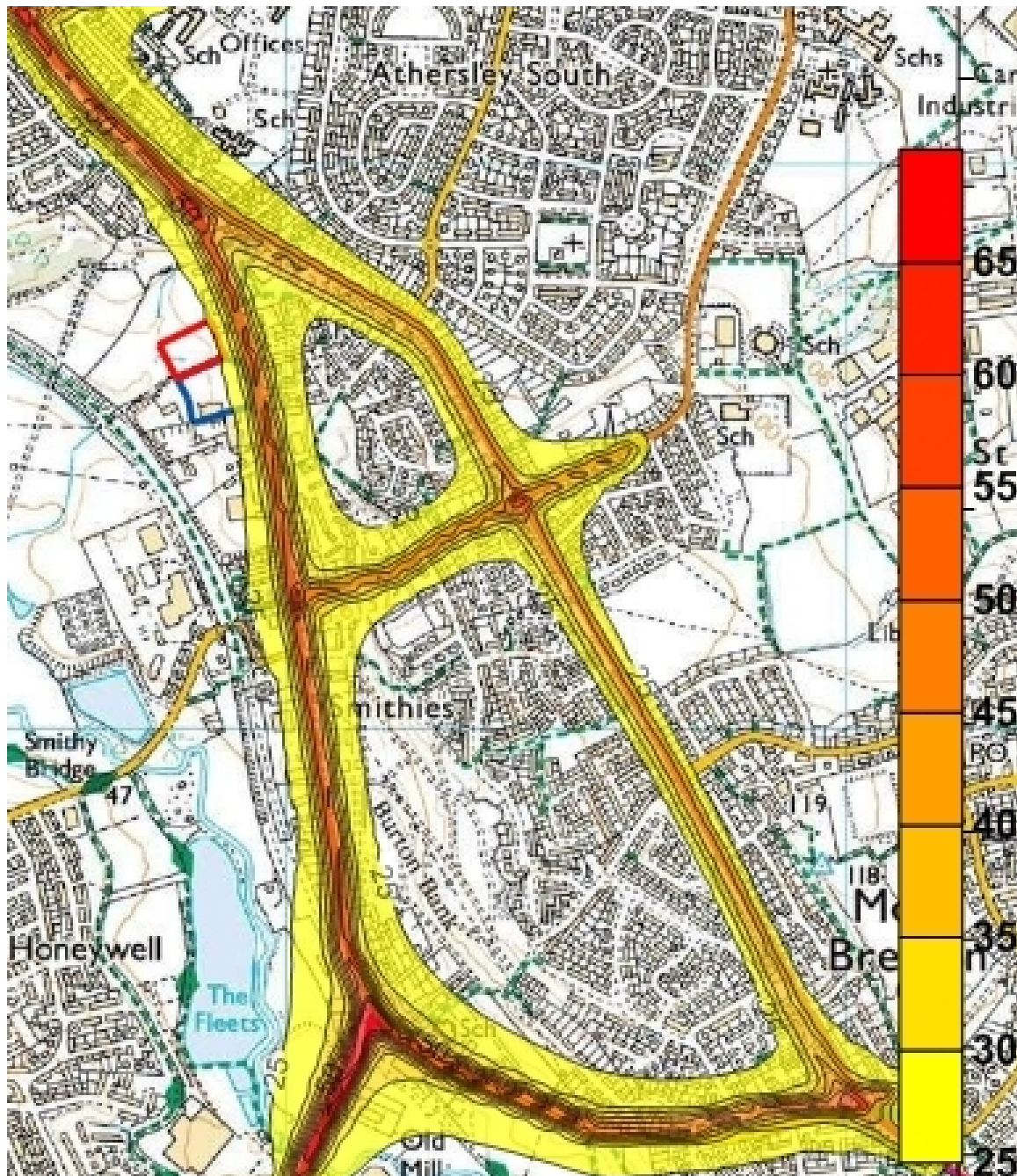
6.3 Mitigation Measures

The assessment has shown that the effects of the bus, car and light goods vehicle traffic generated by the Development would have a **negligible** effect on PM₁₀, PM_{2.5} and NO₂ concentrations outside of AQMA 3 and 5. Within AQMA 3 and 5, the impact would be very small or extremely in relation to NO₂ levels, whilst effects on PM₁₀ and PM_{2.5} concentrations would be of **negligible** significance. The Environment Protection UK (formerly NSCA) criteria determine that any change, however small, within an AQMA leads to an **adverse** effect of **slight** significance. In reality the (extremely small) degree of change determined is well within the confidence limits of the verification process, and thus would be unlikely to be detectable through measurement given the inherent errors in monitoring.

On the above basis no particular mitigation measures are considered to be necessary to reduce the effects of the Development. Measures such as the use of buses to convey the workforce to the site are already in place, whilst the choices of emission controls on the bus fleet already aim to reduce emissions. The operations of the depot in maintaining the bus fleet are also inherently useful in reducing emissions. Measures such as the minimisation of standing times for buses at the depot with engines running are also already encouraged.

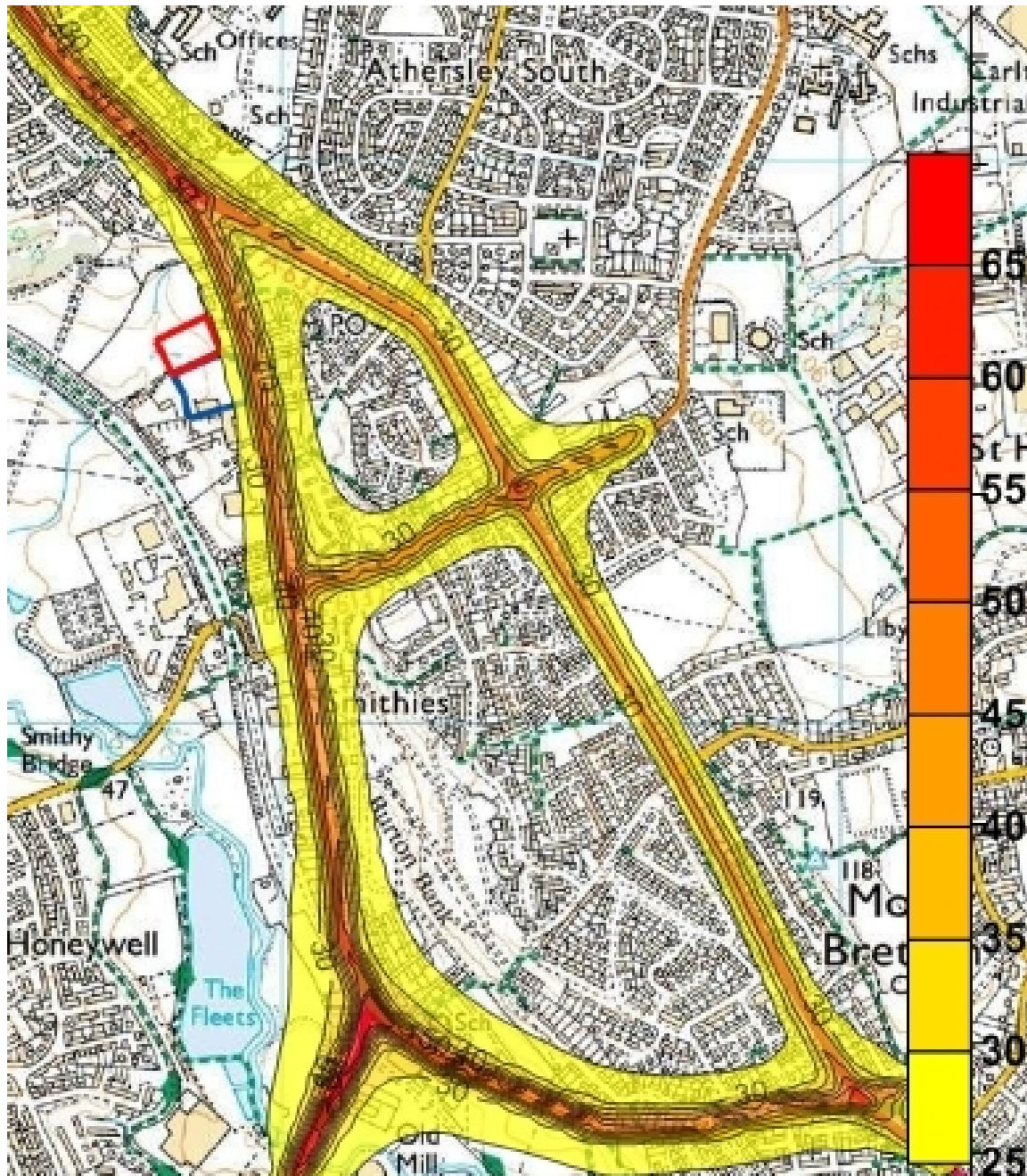
Overall, given the very small increases predicted in NO₂ concentrations further specific mitigation measures beyond the above general measures are not considered to be necessary.

Figure 6.1: Annual Average NO₂ Concentration (µgm⁻³), 2009 Baseline



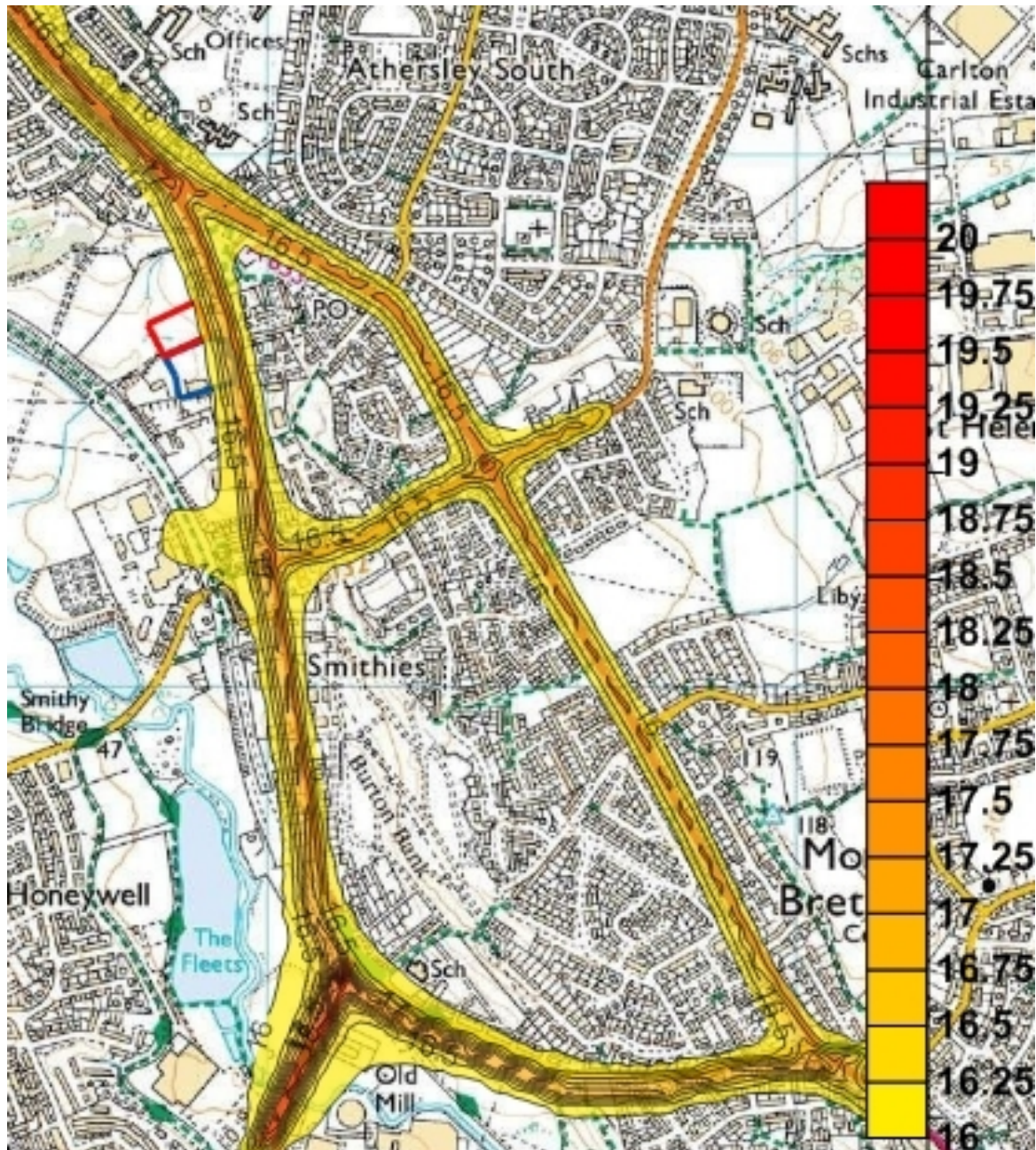
Reproduced from the Ordnance Survey Map with permission of the Controller of Her Majesty's Stationary Office Crown Copyright rights reserved Licence number 100046510

Figure 6.2: Annual Average NO₂ Concentration ($\mu\text{g}\text{m}^{-3}$), 2009 Baseline with Development Traffic Growth



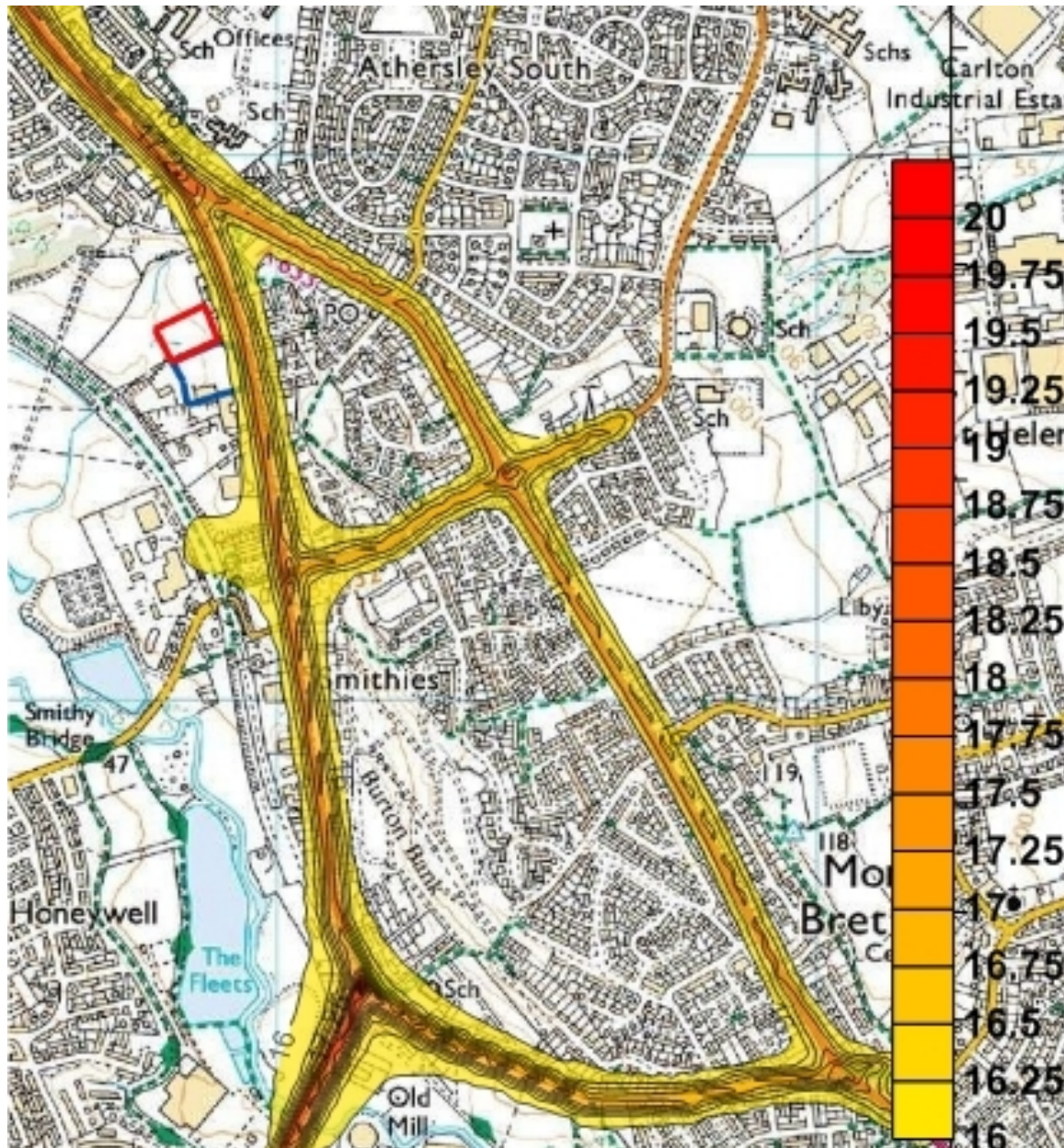
Reproduced from the Ordnance Survey Map with permission of the Controller of Her Majesty's Stationary Office
Crown Copyright rights reserved Licence number 100046510

Figure 6.3: Annual Average of 24 hour PM_{10} Concentration ($\mu g m^{-3}$), 2009
Baseline



Reproduced from the Ordnance Survey Map with permission of the Controller of Her Majesty's Stationary Office
Crown Copyright rights reserved Licence number 100046510

**Figure 6.4: Annual Average of 24 hour PM₁₀ Concentration ($\mu\text{g m}^{-3}$), 2009
Baseline with Development Traffic Growth**



Reproduced from the Ordnance Survey Map with permission of the Controller of Her Majesty's Stationary Office Crown Copyright rights reserved Licence number 100046510

7.0 Summary and Conclusions

An assessment has been carried out of the implications for air quality of an extension of the Wakefield Road Bus Depot to accommodate additional bus and vehicle parking. The extension would increase the traffic generated by the operation of the facilities.

The assessment has used predictive air quality modelling methods (ADMS Roads 3) in conjunction with traffic data to assess the effects of the Development on air quality.

Appropriate background data have been obtained from the Barnsley Gawber continuous monitoring location, which is within 2600 m of the Site. The Meteorological office has provided appropriate climatic data for the Site based on a ratified dataset for 2009 for Church Fenton. A corresponding background data file was prepared using the Barnsley Gawber data for oxides of nitrogen, sulphur dioxide and ozone. No background data were available for PM₁₀, and a data file was prepared from the Sheffield Central background site. Comparison of the annual mean data with Defra model estimates for PM₁₀ concentrations for the 1km grid square within which the Site is located indicated good consistency between the detailed data file used and nationally derived estimates.

The modelling has considered the effects based on 2009 traffic data, since the facility is likely to be in place imminently. Likely traffic growth effects over a 2 year period (given uncertainties post-recession) and reductions in background concentrations would tend to counteract one another. Thus an assessment derived from predicting the situation for future years would be likely to give rise to the same results as one derived for 2009 traffic. The assessment shows that:

- air quality at the Site would not exceed the air quality objective for nitrogen dioxide (NO₂), and changes in NO₂ concentrations would be less than 2% with lowest increases in air quality management areas (AQMA_s_ 3 and 5;
- the air quality objective in relation particulate matter would be met at the Site and within the AQMA_s, whether considered with regard to PM₁₀ or PM_{2.5};
- the contribution of background concentrations of pollutants is substantial, although the local effects of road gradients and the character of the local vehicle fleet in South Yorkshire, with high number of diesel passenger cars, also appears to affect baseline air quality;

Air Quality Report

- The effect of the proposed expansion of the bus depot would not lead to requirement for the extension of either Barnsley MBC AQMA 3 or 5,
- No specific mitigation measures are required with regard to the proposals.

Overall, it concluded that there are no significant air quality issues relating to the Development that would be considered to be impediments to the granting of planning permission for the proposed Development.

Air Quality Report

Appendix A: Air Quality Model

A.1 Introduction

The potential implications of air quality for the Wakefield Road Development have been predicted using the ADMS-Roads air dispersion modelling technique. This method uses a computer model to estimate the ground level concentration of pollutants derived from emission sources. In this case, the main sources are road traffic and the heating and power plant associated with the Development.

ADMS Roads is a 'new generation' dispersion model which uses Gaussian based equations to predict the dispersion of pollutants within the atmosphere. It is primarily designed to model emissions from roads. Up to 150 roads can be input into the model, as well as 3 industrial sources. The ADMS Roads model has been extensively validated against both field and laboratory data sets and against monitoring data collected in cities throughout the UK.

The ADMS-Roads dispersion model predicts how emissions from vehicular sources, and limited industrial sources, combine with local background pollution levels to affect local air quality, taking account of meteorological conditions.

The ADMS Roads model has an in-built database of emission factors derived from the Design Manual for Roads and Bridges (DMRB) emission database. The most recent version, 2003, was used for the assessment.

The grid area covered by the model is shown by the visual representation of the model, showing road and point sources in Figure A.1. The model was used to provide predictions at specific receptors and gridded output. The intelligent gridding option was used in the model. The model grid is shown in Figure A.1.

A.2 Traffic Flow Data

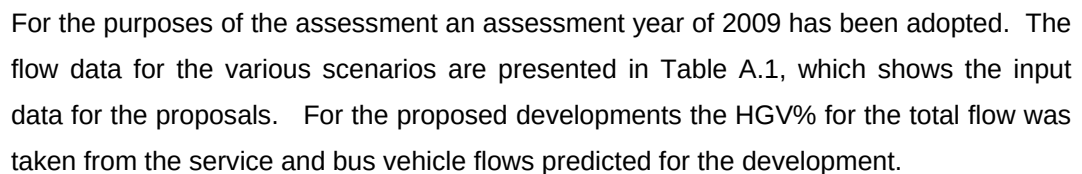
Annual Average Daily Traffic flows (AADT), percentage heavy goods vehicle (HGV) compositions and average vehicle speeds have been obtained Department for Transport²⁶ and the assessment carried out by Jacobs²⁷. The baseline data for major roads incorporated in the air quality model are provided in Table A.1. Growth factors for traffic, where used, have been derived from TEMPRO version 6.1.

²⁶ AADT data available from <http://www.dft.gov.uk/matrix/>

²⁷ Jacobs (2011) Transport Assessment: Wakefield Road Bus Depot.

Visualisation of ADMS-Roads input

C:\ADMS\Barnsley\Base final model\Barnsley_ USA_data_2009_finmod.UPL



A.3 Scenarios Modelled

The model was run for the following scenarios, using the traffic data given in Table A.1, as follows:

- 2009 existing baseline conditions, to allow comparison with monitored data for model verification (this is the year for which the most recent verified air quality and meteorology data are available), with appropriate growth factors on data using on TEMPRO²⁸ output;
- 2009 baseline condition with the additional traffic generated by the Development.

Table A.1: Traffic Input Data (AAHT expressed as vehicles per hour)

Road	2009 Base data		2009 with Development Traffic	
	LDV-cars	HGV/buses	LDV-cars	HGV/Buses
A61 - before Rotherham/Wakefield Rd junction	997	123	1002	127
Rotherham Rd A633	548	68	548	68
A61 Wakefield Rd	674	101	681	105
Laithes Lane	640	79	640	79
Carlton Rd B6132	455	80	455	80
Burton Rd	810	121	810	121
A61 Old Mill Lane	1535	171	1541	175

A.4 Treatment of Emissions due to Stationary Sources

The Development will not include bus and car parking spaces. The existing and proposed areas were represented as area sources within the model. Emissions were estimated using information on vehicle movements on the existing and extended sites, using standard emission factors assuming a cold start.

The assumed emissions from the major stationary source at the Smithies Road depot are set out in Table A.2.

²⁸ Department for Transport TEMPRO Version 6.1 www.tempro.org.uk/

Table A.2 Emissions from the Authorised plant at Smithies Lane Depot

Point Source	Location OS grid	Emission Rate NO _x (g/s)	Emission Rate PM ₁₀ (g/s)
Smithies Lane	434741 408287	0.75	0.038

A.5 Pollutant Background Data

In order to assess the air quality implications of traffic for ambient air quality and the Development, and to assess the predicted pollutant concentrations against the air quality objectives, background concentrations of pollutants must also be taken into consideration. These are the concentrations of pollutants which arise either naturally or from other polluting sources, such as roads, industrial and domestic emissions. Hourly sequential pollutant monitoring data have been used to predict both NO₂ and PM₁₀ background concentrations for this assessment.

The background data for 2009 were taken from the closest urban background site at Barnsley Gawber (2.6 km south west of the Site), and a sequential hourly air quality data file prepared for input to the model to match the meteorological data input file used. The data were obtained from the Defra AURN web-site. These data were used to match 2009 meteorological data for Church Fenton, the latter being the most recent verified dataset available from the Meteorological Office. These were then used for 2009 scenario predictions with the traffic flows given in Table A.2.

The data were largely complete for NO_x, NO₂, SO₂ and O₃ for the entire year of 2009. A PM₁₀ dataset was prepared from data for Sheffield Central. Comparison of the annual mean data with Defra model estimates for PM₁₀ concentrations for the 1km grid square within which the Site is located indicated good consistency between the detailed data file used and nationally derived estimates. Table A.3 summarises the data used. For the model calibration, data for 2006 were prepared (see Table A.3)

A matching meteorological dataset for the Church Fenton 2009, appropriately adjusted for use with ADMS, was obtained from the Meteorological Office (see below).

Table A.3 Annual Average Pollutant Background Concentrations; based on the Gawber 2006 and 2009 and corresponding Sheffield Centre Site Data

Pollutant	2006	2009
NO _x (µgm ⁻³)	28.2	27.8
NO ₂ (µgm ⁻³)	19.1	18.7
PM ₁₀ (µgm ⁻³)	16.1	15.7
O ₃ (µgm ⁻³)	42.9	43.1
SO ₂ (µgm ⁻³)	10.1	9.3

Meteorological Data

Predicted concentrations of both pollutants have been derived using the Meteorological Office's sequential hourly meteorological data from the nearest weather station to the Site. The Church Fenton meteorological site was considered to be the nearest most representative meteorological monitoring station to the Site. The 2006 and 2009 hourly sequential meteorological data from this station were used in the modelling, to be consistent with the background pollutant concentration data.

Model Data Processing

NO₂ is primarily a secondary pollutant, i.e. it is formed in the atmosphere rather than emitted directly. The majority of oxides of nitrogen are emitted from combustion sources as nitric oxide, which is then converted to nitrogen dioxide in the atmosphere. The rate of conversion is governed by the availability of other pollutants, most importantly ozone.

There are a variety of different approaches to dealing with the NO_x: NO₂ relationship and Government Guidance indicates that the use of any of these is acceptable. The ADMS Roads 3 model provides only the option of using the generic reaction scheme (GRS). The GRS requires additional meteorological data on cloud cover and solar radiation and ozone data, which were available.

The model was calibrated for 2006 using the data for the continuous monitoring station at Barnsley (A628 roadside Pogmoor) station and corresponding background data for Barnsley Gawber. A local ADMS 3 model for this location and also for the Old Mill Lane station was set up using traffic data derived from the 2003 USA (Barnsley MBC, 2003), growthed using TEMPRO 6.1 for 2006. The model was then run multiple times to

optimise the predicted NO_x and NO₂ output data to fit the measured data for these stations. This exercise derived a factor of 4.1 on the latest UK emission factors for NO_x and a primary emission fraction for NO₂ (fNO₂) of 27%.

These independently derived calibration factors, which in effect derive local emission factors, were then applied to the emissions for 2009 for the road network model. The model was then run with the diffusion tube locations as receptors. Comparison of the modelled and monitored data indicated a high level of correlation (Pearson $r=0.933$, significant at $P<0.05$, $n = 11$). The model was then run in complex terrain mode (see Figure A.2) using data provide from Ordnance Survey Profile data. The degree of agreement between the modelled and monitored results improved (see Figure A.3) with Pearson r correlation coefficient of 0.947 ($P<0.5\%$, $n=11$).

References

Air Quality Consultants (2009) Note: Derivation and Testing of the Background NO₂ Adjustment Calculator, 18pp, February 2009.

Air Quality Expert Group (2006) Trends in Primary Nitrogen Dioxide in the UK, 71pp, DEFRA, Scottish Executive, Welsh Assembly Government and DoE Northern Ireland Environment Act 1995, Local Air Quality Management, Technical Guidance LAQM. TG(03), DEFRA 2003

Barnsley MBC (2003) Part IV Environment Act 1995 - Local Air Quality Management Updating and Screening Assessment for Metropolitan Borough of Barnsley 2003, May 2003, 59pp

Highways Agency (2003) *Part IV of the Design Manual for Roads and Bridges (DMRB) Vol 11 Environmental Assessment Section 3 Environmental Impact Assessment Techniques Part1 Air Quality*. 73 pp February 2003

Figure A.2: Complex Terrain Grid

Visualisation of ADMS-Roads input

C:\ADMS\Barnsley\Base final model\Barnsley_ USA_data_2009_finmod.UPL

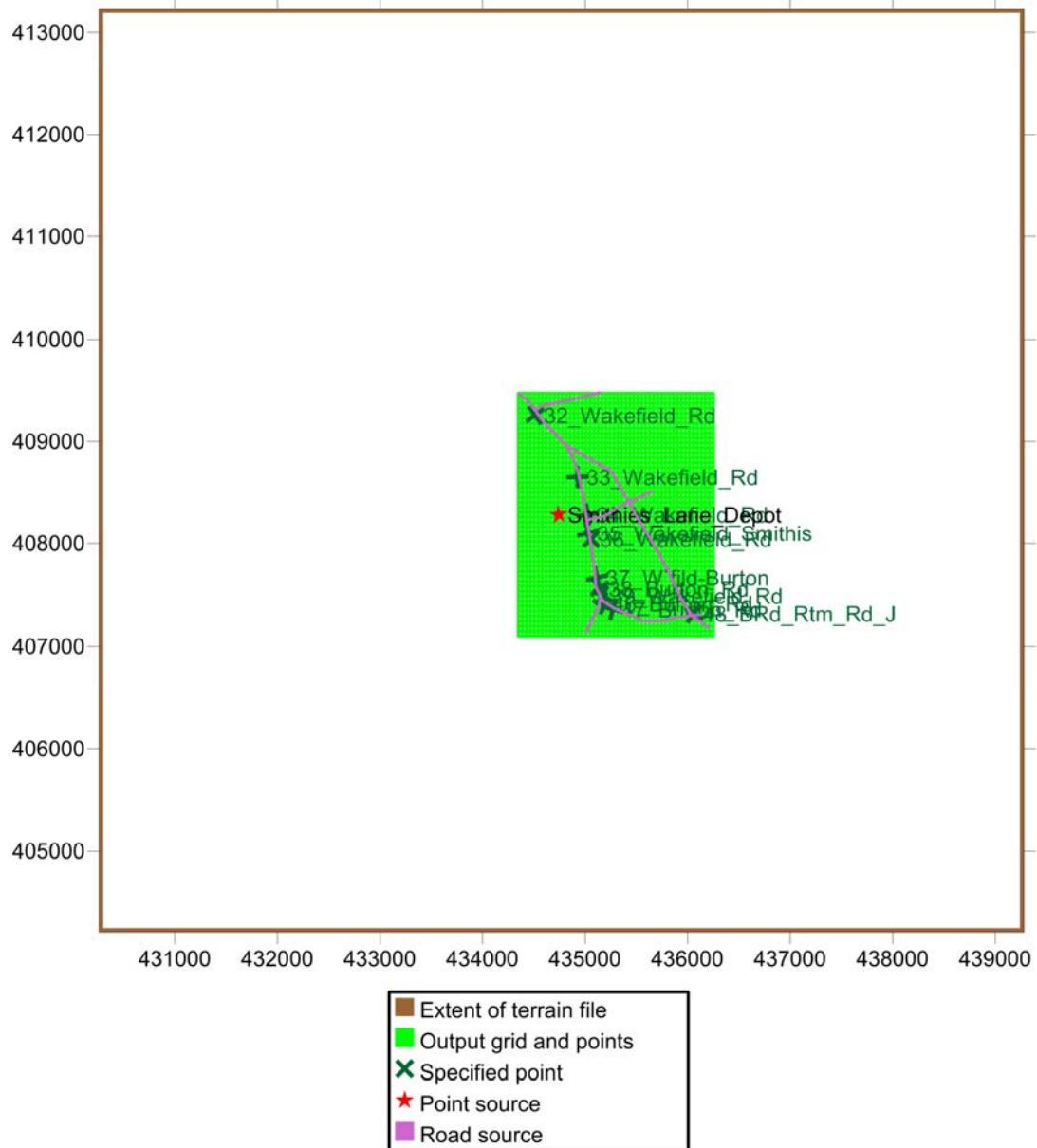
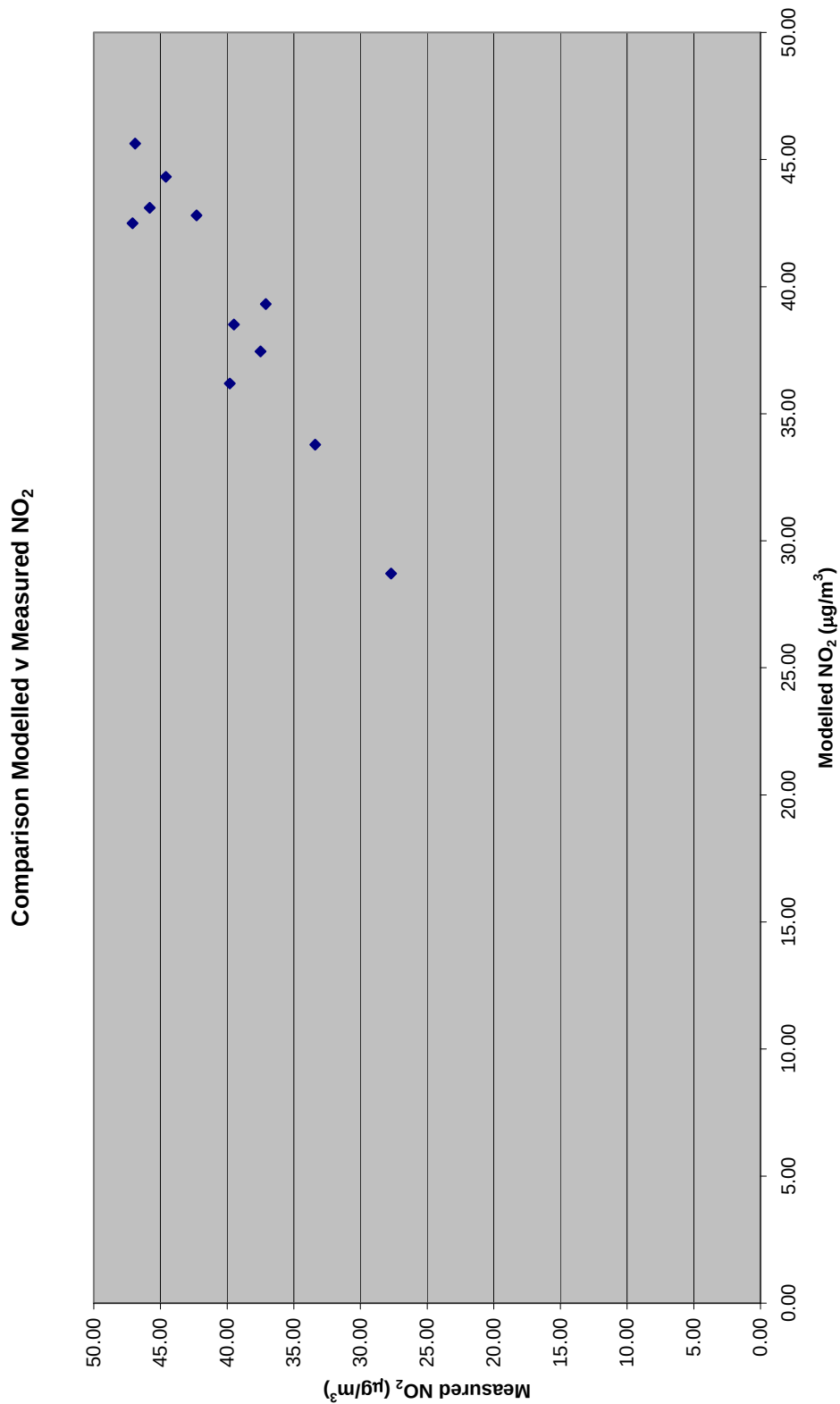


Figure A.3: Relationship between modelled and monitored NO₂ concentrations for diffusion Tube Data for 2009





22 Old Kennels Lane
Winchester, Hampshire SO22 4JP
telephone, +44 (0)1962 621890
www.epal.gb.com