Air Quality Assessment

Bayfield – Phase 2

Bayfield, Chepstow

For Barratt David Wilson Homes






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Quality Management

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Executive Summary

The proposed development, on land south of the B4235, will provide up to 200 dwellings with access from the B4235. The Application Site is located to the north-west of the town of Chepstow, within the administrative area of Monmouthshire County Council (MCC). MCC has designated two Air Quality Management Areas (AQMAs). The Application Site is located approximately 750 m from the nearest AQMA in Chepstow, designated due to elevated concentrations of nitrogen dioxide (NO_2) attributable to road traffic emissions.

This Air Quality Assessment, undertaken to accompany the planning application, considers the air quality impacts from the construction phase and once the Proposed Development is fully operational.

The assessment has been undertaken based upon appropriate information on the Proposed Development provided by Barratt David Wilson Homes and its project team. In undertaking this assessment, RPS experts have exercised professional skills and judgement to the best of their abilities and have given professional opinions that are objective, reliable and backed with scientific rigour. These professional responsibilities are in accordance with the code of professional conduct set by the Institution of Environmental Sciences for members of the Institute of Air Quality Management (IAQM).

Once operational, arrivals at and departures from the Proposed Development may change the number, type and speed of vehicles using the local road network. Changes in road vehicle emissions are the most important consideration during this phase of the development.

Detailed atmospheric dispersion modelling has been undertaken for the first year in which the development is expected to be fully operational, 2023. Pollutant concentrations are predicted to be well within the relevant health-based air quality objectives at the façades of both existing and proposed receptors. Therefore, air quality is acceptable at the development site, making it suitable for its proposed uses. The operational impact of the Proposed Development on existing receptors is predicted to be “negligible” taking into account the changes in pollutant concentrations and absolute levels. Using the criteria adopted for this assessment together with professional judgement, the operational air quality effects are considered to be ‘not significant’ overall.

The Barratt David Wilson Homes development does not, in air quality terms, conflict with national or local policies, or with measures set out in MCC’s Air Quality Action Plan. There are no constraints to the development in the context of air quality.

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1 Introduction

1.1 This report details the air quality assessment undertaken for the proposed residential development in Chepstow, Monmouthshire on land south of the B4235. The proposed development will provide up to 300 dwellings. Monmouthshire County Council (MCC) has designated two Air Quality Management Areas (AQMAs). The Application Site is located approximately 750 m north-west of the Chepstow AQMA, an area encompassing either side of the A48 (from the roundabout with the A466 up to just beyond the junction with the B4293 at Hardwick Terrace).

1.2 This air quality assessment covers the operational phase, comprising an evaluation of the impacts of the development traffic on the local area and the impacts on future occupants of the development from their exposure to the prevailing levels of air pollution, which can be a factor in the suitability of the site for its proposed uses.

1.3 This report begins by setting out the policy and legislative context for the assessment. The methods and criteria used to assess potential air quality effects, agreed in consultation with the Welsh Government, is then described. The baseline air quality conditions have been established taking into account Defra estimates, local authority documents and the results of any local monitoring. The results of the assessment of air quality impacts have been presented. A conclusion has been drawn on the significance of the residual operational-phase effects.

2 Policy and Legislative Context

Ambient Air Quality Legislation and National Policy

The Ambient Air Quality Directive and Air Quality Standards Regulations

2.1 The 2008 Ambient Air Quality Directive (2008/50/EC) [1] aims to protect human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants; it sets legally binding concentration-based limit values, as well as target values. There are also information and alert thresholds for reporting purposes. These are to be achieved for the main air pollutants: particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3), carbon monoxide (CO), lead (Pb) and benzene. This Directive replaced most of the previous EU air quality legislation and in Wales was transposed into domestic law by the Air Quality Standards Wales Regulations 2010 [2], which in addition incorporates the 4th Air Quality Daughter Directive (2004/107/EC) that sets targets for ambient air concentrations of certain toxic heavy metals (arsenic, cadmium and nickel) and polycyclic aromatic hydrocarbons (PAHs). Equivalent regulations exist in England, Scotland, and Northern Ireland. Member states must comply with the limit values (which are legally binding on the Secretary of State) and the Government and devolved administrations operate various national ambient air quality monitoring networks to measure compliance and develop plans to meet the limit values.

UK Air Quality Strategy

2.2 The Environment Act 1995 established the requirement for the Government and the devolved administrations to produce a National Air Quality Strategy (AQS) for improving ambient air quality, the first being published in 1997 and having been revised several times since, with the latest published in 2007 [3]. The Strategy sets UK air quality standards[♦] and objectives[#] for the pollutants in the Air Quality Standards Regulations plus 1,3-butadiene and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. There is no legal requirement to meet objectives set within the UK AQS except where equivalent limit values are set within the EU Directives.

2.3 The 1995 Environment Act also established the UK system of Local Air Quality Management (LAQM), that requires local authorities to go through a process of review and assessment of air quality in their areas, identifying places where objectives are not likely to be met, then declaring

[♦] Standards are concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. Standards, as the benchmarks for setting objectives, are set purely with regard to scientific evidence and medical evidence on the effects of the particular pollutant on health, or on the wider environment, as minimum or zero risk levels.

[#] Objectives are policy targets expressed as a concentration that should be achieved, all the time or for a percentage of time, by a certain date.

Air Quality Management Areas (AQMAs) and putting in place Air Quality Action Plans to improve air quality. These plans also contribute, at local level, to the achievement of EU limit values.

2.4 For the purposes of this assessment, the limit values set out in the Air Quality Standards Regulations 2010 and the objective levels specified under the current UK AQS have been used.

2.5 The limit values and objectives relevant to this assessment are summarised in Table 2.1.

Table 2.1 Summary of Relevant Air Quality Limit Values and Objectives

Pollutant	Averaging Period	Objectives/ Limit Values	Not to be Exceeded More Than	Target Date
Nitrogen Dioxide (NO_2)	1 hour	200 µg.m^{-3}	18 times per calendar year	-
	Annual	40 µg.m^{-3}	-	-
Particulate Matter (PM_{10})	24 Hour	50 µg.m^{-3}	35 times per calendar year	-
	Annual	40 µg.m^{-3}	-	-
Particulate Matter ($PM_{2.5}$)	Annual	Target of 15% reduction in concentrations at urban background locations	-	Between 2010 and 2020 (a)
		Variable target of up to 20% reduction in concentrations at urban background locations (c)		Between 2010 and 2020 (b)
	Annual	25 µg.m^{-3}	-	01.01.2020 (a)
		25 µg.m^{-3}		01.01.2015 (b)

(a) Target date set in UK Air Quality Strategy 2007
(b) Target date set in Air Quality Standards Regulations 2010
(c) Aim to not exceed 18 µg.m^{-3} by 2020

2.6 In July 2017, Defra published the *'UK plan for tackling roadside nitrogen dioxide concentrations'.* This describes the Government's plan for bringing roads with NO_2 concentrations above the EU Limit Value back into compliance within the shortest possible time. In January 2018, the High Court found the plan to be unlawful in certain respects and the UK Government was directed to urgently prepare a Supplement to the 2017 plan. In the interim, the High Court directed that the 2017 plan should remain in force whilst the Supplement is produced, in order to avoid any delay in its implementation.

National Planning Policy

2.7 Current land use policies for Wales are set out in Planning Policy Wales (Edition 9, November 2016). This document is intended to provide a strategic policy framework to assist local authorities in the preparation of their development plans. Planning Policy Wales (PPW) is supported by twenty-four Technical Advice Notes (TANs) which give further guidance on specific topics. Procedural advice is also given in the National Assembly for Wales/Welsh Office Circulars. Planning authorities may use planning conditions or obligations to meet planning aims to protect the environment. PPW, the TANs and Circulars may be material to decisions made on individual planning applications and will be taken into account by the Welsh Minister and his Inspectors in the determination of called-in planning applications and appeals.

2.8 Chapter 13 of PPW concerns minimising and managing environmental risks and pollution. The policy relevant to this assessment is set out at paragraph 13.12.1 and states that:

"The potential for pollution affecting the use of land will be a material consideration in deciding whether to grant planning permission. Material considerations in determining applications for potentially polluting development are likely to include:

- *Location, taking into account such considerations as the reasons for selecting the chosen site itself;*
- *impact on health and amenity;*
- *the risk and impact of potential pollution from the development insofar as this might have an effect on the use of other land and the surrounding environment (the environmental regulatory regime may well have an interest in these issues, particularly if the development would impact on an Air Quality Management Area or a Special Area of Conservation (SAC));*
- *prevention of nuisance;*
- *impacts on the road and other transport networks, and in particular traffic generation; and*
- *the need, where relevant, and feasibility of restoring the land (and water resources) to standards sufficient for an appropriate after use…"*

2.9 PPW recognises that transport emissions contribute significantly to climate change and poor local air quality, which can in turn affect people's health. TAN 18 on Transport [4] elaborates further on traffic growth and its implications on the UK's ability to meet objectives for greenhouse gas emissions and for air quality. It advises that local planning authorities should therefore take into account statutory air quality objectives together with the outcomes of reviews and assessments any Air Quality Action Plans that may have been prepared.

Local Planning Policy

2.10 The Monmouthshire County Council Local Development Plan was adopted in 2014, setting out policies over a ten year period from 2011 to 2021. The plan area excludes that part of the County contained within the Brecon Beacons National Park.

2.11 The following policy is relevant to this assessment:

"EP1 – Amenity and Environmental Protection

Development, including proposals for new buildings, extensions to existing buildings and advertisements, should have regard to the privacy, amenity and health of occupiers of neighbouring properties. Development proposals that would cause or result in an unacceptable risk /harm to local amenity, health, the character /quality of the countryside or interests of nature conservation, landscape or built heritage importance due to the following will not be permitted, unless it can be demonstrated that measures can be taken to overcome any significant risk:

- *Air pollution;*
- *Light pollution;*
- *Noise pollution;*
- *Water pollution;*
- *Contamination;*
- *Land instability;*
- *Or any identified risk to public health or safety"*

Monmouthshire's Air Quality Action Plan for Chepstow

2.12 Monmouthshire's Air Quality Action Plan for Chepstow [5] sets out several measures to reduce NO_2 concentrations at sensitive receptors within the Chepstow AQMA. The measures are split into five categories, made up of suggestions from steering group meetings and stakeholder workshops. The categories are:

- Traffic Management;
- Lowering Emissions;
- Promotion of Alternatives;
- Planning; and
- Education and Information.

2.13 Building upon the earlier Air Quality Action Plan for Chepstow, the A48 Chepstow Air Quality Options Assessment March 2016 [6] was commissioned by the South Wales Trunk Road Agent

to investigate highways options to improve air quality within the AQMA along the A48 Trunk Road through Chepstow. The study comprised a review of initial qualitative options; traffic modelling of viable options; detailed dispersion modelling of air pollution of air quality based upon the results of the traffic modelling; and identification of the optimum options for air quality improvements. Identified measures to reduce NO_2 concentrations within the AQMA include:

- Limit HGV weight or emissions;
- Monitor developments in adjoining areas;
- Promote sustainable transport as part of new developments.
- Provide information to residents.
- Traffic management measures; and
- Travel Plans.

3 Assessment Methodology

Approach

3.1 The air quality assessment is consistent with the EPUK & IAQM Land-Use Planning & Development Control: Planning For Air Quality document [7], the IAQM Guidance on the assessment of dust from demolition and construction [8] and, where relevant, Defra's Local Air Quality Management Technical Guidance: LAQM.TG16 [9]. It provides:

- an assessment of the existing air quality in the study area (existing baseline) and prediction of the future air quality without the development in place (future baseline), using official government estimates from Defra, publically available air quality monitoring data for the area, and relevant Air Quality Review and Assessment (R&A) documents;
- a quantitative prediction of the future operational-phase air quality impact with the development in place (with any necessary mitigation), encompassing
  - the impacts of the development traffic on the local area including any effects on the AQMA
  - the impacts on future occupants of the development from their exposure to the prevailing levels of air pollution, which can be a factor in the suitability of the site for its proposed uses.

3.2 In line with good practice guidance, the Environmental Health Department at MCC and the Welsh Government were consulted to agree the scope and methodology for this assessment. The methodology was agreed by email on 21/03/2018.

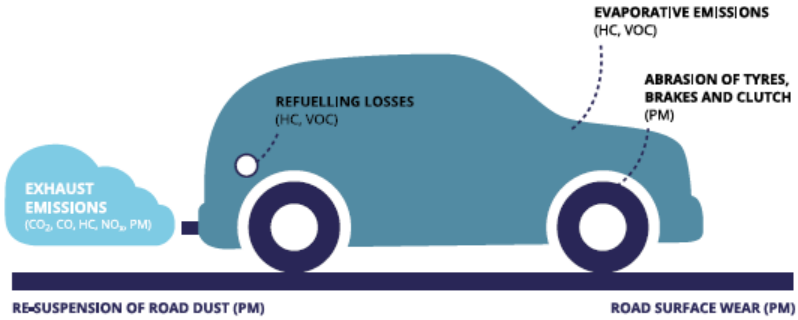
3.3 Air quality guidance advises that the organisation engaged in assessing the overall risks should hold relevant qualifications and/or extensive experience in undertaking air quality assessments. The RPS air quality team members involved at various stages of this assessment have professional affiliations that include Fellow and Member of the Institute of Air Quality Management, Chartered Chemist, Chartered Scientist, Chartered Environmentalist and Member of the Royal Society of Chemistry and have the required academic qualifications for these professional bodies. In addition, the Director responsible for authorising all deliverables has over 14 years' experience.

Summary of Key Pollutants Considered

3.4 For the operational phase of the Proposed Development, the main pollutants from road traffic with potential for local air quality impacts are nitrogen oxides (NO_x) and particulate matter (PM_{10}). Emissions of total NO_x from combustion sources comprise nitric oxide (NO) and NO_2. The NO oxidises in the atmosphere to form NO_2. The assessment of operational impacts therefore focuses on changes in NO_2 and PM_{10} concentrations. The impact from fine particulate matter, known as $PM_{2.5}$ (a subset of PM_{10}) concentrations has also been considered.

Figure 3.1 Types of Vehicle Emissions

The different types of emissions from vehicles, and a comparison of the relative amounts of selected pollutants released by the latest Euro 6 petrol and diesel vehicles



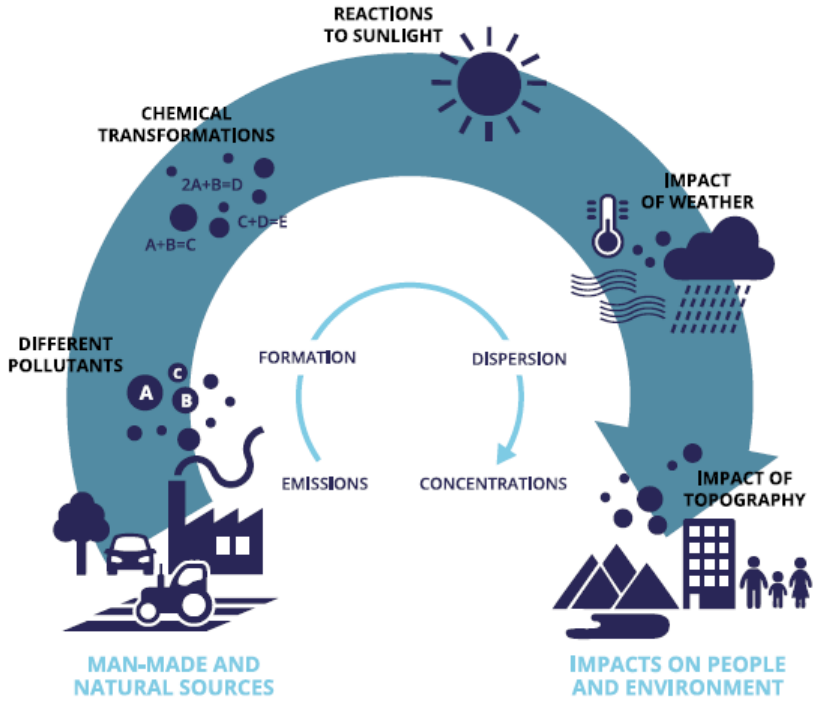
Source: European Environment Agency (2016) Explaining Road Transport Emissions: A Non-technical Guide

3.5 Regarding exhaust emissions from construction-related vehicles (contractors' vehicles and Heavy Goods Vehicles (HGVs), diggers, and other diesel-powered vehicles), these are unlikely to have a significant impact on local air quality [8] except for large, long-term construction sites: the EPUK & IAQM Land-Use Planning & Development Control: Planning For Air Quality document [7] indicates that air quality assessments should include developments increasing annual average daily Heavy Duty Vehicle (HDV) traffic flows by more than 25 within or adjacent to an AQMA and more than 100 elsewhere. The results of the Highways and Access assessment indicates that the aforementioned EPUK & IAQM thresholds are not expected to be exceeded for any individual road during the construction phase of this project; therefore, construction-vehicle exhaust emissions have not been assessed specifically.

Atmospheric Dispersion Modelling of Pollutant Concentrations

3.6 In urban areas, pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition. An atmospheric dispersion model is used as a practical way to simulate these complex processes; such a model requires a range of input data, which can include emissions rates, meteorological data and local topographical information. The model used and the input data relevant to this assessment are described in the following sub-sections.

Figure 3.2 Air Pollution: From Emissions to Exposure



Source: European Environment Agency (2016) Explaining Road Transport Emissions: A Non-technical Guide

3.7 The atmospheric pollutant concentrations in an urban area depend not only on local sources at a street scale, but also on the background pollutant level made up of the local urban-wide background, together with regional pollution and pollution from more remote sources brought in on the incoming air mass. This background contribution needs to be added to the fraction from the modelled sources, and is usually obtained from measurements or estimates of urban background concentrations for the area in locations that are not directly affected by local emissions sources. Background pollution levels are described in detail in Section 4.

3.8 The ADMS-Roads model has been used in this assessment to predict the air quality impacts from changes in traffic on the local road network. This is a version of the Atmospheric Dispersion Modelling System (ADMS), a formally validated model developed in the UK by Cambridge Environmental Research Consultants Ltd (CERC) and widely used in the UK and internationally for regulatory purposes.

Modelled Scenarios

3.9 The following scenarios were modelled:

- Without Development – without the Proposed Development in the first year that the development is expected to be fully operational, 2023; and
- With Development – with the Proposed Development in the first year that the development is expected to be fully operational, 2023.

Model Input Data

Traffic Flow Data

3.10 Traffic data used in the assessment have been provided by the project's transport consultants, Hydrock. The traffic flow data provided for this assessment are summarised in Table 3.1. The modelled road links are illustrated in Figure 1.

Table 3.1 Traffic Data Used Within the Assessment

Road Link ID	Road Link Name	Speed ($km.hr^{-1}$)	Daily Two Way Vehicle Flow			
			Without Development		With Development	
			LDV	HDV	LDV	HDV
1	B4235 East of site access	56	2239	52	2563	52
2	B4235 West of site access	56	2239	52	2247	52
3	A466 between the B4235 and Racecourse Roundabout	51	8146	260	8280	260
4	A466 north of Racecourse Roundabout	51	5434	161	5444	161
5	Welsh Street east of Racecourse Roundabout	51	4684	80	4795	80
6	Itton Road west of Racecourse Roundabout	102	3279	110	3294	110
7	A466 between B4235 and Tempest Way	51	12259	187	12449	187
8	Tempest Way	51	2431	83	2437	83
9	St Lawrence Park	51	960	17	963	17
10	A466 between Tempest Way and High Beech	51	13051	304	13232	304
11	A48 West of High Beech	51	15360	557	15394	557
12	A48 East of High Beech	51	24390	631	24400	631
13	A466 South of High Beech	102	19869	776	19997	776

Notes: ($km.hr^{-1}$) = kilometres per hour
HDV = Heavy Duty Vehicle - vehicles greater than 3.5 t gross vehicle weight including buses
LDV = Light Duty Vehicle

3.11 The average speed on each road has been reduced by 10 km.hr^{-1} to take into account the possibility of slow moving traffic near junctions and at roundabouts in accordance with LAQM.TG16.

Vehicle Emission Factors

3.12 The modelling has been undertaken using Defra's 2017 emission factor toolkit (version 8.0) which draws on emissions generated by the European Environment Agency (EEA) COPERT 5 emission calculation tool.

Meteorological Data

3.13 ADMS-Roads requires detailed meteorological data as an input. The most representative observing station for the region of the study area that supplies all the data in the required format is Filton approximately 22 km south of the Application Site. Meteorological data from that station for 2017 have been used within the dispersion model. The wind rose is presented in Figure 2.

Receptors

3.14 The air quality assessment predicts the impacts at locations that could be sensitive to any changes. For assessing human-health impacts, such sensitive receptors should be selected where the public is regularly present and likely to be exposed over the averaging period of the objective. LAQM.TG16 [9] provides examples of exposure locations and these are summarised in Table 3.2.

Table 3.2 Example of Where 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 façades of residential properties, schools, hospitals, care homes.	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's façades), or any other location where public exposure is expected to be short-term.
Daily-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's façade), or any other location where public exposure is expect to be short-term.
Hourly-mean	All locations where the annual and 24 hour mean would 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 members of the public might reasonably be expected to spend one hour or more. Any outdoor locations to which the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.15 Representative sensitive receptors for this assessment have been selected at properties where pollutant concentrations and/or changes in pollutant concentrations are anticipated to be greatest, as listed in Table 3.3. The modelled sensitive receptors are illustrated in Figure 1.

Table 3.3 Modelled Sensitive Receptors

ID	Existing/Proposed	x	y
1 (Site Boundary)	Proposed	352104	194343
2 (Site Boundary)	Proposed	352186	194332
3 (A466)	Existing	352320	194354
4 (St Anne's Nursing Home)	Existing	352537	194479
5 (B4293)	Existing	352629	194421
6 (B4293)	Existing	352737	194372
7 (Chepstow Comprehensive School)	Existing	352746	194425
8 (B4293)	Existing	352687	194327
9 (A466)	Existing	352347	194193
10 (A466)	Existing	352403	193922
11 (Tempest Way)	Existing	352507	193696
12 (Tempest Way)	Existing	352428	193674
13 (Tempest Way)	Existing	352374	193550
14 (A466)	Existing	352568	193445
15 (A48 AQMA)	Existing	352689	193204
16 (A48 AQMA)	Existing	352733	193249
17 (A48 AQMA)	Existing	352718	193145
18 (A48 AQMA)	Existing	352764	193220
19 (A48 AQMA)	Existing	352821	193285
20 (A48 AQMA)	Existing	352773	193303
21 (A48 AQMA)	Existing	352821	193342
22 (A48 AQMA)	Existing	352846	193384
23 (A48 AQMA)	Existing	352907	193360
24 (A48 AQMA)	Existing	352891	193401
25 (A48 AQMA)	Existing	352942	193383
26 (A48 AQMA)	Existing	352963	193455
27 (A48 AQMA)	Existing	353007	193433
28 (A48 West)	Existing	352596	193018
29 (A48 South)	Existing	352825	192764
30 (A48 South)	Existing	352889	192466

ID	Existing/Proposed	x	y
31 (A48 South)	Existing	353089	192348
32 (A48 West)	Existing	352028	192564
33 (Chepstow Community Hospital)	Existing	352536	193614
34 (A48 AQMA)	Existing	353170	193572
35 (A48 AQMA)	Existing	353129	193525
36 (A48 West)	Existing	351799	192469
37 (A466)	Existing	352429	194038
38 (B4293)	Existing	352475	194444
39 (Dell School)	Existing	353091	194028
40 (B4293)	Existing	352848	194185
41 (B4293)	Existing	353011	193998
42 (Chepstow Community Hospital)	Existing	352558	193660
43 (B4235)	Existing	352210	194563

3.16 The annual, daily and hourly-mean AQS objectives apply at the front and rear façades of all residential properties, schools and hospitals. The approaches used to predict the concentrations for these different averaging periods are described below.

Long-Term Pollutant Predictions

3.17 Annual-mean NO_x and PM_{10} concentrations have been predicted at selected sensitive receptors using ADMS-Roads, then added to relevant background concentrations. Primary NO in the NO_X emissions is converted to NO_2 to a degree determined by the availability of atmospheric oxidants locally and the strength of sunlight. For road traffic sources, annual-mean NO_2 concentrations have been derived from the modelled road-related annual-mean NO_x concentration using Defra's calculator [10].

Short-Term Pollutant Predictions

3.18 In order to predict the likelihood of exceedences of the hourly-mean AQS objectives for NO_2 and the daily-mean AQS objective for PM_{10}, the following relationships between the short-term and the annual-mean values at each receptor have been considered.

Hourly-Mean AQS Objective for NO_2

3.19 Research undertaken in support of LAQM.TG16 has indicated that the hourly-mean limit value and objective for NO_2 is unlikely to be exceeded at a roadside location where the annual-mean NO_2 concentration is less than 60 $\mu g.m^{-3}$. The threshold of 60 $\mu g.m^{-3}$ NO_2 has been used as the guideline for considering a likely exceedence of the hourly-mean nitrogen dioxide objective.

Daily-Mean AQS Objective for PM_{10}

3.20 The number of exceedences of the daily-mean AQS objective for PM_{10} of 50 $\mu g.m^{-3}$ may be estimated using the relationship set out in LAQM.TG16:

*Number of Exceedences of Daily Mean of 50 $\mu g.m^{-3}$ = -18.5 + 0.00145 * (Predicted Annual-mean PM_{10})^3 + 206 / (Predicted Annual-mean PM_{10} Concentration)*

3.21 This relationship suggests that the daily-mean AQS objective for PM_{10} is likely to be met if the predicted annual-mean PM_{10} concentration is 31.8 $\mu g.m^{-3}$ or less.

3.22 The daily mean objective is not considered further within this assessment if the annual-mean PM_{10} concentration is predicted to be less than 31.5 $\mu g.m^{-3}$.

Fugitive PM_{10} Emissions

3.23 Transport PM_{10} emissions arise from both the tailpipe exhausts and from fugitive sources such as brake and tyre wear and re-suspended road dust. Improvements in vehicle technologies are reducing PM_{10} exhaust emissions; therefore, the relative importance of fugitive PM_{10} emissions is increasing. Current emission factors for particulate matter include brake dust and tyre wear (which studies suggest may account for approximately one-third of the total particulate emissions from road transport); however, no allowance is made for re-suspended road dust as this remains unquantified.

Significance Criteria for Development Impacts on the Local Area

3.24 The EPUK & IAQM Land-Use Planning & Development Control: Planning For Air Quality document [7] advises that:

"The significance of the effects arising from the impacts on air quality will depend on a number of factors and will need to be considered alongside the benefits of the development in question. Development under current planning policy is required to be sustainable and the definition of this includes social and economic dimensions, as well as environmental. Development brings opportunities for reducing emissions at a wider level through the use of more efficient technologies and better designed buildings, which could well displace emissions elsewhere, even if they increase at the development site. Conversely, development can also have adverse consequences for air quality at a wider level through its effects on trip generation."

3.25 When describing the air quality impact at a sensitive receptor, the change in magnitude of the concentration should be considered in the context of the absolute concentration at the sensitive receptor. Table 3.4 provides the EPUK & IAQM approach for describing the long-term air quality impacts at sensitive human-health receptors in the surrounding area.

Table 3.4 Impact Descriptors for Individual Sensitive Receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level			
	1	2-5	6-10	>10
75 % or less of AQAL	Negligible	Negligible	Slight	Moderate
76 -94 % of AQAL	Negligible	Slight	Moderate	Moderate
95 - 102 % of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109 % of AQAL	Moderate	Moderate	Substantial	Substantial
110 % or more than AQAL	Moderate	Substantial	Substantial	Substantial

1. AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.
2. The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5% will be described as negligible.
3. The table is only designed to be used with annual mean concentrations.
4. Descriptors for individual receptors only; the overall significance is determined using professional judgement. For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.
5. When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme;' concentration for an increase.
6. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.
7. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

3.26 The human-health impact descriptors above apply at individual receptors. The EPUK & IAQM guidance states that the impact descriptors *"are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual receptors. Whilst it maybe that there are 'slight', 'moderate' or 'substantial' impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances."*

3.27 Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts. This judgement is likely to take into account the extent of the current and future population exposure to the impacts and the influence and/or validity of any assumptions adopted during the assessment process.

Significance Criteria for New Population Exposure (Site Suitability)

3.28 The EPUK & IAQM guidance considers an exceedance of an air quality objective at a building façade to be significant adverse effect unless provision is made to reduce the resident's or occupant's exposure by some means.

Uncertainty

3.29 All air quality assessment tools, whether models or monitoring measurements, have a degree of uncertainty associated with the results. The choices that the practitioner makes in setting-up the model, choosing the input data, and selecting the baseline monitoring data will decide whether the final predicted impact should be considered a central estimate, or an estimate tending towards the upper bounds of the uncertainty range (i.e. tending towards worst-case).

3.30 The atmospheric dispersion model itself contributes some of this uncertainty, due to it being a simplified version of the real situation: it uses a sophisticated set of mathematical equations to approximate the complex physical and chemical atmospheric processes taking place as a pollutant is released and as it travels to a receptor. The predictive ability of even the best model is limited by how well the turbulent nature of the atmosphere can be represented.

3.31 Each of the data inputs for the model, listed earlier, will also have some uncertainty associated with them. Where it has been necessary to make assumptions, these have mainly been made towards the upper end of the range informed by an analysis of relevant, available data.

3.32 The atmospheric dispersion model used for this assessment, ADMS Roads, has been validated by its supplier and is widely used by professionals in the UK and overseas. A site-specific verification (calibration) provides additional certainty and is particularly important when air quality levels are close to exceeding the objectives/limit values.

3.33 LAQM.TG16 requires that local authorities verify the results of any detailed modelling undertaken for the purposes of fulfilling their R&A duties. Model verification refers to the checks that are carried out on model performance at a local level. Modelled concentrations are compared with the results of monitoring. Where there is a disparity between modelled and monitored concentrations, the first step is to review the appropriateness of the data inputs to determine whether the performance of the model can be improved. Once reasonable efforts have been made to reduce the uncertainties in the data inputs, an adjustment may be established and applied to reduce any remaining disparity between modelled and monitored concentrations. No adjustment factor is deemed necessary where the modelled concentrations are within 25% of the monitored concentrations.

3.34 For the verification and adjustment of NO_x/NO_2 concentrations for R&A purposes, it is recommended that the comparison involves a combination of automatic and diffusion monitoring, rather than a single automatic monitor. This is to ensure any adjustment factor derived is representative of all locations modelled and not unduly weighted towards the characteristics at a single site. Where only diffusion tubes are used for the model verification, the study should consider a broad spread of monitoring locations across the study area to provide sufficient information relating to the spatial variation in pollutant concentrations.

3.35 Local Authorities generally implement a broad spread of monitoring, particularly in areas that are known to be sensitive to changes in air quality. Consequently, Local Authorities are usually able to verify the models they use for R&A purposes; however for individual developments, there is

less likely to be a broad range of monitoring locations within the relevant study area. Notwithstanding this, a small number of monitoring locations have been identified within the study area and a model verification study has been undertaken for the proposed development and is included at Appendix A.

3.36 The main components of uncertainty in the total predicted concentrations, made up of the background concentration and the modelled fraction, include those summarised in Table 3.5.

Table 3.5 Approaches to Dealing with Uncertainty used Within the Assessment

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
Background Concentration	Characterisation of current baseline air quality conditions	The background particulate matter concentrations used within the assessment are the most conservative values from a comparison of measured and Defra mapped concentration estimates.	The background concentration is the major proportion of the total predicted concentration. The conservative assumptions adopted ensure that the background concentration used within the model contributes to the result being towards the top of the uncertainty range, rather than a central estimate.
	Characterisation of future baseline air quality (i.e. the air quality conditions in the future assuming that the development does not proceed)	The future background concentration used in the assessment is the same as the current background concentration and no reduction has been assumed. This is a conservative assumption as, in reality, background concentrations are likely to reduce over time as cleaner vehicle technologies form an increasing proportion of the fleet.	
Fraction from Modelled Sources	Traffic flow estimates	Some of the traffic flows provided have been based on traffic counts, rather than flows derived from a traffic model. High growth assumptions have been used to develop the traffic dataset used within the model.	The modelled fraction is a minor proportion of the total predicted concentration. The modelled fraction is likely to contribute to the result being between a central estimate and the top of the uncertainty range.
	Traffic speed estimates	Measured and estimated average traffic speeds have been used within the model. The average speed has been reduced in congested areas to take account of slow-moving and queuing traffic.	
	Road-related emission factors – projection to future years	The most recently published emission factors have been used within the modelling and these are based on the current and best understanding of the variation in emission factors in future years.	
	Meteorological Data	Uncertainties arise from any differences between the conditions at the met station and the development site, and between the historical met years and the future years. These have been minimised by using	

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
		meteorological data collated at a representative measuring site. The model has been run for a full year of meteorological conditions. This means that the conditions in 8,760 hours have been considered in the assessment.	
	Receptors	Receptor locations have been identified where concentrations are highest or where the greatest changes are expected.	
	Dispersion Modelling	The model predictions have been compared with monitored concentrations. The model outputs have been adjusted accordingly. The fractional bias indicates that the corrected model is not significantly under or over-predicting.	

3.37 The analysis of the component uncertainties indicates that, overall, the predicted total concentration is likely to be towards the top of the uncertainty range rather than being a central estimate. The actual concentrations that will be found when the development is operational are unlikely to be higher than those presented within this report and are more likely to be lower.

4 Baseline Air Quality Conditions

Overview

4.1 The background concentration often represents a large proportion of the total pollution concentration, so it is important that the background concentration selected for the assessment is realistic. EPUK & IAQM guidance highlight public information from Defra and local monitoring studies as potential sources of information on background air quality. LAQM.TG16 recommends that Defra mapped concentration estimates are used to inform background concentrations in air quality modelling and states that: "*Where appropriate these data can be supplemented by and compared with local measurements of background, although care should be exercised to ensure that the monitoring site is representative of background air quality*".

4.2 For this assessment, the background air quality has been characterised by drawing on information from the following public sources:

- Defra maps [11], which show estimated pollutant concentrations across the UK in 1 km grid squares; and
- published results of local authority Review and Assessment (R&A) studies of air quality, including local monitoring and modelling studies.

4.3 A detailed description of how the baseline air quality has been derived for this Proposed Development site is summarised in the following paragraphs.

Review and Assessment Process

4.4 MCC has designated two AQMAs:

- The Chepstow AQMA – an area encompassing either side of the A48 (from the roundabout with the A466 up to just beyond the junction with the B4293 at Hardwick Terrace); and
- The Usk AQMA - An area encompassing Bridge Street, from its junction with Newmarket Street up to and including the area around the junction with Castle Parade and Porthycarne Street.

4.5 The Application Site is located approximately 750 m north-west of the Chepstow AQMA.

Local Urban Background Monitoring

4.6 Monitors at urban background locations measure concentrations away from the local influence of emission sources and are therefore broadly representative of residential areas within large conurbations. Monitoring at local urban background locations is considered an appropriate source of data for the purposes of describing baseline air quality for this Proposed Development site. MCC does not undertake any monitoring in an urban background location. Therefore, it has not

been possible to supplement and/or compare Defra-mapped concentration estimates with local NO_2 measurements.

4.7 The Air Quality Expert Group (AQEG) study of Particulate Matter in the UK [12] provides a comparison of NO_2 and PM_{10} monitoring undertaken in the UK at roadside, urban background and rural locations. A much larger variation in monitored NO_2 concentrations is reported compared to PM_{10} concentrations. The lower variation in monitored PM_{10} concentrations reflects the more even distribution of particulate matter across the UK due to the wide range of sources and the contribution of secondary particulate matter. On this basis, the results of continuous automatic PM_{10} and $PM_{2.5}$ roadside monitoring at A48 Hardwick Hill, Chepstow have been used to inform background concentrations.

4.8 The most recent monitored annual-mean PM_{10} and $PM_{2.5}$ concentrations are presented in Table 4.1.

Table 4.1 Monitored Annual-Mean PM_{10} and $PM_{2.5}$ Concentrations

Monitor Name	Site Type	x	y	Approx. Distance from Site (km)	Pollutant	Concentration (µg.m^{-3})		
						2014	2015	2016
A48 Hardwick Hill, Chepstow	Roadside	353128	193472	1.2	PM_{10}	18	17	18
					$PM_{2.5}$	14	10	11

Defra Mapped Concentration Estimates

4.9 Defra's total annual-mean PM_{10} and $PM_{2.5}$ concentration estimates have been collected for the 1 km grid square of the monitoring site and the Proposed Development and are summarised in Table 4.2.

Table 4.2 Defra Mapped Annual-Mean Background NO2 Concentration Estimates

Site	Pollutant	Concentration (µg.m^{-3})	
		Range of Monitored	Estimated Defra Mapped
A48 Hardwick Hill, Chepstow	PM_{10}	17 – 18	12.8
	$PM_{2.5}$	10 – 14	8.7
Application Site	PM_{10}	-	11.7
	$PM_{2.5}$	-	7.9

Appropriate Background Concentrations for the Development Site

4.10 In the absence of NO_2 monitoring, the background annual-mean concentration for each receptor is taken from the corresponding grid square of the Defra-mapped concentration estimates.

4.11 have been derived from the Defra mapped background concentration estimates, where the background concentration

4.12 For PM_{10} and $PM_{2.5}$ the Defra mapped background concentration estimates are lower than the range of results from monitoring and the use of these data would not be conservative. The background annual-mean PM_{10} and $PM_{2.5}$ concentrations for all receptors have been derived from the maximum monitored concentrations at A48 Hardwick Hill, Chepstow.

4.13 Historically the view has been that background traffic-related NO_2 concentrations in the UK would reduce over time, due to the progressive introduction of improved vehicle technologies and increasingly stringent limits on emissions. However, the results of recent monitoring across the UK suggest that background annual-mean NO_2 concentrations have not decreased in line with expectations. Inspection of the results of local monitoring presented here indicates that there is no particular trend over time for concentrations of either PM_{10} or $PM_{2.5}$ in the vicinity of the Application Site.

4.14 To ensure that the assessment presents conservative results, no reduction in the background has been applied for future years.

4.15 Table 4.3 summarises the annual-mean background concentrations for NO_2, PM_{10} and $PM_{2.5}$ used in this assessment.

Table 4.3 Summary of Background Annual-Mean (Long-term) Concentrations used in the Assessment

Pollutant	Data Source	Concentration (µg.m^{-3})
NO_2	Defra grid square 352500,194500	7.5
	Defra grid square 352500,193500	8.7
	Defra grid square 353500,193500	9.7
	Defra grid square 352500,192500	8.7
	Defra grid square 353500,192500	9.0
	Defra grid square 351500,192500	8.4
PM_{10}	A48 Hardwick Hill, Chepstow Automatic Monitor (2014)	18.0
$PM_{2.5}$		14.0

5 Assessment of Operational-Phase Air Quality Impacts

Assessment of Air Quality Impacts on Surrounding Area

5.1 This section of the report summarises the future operational-phase air quality impacts of the key pollutants associated with the development traffic of the proposed scheme.

Nitrogen Dioxide (NO_2)

5.2 Table 5.1 presents the annual-mean NO_2 concentrations predicted at the façades of existing receptors.

Table 5.1 Predicted Annual-Mean NO_2 Impacts at Existing Receptors

Receptor ID	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
3	11.1	11.2	0	Negligible
4	9.7	9.8	0	Negligible
5	11.9	12.0	0	Negligible
6	9.5	9.5	0	Negligible
7	8.6	8.6	0	Negligible
8	9.3	9.4	0	Negligible
9	10.7	10.7	0	Negligible
10	11.0	11.1	0	Negligible
11	14.5	14.8	1	Negligible
12	10.8	10.8	0	Negligible
13	10.1	10.2	0	Negligible
14	17.1	17.2	0	Negligible
15	19.0	19.7	2	Negligible
16	17.8	17.9	0	Negligible
17	18.2	18.7	1	Negligible
18	22.9	23.1	1	Negligible
19	21.4	21.4	0	Negligible
20	17.6	17.7	0	Negligible
21	17.1	17.1	0	Negligible
22	14.9	15.0	0	Negligible

Receptor ID	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
23	22.3	22.3	0	Negligible
24	17.6	17.6	0	Negligible
25	19.6	19.7	0	Negligible
26	17.7	17.8	0	Negligible
27	26.7	26.7	0	Negligible
28	16.1	16.4	1	Negligible
29	15.0	15.0	0	Negligible
30	11.6	11.6	0	Negligible
31	14.8	14.9	0	Negligible
32	15.3	15.3	0	Negligible
33	12.7	12.8	0	Negligible
34	27.6	27.6	0	Negligible
35	18.0	18.0	0	Negligible
36	12.3	12.3	0	Negligible
37	12.2	12.5	1	Negligible
38	9.8	9.9	0	Negligible
39	9.4	9.4	0	Negligible
40	9.2	9.3	0	Negligible
41	10.9	11.0	0	Negligible
42	11.6	11.7	0	Negligible
43	9.4	9.4	0	Negligible
Maximum	**27.6**	**27.6**	**2**	**-**
Minimum	**8.6**	**8.6**	**0**	**-**

5.3 Predicted annual-mean NO_2 concentrations in the opening year at the façades of the existing receptors are above/below the AQS objective for NO_2. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptor for all receptors is 'negligible'.

5.4 As all predicted annual-mean NO_2 concentrations are below 60 µg.m^{-3}, the hourly-mean objective for NO_2 is likely to be met at all receptors. The short-term NO_2 impact can be considered 'negligible' and is not considered further within this assessment.

5.5 Overall, the impact on the surrounding area from NO_2 is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Particulate Matter (PM_{10})

5.6 Table 5.2 presents the annual-mean PM_{10} concentrations predicted at the façades of existing receptors.

Table 5.2 Predicted Annual-Mean PM_{10} Impacts at Existing Receptors

Receptor ID	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
3	18.9	18.9	0	Negligible
4	18.6	18.6	0	Negligible
5	19.1	19.2	0	Negligible
6	18.5	18.5	0	Negligible
7	18.3	18.3	0	Negligible
8	18.5	18.5	0	Negligible
9	18.8	18.8	0	Negligible
10	18.6	18.6	0	Negligible
11	19.5	19.5	0	Negligible
12	18.5	18.5	0	Negligible
13	18.4	18.4	0	Negligible
14	20.2	20.3	0	Negligible
15	20.8	20.8	0	Negligible
16	20.4	20.4	0	Negligible
17	20.5	20.5	0	Negligible
18	21.9	21.9	0	Negligible
19	21.4	21.4	0	Negligible
20	20.4	20.4	0	Negligible
21	20.2	20.2	0	Negligible
22	19.6	19.6	0	Negligible
23	21.7	21.7	0	Negligible
24	20.4	20.4	0	Negligible
25	20.9	20.9	0	Negligible
26	20.4	20.4	0	Negligible
27	22.7	22.7	0	Negligible
28	19.9	20.0	0	Negligible

Receptor ID	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
29	19.5	19.5	0	Negligible
30	18.7	18.7	0	Negligible
31	19.4	19.4	0	Negligible
32	19.8	19.8	0	Negligible
33	19.0	19.1	0	Negligible
34	23.0	23.0	0	Negligible
35	20.2	20.2	0	Negligible
36	19.0	19.0	0	Negligible
37	19.2	19.2	0	Negligible
38	18.6	18.6	0	Negligible
39	18.5	18.5	0	Negligible
40	18.4	18.4	0	Negligible
41	18.3	18.3	0	Negligible
42	18.8	18.8	0	Negligible
43	18.4	18.4	0	Negligible
Maximum	**23.0**	**23.0**	**0**	**-**
Minimum	**18.3**	**18.3**	**0**	**-**

5.7 Predicted annual-mean PM_{10} concentrations in the opening year at the façades of the existing receptors are below the AQS objective for PM_{10}. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptor is categorised as 'negligible' at all receptors.

5.8 As all predicted annual mean PM_{10} concentrations are below 31.5 µg.m^{-3}, the daily-mean PM_{10} objective is expected to be met at all receptors and the short-term PM_{10} impact is not considered further within this assessment.

5.9 Overall, the impact on the surrounding area from PM_{10} is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Fine Particulate Matter ($PM_{2.5}$)

5.10 Table 5.3 presents the annual-mean $PM_{2.5}$ concentrations predicted at the façades of existing receptors.

Table 5.3 Predicted Annual-Mean $PM_{2.5}$ Impacts at Existing Receptors

Receptor ID	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
3	14.5	14.5	0	Negligible
4	14.3	14.3	0	Negligible
5	14.6	14.6	0	Negligible
6	14.3	14.3	0	Negligible
7	14.1	14.2	0	Negligible
8	14.3	14.3	0	Negligible
9	14.4	14.5	0	Negligible
10	14.3	14.3	0	Negligible
11	14.8	14.8	0	Negligible
12	14.3	14.3	0	Negligible
13	14.2	14.2	0	Negligible
14	15.2	15.2	0	Negligible
15	15.5	15.5	0	Negligible
16	15.3	15.3	0	Negligible
17	15.4	15.4	0	Negligible
18	16.1	16.1	0	Negligible
19	15.9	15.9	0	Negligible
20	15.3	15.3	0	Negligible
21	15.2	15.2	0	Negligible
22	14.9	14.9	0	Negligible
23	16.0	16.0	0	Negligible
24	15.3	15.3	0	Negligible
25	15.6	15.6	0	Negligible
26	15.3	15.3	0	Negligible
27	16.6	16.6	0	Negligible
28	15.1	15.1	0	Negligible
29	14.8	14.8	0	Negligible
30	14.4	14.4	0	Negligible
31	14.8	14.8	0	Negligible
32	15.0	15.0	0	Negligible
33	14.6	14.6	0	Negligible
34	16.7	16.7	0	Negligible

Receptor ID	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
35	15.2	15.2	0	Negligible
36	14.6	14.6	0	Negligible
37	14.7	14.7	0	Negligible
38	14.3	14.3	0	Negligible
39	14.3	14.3	0	Negligible
40	14.2	14.2	0	Negligible
41	14.2	14.2	0	Negligible
42	14.4	14.4	0	Negligible
43	14.2	14.2	0	Negligible
Maximum	**16.7**	**16.7**	**0**	**-**
Minimum	**14.1**	**14.2**	**0**	**-**

AQS objective = 25 µg.m^{-3}

5.11 Predicted annual-mean $PM_{2.5}$ concentrations in the opening year at the façades of the existing receptors are well below the AQS objective for $PM_{2.5}$ at all receptors. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptor is categorised as 'negligible' at all receptors.

5.12 Overall, the impact on the surrounding area from $PM_{2.5}$ is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Assessment of New Population Exposure (Site Suitability)

5.13 This section of the report summarises the operational-phase air quality impacts on future occupants of the development from their exposure to the prevailing levels of air pollution, which can be a factor in the suitability of the site for its proposed uses.

5.14 Table 5.4 presents the annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations predicted at the façades of proposed receptors.

Table 5.4 Predicted Annual-Mean NO_2, PM_{10} and $PM_{2.5}$ Concentrations (µg.m^{-3}) at Proposed Receptors

Receptor ID	NO_2	PM_{10}	$PM_{2.5}$
1 (Application Site)	8.8	18.3	14.2
2 (Application Site)	8.8	18.3	14.2

5.15 Both the long and short-term objectives apply at the Proposed Development.

5.16 The predicted annual-mean NO_2 concentration at both receptors is 8.8 $\mu g.m^{-3}$, well below the annual-mean AQS objective of 40 $\mu g.m^{-3}$. Furthermore, as the annual-mean NO_2 concentration is predicted to be less than 60 $\mu g.m^{-3}$, the hourly-mean AQS objective is expected to be met.

5.17 The predicted annual-mean PM_{10} concentrations at both receptors is 18.3 $\mu g.m^{-3}$, well below the annual-mean AQS objective of 40 $\mu g.m^{-3}$ at all receptors. Furthermore, as the annual-mean PM_{10} concentration is predicted to be less than 31.5 $\mu g.m^{-3}$, the daily-mean AQS objective for this pollutant is expected to be met.

5.18 The predicted annual-mean $PM_{2.5}$ concentration at both receptors is 14.2 $\mu g.m^{-3}$, well below the annual-mean AQS objective of 25 $\mu g.m^{-3}$.

Significance of Effects

5.19 It is generally considered good practice that, where possible, an assessment should communicate effects both numerically and descriptively. Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts.

5.20 The impacts predicted at individual receptors and the geographical extent over which such impacts occur, can be used to inform the judgement on the impact on the surrounding area as a whole, and whether the resulting overall effect is significant or not. The IAQM guidance states, *"Whilst it may be that there are 'slight', 'moderate', or 'substantial' impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances."* and *"…a 'moderate' or 'substantial' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health."*

5.21 The results of the modelling indicate that with the development, the predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations at existing receptors are below the relevant long and short-term AQS objectives. When the magnitude of change in annual-mean NO_2 , PM_{10} and $PM_{2.5}$ concentrations is considered in the context of the absolute predictions, the air quality impacts of the development on existing receptors are categorised as 'negligible'. Taking into account the geographical extent of the impacts predicted in this study, the overall impact of the development on the surrounding area as a whole is considered to be 'negligible', using the descriptors adopted for this assessment.

5.22 The AQS objectives for NO_2, PM_{10} and $PM_{2.5}$ are likely to be met at the facades of the Proposed Development. On that basis, future occupants of the development should be exposed to acceptable air quality and the site is deemed suitable for its proposed future in this respect.

5.23 Using professional judgement, the resulting air quality effect is considered to be 'not significant' overall.

Sensitivity and Uncertainty

5.24 Section 3 provided an analysis of the sources of uncertainty in the results of the assessment. The conclusion of that analysis was that, overall, the predicted total concentration is likely to be towards the top of the uncertainty range rather than being a central estimate. The actual concentrations that will be found when the development is operational are unlikely to be higher than those presented within this report and are more likely to be lower.

5.25 The impacts at existing receptors are shown to be not significant even for this conservative scenario. Similarly, the predicted pollutant concentrations at proposed receptors are below the relevant AQS objectives. Consequently, further sensitivity analysis has not been undertaken and, in practice, the impacts at sensitive receptors are likely to be lower than those reported in this conservative assessment.

6 Mitigation

Mitigation for the Operational Impact of the Development on the Surrounding Area

6.1 When the change in concentration at existing sensitive receptors is considered in the context of the absolute concentration, the overall air quality impact on the surrounding area as a whole is categorised as “negligible” and the resulting effect is considered to be “not significant”. On that basis, no mitigation measures are considered necessary.

Mitigation for New Population Exposure (Site Suitability)

6.2 The predicted pollutant concentrations at proposed sensitive receptors are below the relevant AQS objectives. As such, the air quality effect of exposure on future occupants is considered to be “not significant”. On that basis, no mitigation measures are considered necessary.

7 Conclusions

7.1 This assessment has considered the air quality impacts during the operational phase of the proposed Bayfield - Phase 2 residential development in Chepstow.

7.2 Regarding the operational impact of the development on the surrounding area, detailed atmospheric dispersion modelling has been undertaken for the first year in which the development is expected to be fully operational, 2023. The operational impact of the Barratt David Wilson Homes development on existing receptors in the local area is predicted to be 'negligible' taking into account the changes in pollutant concentrations and absolute levels. Using the criteria adopted for this assessment together with professional judgement, the overall impact on the area as a whole is described as 'negligible'.

7.3 Regarding suitability of air quality at the site for introducing new occupants, pollutant concentrations at the façades of proposed residential receptors are predicted to be well within the relevant health-based air quality objectives. On that basis, future occupants of the Barratt David Wilson Homes development should be exposed to acceptable air quality and the site is deemed suitable for its proposed future use in this respect.

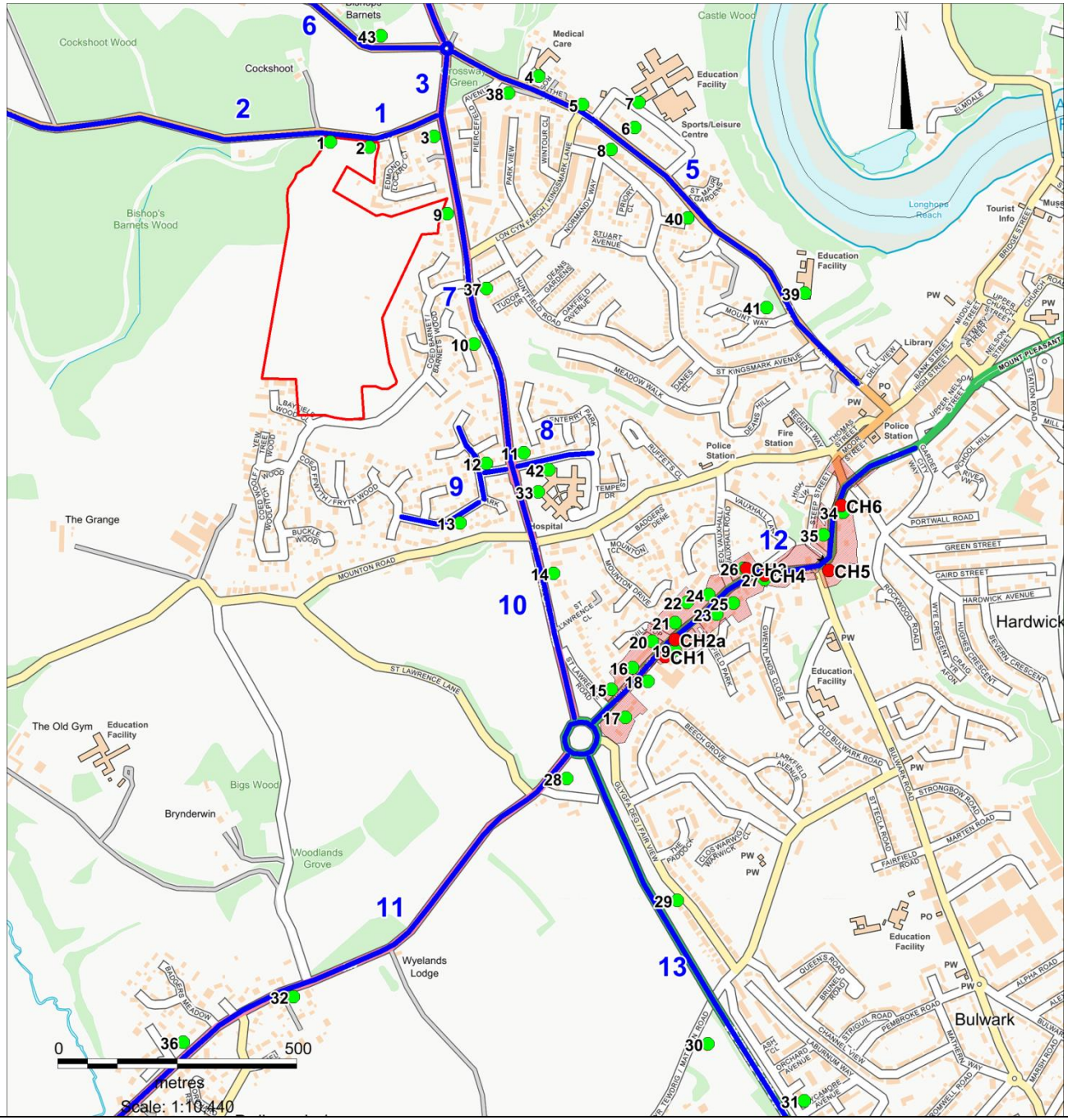
7.4 Using professional judgement, the resulting air quality effect of the Barratt David Wilson Homes development is considered to be 'not significant' overall.

7.5 The proposed Bayfield – Phase 2 development does not, in air quality terms, conflict with national or local policies, or with measures set out in MCCs Air Quality Action Plan. There are no constraints to the development in the context of air quality.

Glossary

AADT	Annual Average Daily Traffic Flow
ADMS	Atmospheric Dispersion Modelling System
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
Effect	The consequences of an impact, experienced by a receptor
EPUK	Environmental Protection UK
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
Impact	The change in atmospheric pollutant concentration and/or dust deposition. A scheme can have an 'impact' on atmospheric pollutant concentration but no effect, for instance if there are no receptors to experience the impact
LGV	Light Goods Vehicle
MCC	Monmouthshire County Council
PPW	Planning Policy Wales
R&A	Review and Assessment
Receptor	A person, their land or property and ecologically sensitive sites that may be affected by air quality
Risk	The likelihood of an adverse event occurring
TAN	Technical Advice Note

Figures



Nitrogen Dioxide Monitoring Sites

Sensitive Receptors

ADMS Road Source

Site Redline

AQMA Boundary

Notes

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Project: Barratt Homes, Chepstow – Air Quality Assessment

Job Ref: JAR10292

File location:

Date: 29/03/2018	**Rev: 0**
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Figure 1: Modelled Roads and Receptors

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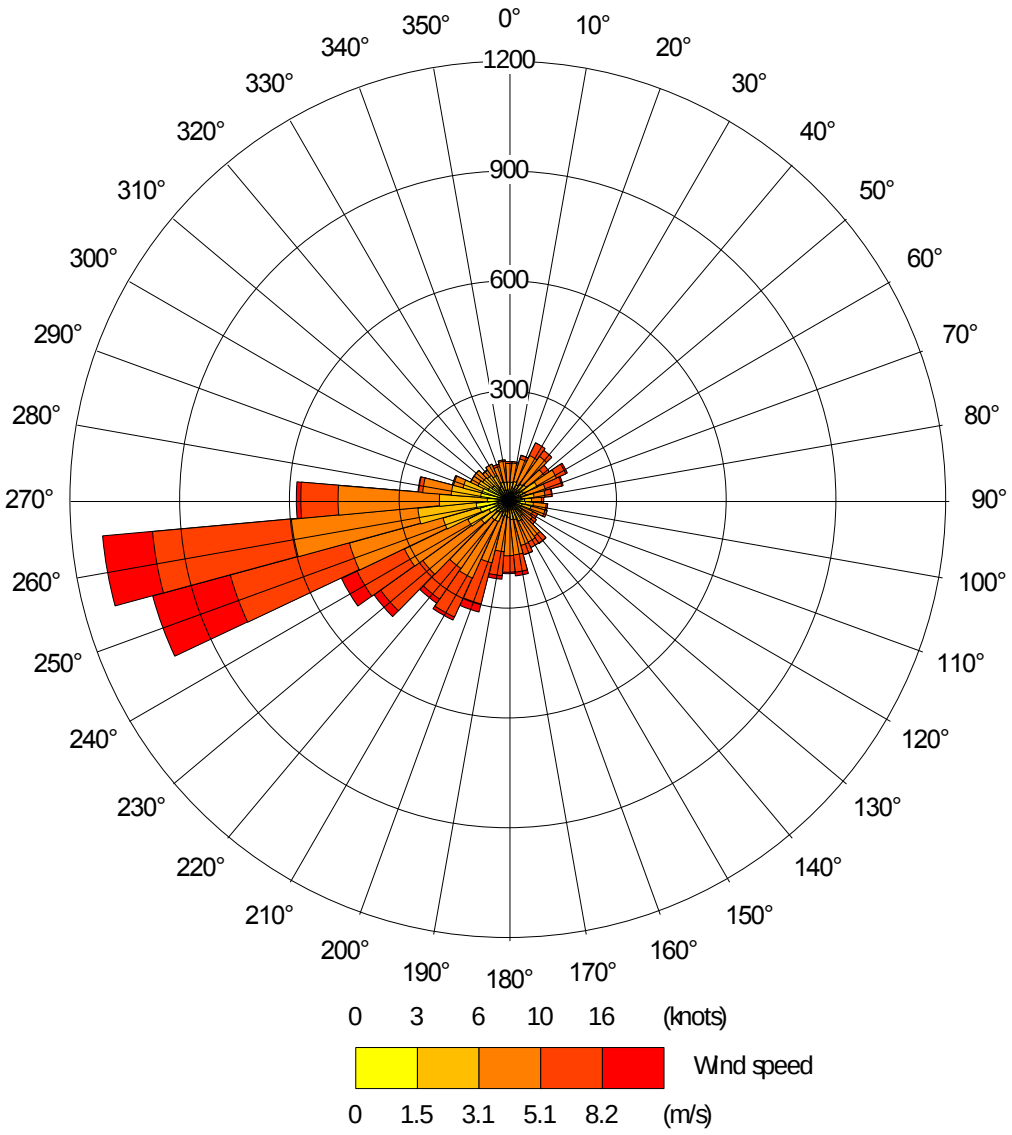

Figure 2: Windrose for Filton Station (2017)

Job ref:	**JAR10292**	**Project Title**	**Barratt David Wilson Homes, Chepstow – Air Quality Assessment**		
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Appendix A: Model Verification

The approach to model verification that LAQM.TG16 recommends for local authorities when they carry out their LAQM duties is summarised in Section 3. For the verification and adjustment of NO_x/NO_2 concentrations, the guidance recommends that the comparison considers a broad spread of automatic and diffusion monitoring. MCC monitors roadside NO_2 concentrations passively using diffusion tubes at a number of locations in the vicinity of the Application Site, six of which are located on the A48 within the study areas for this assessment. The concentrations monitored at roadside locations over recent years are provided in Table B.1.

Table B.1 Measured Annual-mean NO_2 Concentrations ($\mu g.m^{-3}$)

Monitoring Site	Measured Annual-mean NO_2 Concentrations ($\mu g.m^{-3}$)					
	2011	2012	2013	2014	2015	2016
CH1	22.6	25.3	22.4	21.8	22.5	22.9
CH2a	30.7	32	30.4	33.1	30.9	31
CH3	32.8	35.5	32.7	32.5	29.8	31.1
CH4	60.1	60.3	56	57.7	51.4	53.2
CH5	30.4	33.2	28.4	26.1	25.9	26.7
CH6	40.7	42.6	41.7	40	36.8	37.6

Ideally, any model verification study should use background concentrations, emissions factors and meteorological data relating to the same year. In this case, the study has used traffic data flows in 2017, meteorological data collated in 2017 and Defra's emissions factors for 2017. The predicted concentrations have been compared with the most recently measured annual-mean NO_2 concentrations.

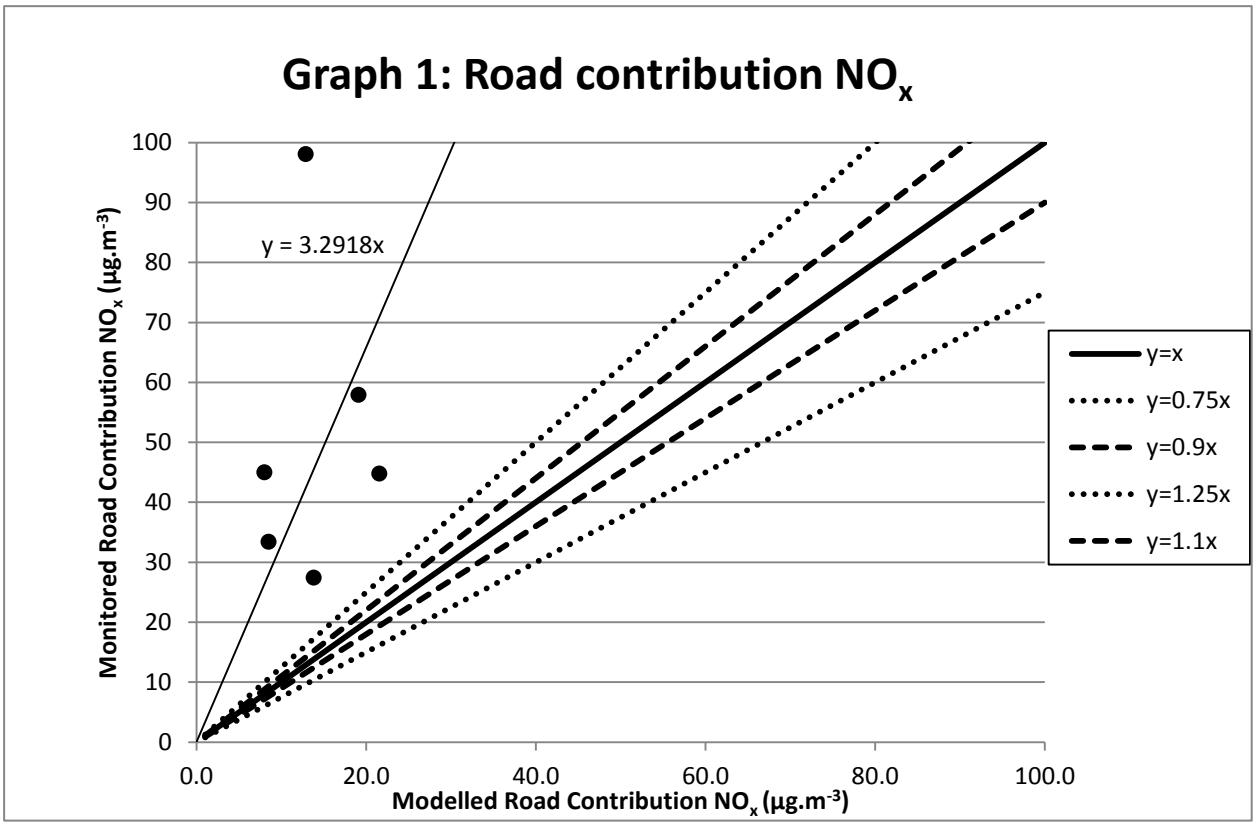
The monitored annual-mean NO_x road contributions have been derived from the monitored annual-mean NO_2 concentrations using the LAQM.TG16 calculator. The monitored annual-mean NO_X road contributions have then been compared with the modelled annual-mean NO_X road contributions. This comparison is provided in Table B.2 below.

Table B.2 Comparison of Monitored and Modelled Annual-mean Road NO_X Contribution ($\mu g.m^{-3}$)

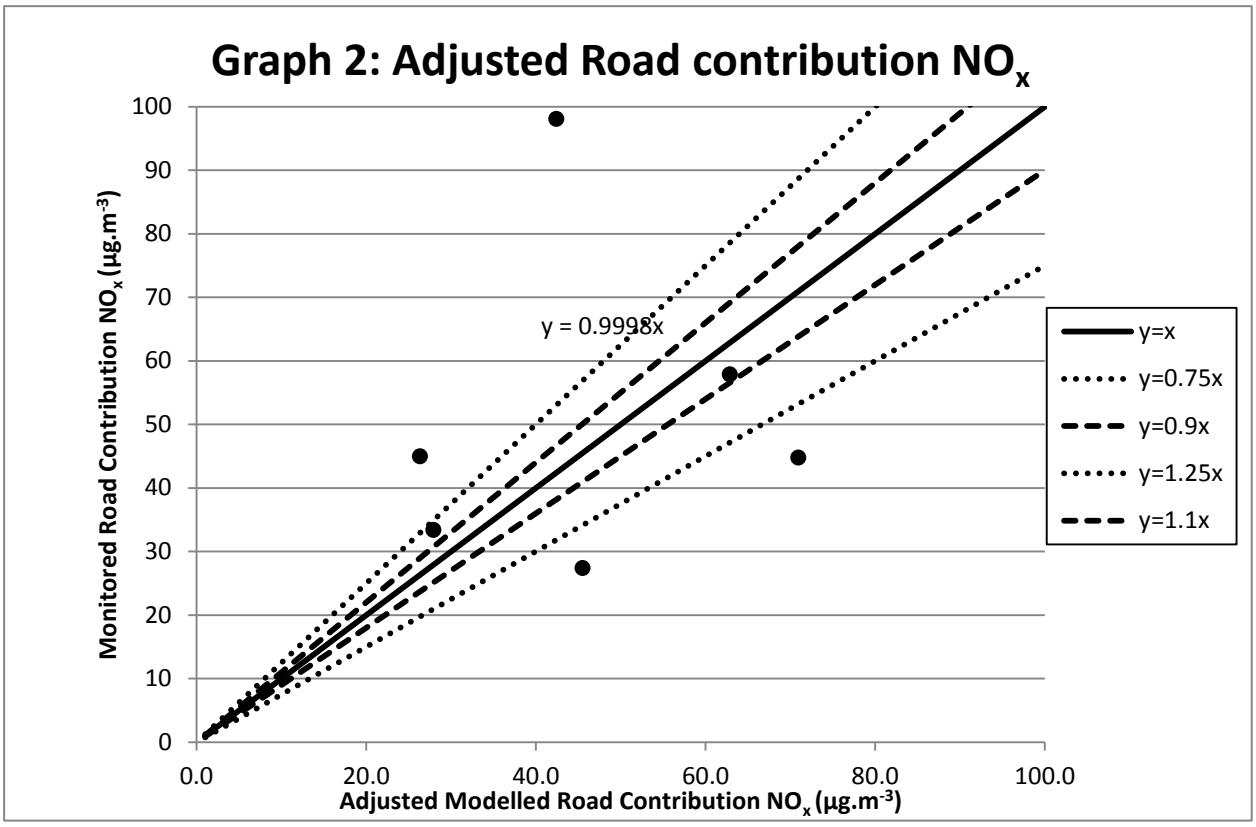
Monitoring Site	Annual-mean Road NO_X Contribution ($\mu g.m^{-3}$)	
	Monitored	Modelled
CH1	27.4	13.8
CH2a	44.7	21.6
CH3	45.0	8.0
CH4	98.0	12.9
CH5	33.4	8.5
CH6	57.9	19.1

It should be borne in mind that the monitored concentrations are themselves only estimates to the true concentrations at each point; the EU Directive on air quality states that passive NO_2 samplers have an inherent potential uncertainty of +/-30 %. Ignoring any uncertainty errors in the monitoring results, Table B.2 above shows that the model is under-predicting at all monitoring locations. As set out above, the wider datasets indicate that the 2016 monitored concentrations are approximately representative for all monitoring sites.

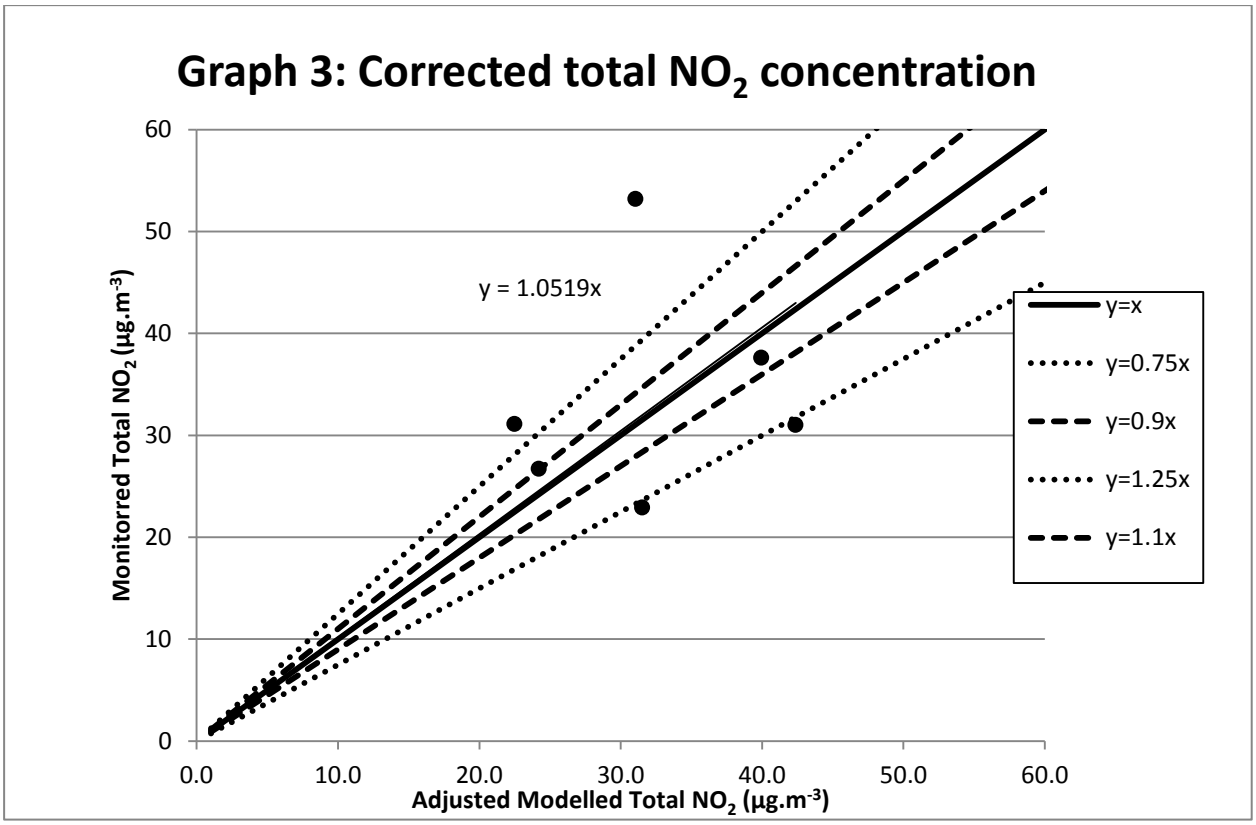
The modelled annual-mean NO_x road contributions have been plotted against the monitored annual-mean NO_x road contributions in Graph 1.



The modelled NO_X contributions have been multiplied by the gradient of the trend line (3.29) to determine the corrected NO_X contributions. The corrected modelled annual-mean NO_x road contributions have been plotted against the monitored annual-mean NO_x road contributions in Graph 2.



Modelled annual-mean NO_2 concentrations have been derived from the corrected modelled annual-mean NO_X road contributions. The corrected modelled annual-mean NO_2 concentrations have been plotted against the monitored annual-mean NO_2 concentrations in Graph 3.



With the correction factor, two of the modelled annual-mean NO_2 concentrations exceed the monitored concentrations by more than 25%, and two of the modelled NO_2 concentrations are more than 25% below the monitored concentration. On balance, the correction is considered to improve the model output and the correction factor has therefore been applied to all predictions used within the assessment.

The fractional bias can also be used to determine whether the corrected model has a tendency to over or under-predict. The fractional bias is calculated as:

(Average Monitored NO_x Concentration – Average Predicted NO_x Concentration) / 0.5 x (Average Monitored NO_x - Average Predicted NO_x Concentration)

Fractional bias values vary between +2 and -2 and has an ideal value of zero. A negative value suggests a model over-prediction and a positive value suggests a model under-prediction.

Table B.3 sets out the average monitored concentration and the average predicted concentration.

Table B.3 Comparison of Monitored and Adjusted Modelled Annual-mean Road NO_X Contribution ($\mu g.m^{-3}$)

Monitoring Site	Annual-mean Road NO_X Contribution ($\mu g.m^{-3}$)	
	Monitored	Corrected Modelled
CH1	27.4	45.5
CH2a	44.7	71.0
CH3	45.0	26.4
CH4	98.0	42.4
CH5	33.4	27.9
CH6	57.9	62.9
Average	**51.1**	**46**

The fractional bias for this study is therefore (51.1 – 46) / (0.5 x (51.1 +46)) = 0.1044. As the fractional bias is close to zero, the adjusted model is not significantly under or over-estimating relative to the monitored concentrations.

References

1 Council Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe.

2 Defra, 2010, The Air Quality Standards (Wales) Regulations.

3 Defra, 2007, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Volume 2.

4 Planning Policy Wales Technical Advice Note (TAN) 18: Transport (2007)

5 Air Quality Action Plan: Chepstow, Monmouthshire, 31 August 2011

6 A48 Chepstow Air Quality Options Assessment March 2017: WSP | Parsons Brinckerhoff

7 EPUK & IAQM (January 2017) Land-Use Planning & Development Control: Planning For Air Quality

8 IAQM (2014) Guidance on the assessment of dust from demolition and construction

9 Defra (2016) Local Air Quality Management Technical Guidance, 2016 (LAQM.TG16)

10 http://laqm.defra.gov.uk/review-and-assessment/tools/tools.html

11 Drawn from Defra Maps at http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015

12 AQEG(2005). Particulate Matter in the UK: Defra, London

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