Adran yr Economi a'r Seilwaith
Department for Economy and Infrastructure

Llywodraeth Cymru
Welsh Government

**The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East of Magor) Connecting Road) Scheme 201-**

**The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East of Magor) Connecting Road) (Amendment) Scheme 201-**

**The London to Fishguard Trunk Road (East of Magor to Castleton) Order 201-**

**The M4 Motorway (West of Magor to East of Castleton) and the A48(M) Motorway (West of Castleton to St Mellons)(Variation of Various Schemes) Scheme 201-**

**The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and the M48 Motorway (Junction 23 (East of Magor) Connecting Road) and The London to Fishguard Trunk Road (east of Magor to Castleton) (Side Roads) Order 201-**

**The Welsh Ministers (The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and the M48 Motorway (Junction 23 (East of Magor) Connecting Road) and the London to Fishguard Trunk Road (East of Magor to Castleton)) Compulsory Purchase Order 201-**

**The M4 Motorway (Junction 23 (East Of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East Of Magor) Connecting Road) (Supplementary) Scheme 201-**

**The Welsh Ministers (The M4 Motorway (Junction 23 (East Of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East Of Magor) Connecting Road) and The London to Fishguard Trunk Road (East of Magor to Castleton)) Supplementary Compulsory Purchase Order 201-**

**Proof of Evidence**

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**Welsh Government, Air Quality**

**Document Reference: WG 1.12.1**

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# 1. Introduction

## 1.1. Personal Details

1.1.1. My name is Michael Andrew Bull. I hold a BSc (Hons) degree in Chemical Engineering from Exeter University in 1979 and a PhD in Public Health Engineering from Imperial College London in 1983. I am a Chartered Engineer, a Chartered Environmentalist and a Chartered Scientist. I am a Fellow of the Institute of Air Quality Management, a Member of the Institute of Environmental Science and a Member of the Institution of Chemical Engineers.

1.1.2. I am currently vice chairman of the Institute of Air Quality Management and have sat on its council since its formation. I have published several technical papers and magazine articles on air quality matters and speak frequently at conferences. I have also contributed to several significant guidance documents including the first guidance on air quality and planning produced in the UK by the Royal Town Planning Institute in 1999 and have been a contributing author to similar guidance subsequently produced by Environmental Protection UK.

1.1.3. I have worked as a professional environmental scientist for more than 33 years. I have worked in industry for British Gas (1983-1986) and then in consultancy for 30 years with positions at Cap Scientific (1986-88), Ashdown Environmental Ltd (1988-1996) and at Ove Arup and Partners Ltd (since 1996). I have been a Director of Ove Arup and Partners Ltd (Arup) since 2008. I have been responsible for leading most of the air quality work carried out by Arup for the last 20 years.

1.1.4. The majority of my career has been concerned with assessment of air quality for a wide range of activities. Assessment of the air quality impacts from major road schemes has been a large part of this work. Since 1988 I have worked on numerous major road schemes including the M25, M2, M20, M65, M4, A465, A23, A13, A14, A1(M),

M1, Replacement Forth Crossing, New Tyne Tunnel and Dublin Port Tunnel. In most cases I have appeared as the air quality expert witness where a Public Local Inquiry was required for the proposals. I have also appeared at Development Consent Order (DCO) hearings for various proposals assisting the panel with air quality matters including the recent hearing for the A14 improvement scheme near to Cambridge.

1.1.5. As a result, I have extensive experience in the air quality assessment techniques used for highways proposals. During my career I have also developed air quality models for assessment purposes. Examples have included the development of the first countywide air quality model used in the UK for Kent County Council in 1996, a model for road tunnel assessments and extensive modifications to some USEPA models for use in a UK context.

1.1.6. I also have specified, installed and operated air quality monitoring schemes including multi-site fully instrumented networks for UK councils and overseas in the Philippines and in support of air quality assessments for UK projects such as the M1. I have also installed and operated monitoring schemes using simpler passive monitoring devices such as diffusion tubes for numerous projects.

1.1.7. I have also carried out research for the DfT, TRL, the GLA and Highways England on air quality matters. My recent work for Highways England has included examination of future trends in nitrogen oxides emissions, the use of model verification for highway scheme assessment and the availability of air quality mitigation measures to reduce pollutant concentrations near to roads.

1.1.8. Some of my earlier research work for TRL is particularly significant for this scheme where I investigated the air quality impacts from road tunnels and developed air quality assessment techniques including

specific modelling approaches. Although this work was carried out over 20 years ago, the same approaches are still applied today.

1.1.9. I have been involved with the M4 project since 1996 when I joined Ove Arup and Partners Ltd. I was the air quality lead for previous proposals on this section on the M4 including the identification of a preferred route corridor to the south of Newport and preparatory work for an Environmental Statement in 2008 prior to the Scheme being announced as unaffordable by Welsh Government in 2009.

1.1.10 For the current assessment I am the lead air quality expert for the proposals leading the air quality team that has undertaken the assessment and have had this role since the start of the project. I have therefore determined the methodology to be applied and reviewed and approved the assessment. I have been principally assisted in this task by Ms Lesley-Anne Stone who is the deputy air quality witness for this proposal.

1.1.11 The Proof of Evidence which I have prepared and provide in this Proof of Evidence is true and has been prepared and is given in accordance with the Code of Conduct of the Institution of Air Quality Management (IAQM) and I confirm that the opinions expressed are my true and professional opinions.

## 1.2. Scope and Structure of this Proof of Evidence

1.2.1. My Proof of Evidence provides a summary of the assessment of air quality impacts reported in the Environmental Statement [Document 2.3.2], Environmental Statement Supplement [Document 2.4.4] and Environmental Statement Supplement December 2016 [Document 2.4.14]. This summary includes details of the relevant air quality standards applied for the assessment, the existing air quality in the area based on published information and from air quality monitoring undertaken for the purposes of the Scheme, details the methods used for assessment of impacts during construction and operation, reports

on the input data used for the assessment, the results of the air quality modelling carried out to determine the likely changes in air quality and the significance of these changes.

1.2.2. My Proof of Evidence also responds to objections that have included reference to air quality. This has been undertaken by responding to the general themes raised in the objections and in some cases where necessary, a detailed response to a specific objection has been provided.

1.2.3. Where air quality modelling results are reported in my Proof of Evidence these are based on the most recent assessment of the proposals reported in the Environmental Statement Supplement dated December 2016 [Document 2.4.14]. Since submission of the Environmental Statement Supplement December 2016 [Document 2.4.14], further assessment of operational air quality impacts has been undertaken to correct small errors reported in this supplementary information. These errors relate to the assessment of operational air quality impacts using the new traffic forecasts only and do not affect any other air quality input to the Environmental Statement Supplement December 2016 [Document 2.4.14]. An update to Appendix SR7.3 of the Environmental Statement Supplement December 2016 is provided in Appendix A of this Proof of Evidence.

1.2.4. At the outset it is worth considering the overall air quality impacts of the Scheme. The Scheme will result in a reduction in traffic along the current alignment of the M4, which passes through densely populated areas, and therefore pollutant concentrations will decrease at properties close to the route. Concentrations of pollutants will inevitably increase near to the route of the proposed new section of motorway. However, the new route passes through an area that is lightly populated and consequently it can be expected that the overall

population exposure to air pollutants will reduce. The Scheme will result in an increase in pollutants at some designated ecological sites, however this has been assessed to be not significant as defined by guidance from the IAQM and the Welsh Government.

# 2. Assessment Methodology

## 2.1 Air Quality Standards

2.1.1. The main pollutants associated with road transport are nitrogen dioxide ($NO_2$) and fine particulate matter ($PM_{10}$). Air quality limit values and objectives are set both at European and National level. The Air Quality Standards (Wales) Regulations 2010 [Document 8.1.4] transpose the European Directive 2008/50/EC [Document 8.1.1] into national regulation. The UK Air Quality Strategy for England, Scotland Wales and Northern Ireland [Document 8.2.1] was published in its latest form in July 2007 and details air quality objectives for the UK. These have already been introduced into national legislation through the Air Quality Regulations 2000 [Document 8.1.2] and 2002 [Document 8.1.3]. Table 1 details the relevant UK and EU Air Quality Objectives and Limit Values.

**Table 1 Air Quality Standards**

| Pollutant | Averaging Period | Limit Value/Objective | Date for Compliance | Basis |
|---|---|---|---|---|
| Nitrogen dioxide ($NO_2$) | 1 hour mean | 200 µg/m$^3$, not to be exceeded more than 18 times a year (99.8$^{th}$ percentile) | 31 Dec 2005 | UK Objective |
| | | | 1 Jan 2010 | EU Limit Value |
| | Annual mean | 40 µg/m$^3$ | 31 Dec 2005 | UK Objective |
| | | | 1 Jan 2010 | EU Limit Value |
| Nitrogen Oxides ($NO_x$)* | Annual mean | 30 µg/m$^3$ | 31 December 2000 | UK Objective |
| | | | 19 July 2001 | EU Limit Value |
| Fine particulates ($PM_{10}$) Measurement technique: | Daily mean | 50 µg/m$^3$, not to be exceeded more than 35 times a year (90.4$^{th}$ percentile) | 31 Dec 2004 | UK Objective |
| | | | None specified | EU Limit Value |

| Pollutant | Averaging Period | Limit Value/Objective | Date for Compliance | Basis |
|---|---|---|---|---|
| Gravimetric | Annual mean | 40 µg/m$^3$ | 31 Dec 2004 | UK Objective |
| | | | None specified | EU Limit Value |

* For the protection of vegetation only, not applicable to human health

2.1.2. Where the limit values are met the directive also requires that member states maintain the levels of those pollutants below the limit values and shall endeavour to preserve the best ambient air quality, compatible with sustainable development.

2.1.3. Each local authority in the UK is required to assess air quality in their district against these air quality objectives. If this shows that the objective is unlikely to be met by its date for compliance, then the local authority must declare an Air Quality Management Area (AQMA) and propose actions to reduce pollutant concentrations. Action is also being taken at a national level to reduce pollutant emissions, largely through the use of vehicle emission controls to reduce emissions from the motor vehicle fleet.

2.1.4. As well as impacts on human health, some air pollutants can also have an effect on vegetation and affect their health and productivity. In relation to vehicle emissions, the pollutant of most concern is nitrogen oxides (NOx). The EU Directive and UK regulations set a limit value for NOx for the protection of vegetation of 30µg/m$^3$. This limit value does not apply in locations close to major roads and agglomerations but it is the policy of Natural Resources Wales as well as other UK Statutory Nature Conservation Agencies to apply the limit value in internationally designated conservation sites and Sites of Special Scientific Interest on a precautionary basis. However, the main parameter assessed in relation to impacts of vegetation is the deposition of nitrogen. Critical loads for the deposition of nitrogen

have been established for various habitats and are reported on the Air Pollution Information System website (www.apis.ac.uk), these represent the exposure below which there should be no significant harmful effects on sensitive elements of the ecosystem (see Table 7.2 Environmental Statement [Document 2.3.2]). It should be noted that of the critical loads presented in Table 7.2 of the Environmental Statement [Document 2.3.2] NRW clarified that the Fforestganol a Chwm Nofydd SSSI is designated for its woodland habitat rather than the valley mire habitat listed in Table 7.2. However, they also note that the alteration of habitat would not significantly alter the assessment as the critical load is similar (10-20 kgN/ha/yr for woodland) to that applied (10-15 kgN/ha/yr).

## 2.2. Vehicle Emissions

2.2.1. Pollutant emissions from vehicles are regulated as a result of European led controls. Since 1992, increasingly strict emission controls have been introduced for both cars and HDVs (Heavy Duty Vehicles). These have been introduced in six stages to date and consequently are known as Euro 1-6 controls (for cars and Light Goods Vehicles (LGVs)) and Euro I-VI (for HDVs), Euro 6/VI are the most recent controls. Each new Euro stage requires reductions in emissions of NOx and $PM_{10}$. A summary of the controls for LGVs and HDVs is shown in Tables 2 and 3 below.

**Table 2 Euro Emission standards for LGVs**

| Euro standard | Date for new type approval | NOx emissions (g/km) | | PM emissions (g/km) | |
|---|---|---|---|---|---|
| | | Petrol | Diesel | Petrol | Diesel |
| Euro 1 | 1994 | 1.7* | 1.7* | n/a | 0.25 |
| Euro 2 | 1998 | 0.7* | 1.2* | n/a | 0.17 |
| Euro 3 | 2000 | 0.21 | 0.78 | n/a | 0.1 |

| Euro standard | Date for new type approval | NOx emissions (g/km) | | PM emissions (g/km) | |
|---|---|---|---|---|---|
| | | Petrol | Diesel | Petrol | Diesel |
| Euro 4 | 2005 | 0.11 | 0.39 | n/a | 0.06 |
| Euro 5 | 2010 | 0.082 | 0.28 | 0.005 | 0.005 |
| Euro 6 | 2015[1] | 0.082 | 0.125 | 0.005 | 0.005 |

** hydrocarbons and $NO_X$ combined*

*[1] Compliance is from the 1st of September 2015, which corresponds to UK vehicle registration numbers beginning XX65.*

**Table 3 Euro Emission Standards for HDVs**

| Euro standard | Date for new type approval | NOx emissions (g/kWh) | PM emissions (g/kWh) |
|---|---|---|---|
| Euro I | 1992 | 8.0 | 0.612 (engines less than 85 kW)<br>0.36 (engines more than 85 kW) |
| Euro II | 1996 | 7.0 | 0.25<br>0.15 (1998 regulation) |
| Euro III | 2000 | 5.0 | 0.10 |
| Euro IV | 2005 | 3.5 | 0.02 |
| Euro V | 2008 | 2.0 | 0.02 |
| Euro VI | 2013[1] | 0.4 | 0.01 |

*[1] Compliance is from the 31st of December 2013, which corresponds to UK vehicle registration numbers beginning XX63 and XX14.*

2.2.2. For cars, the Euro 6 emission controls are being introduced in stages and a new test cycle will be used to determine compliance using more "on the road conditions". The date for type approval in Table 2 relates to the first stage of Euro 6 controls and further improvements will be introduced around 2017 and fully implemented by 2019. As newer vehicles enter the UK fleet average emission rates of NOx and

particulate matter will reduce and therefore there can be expected to be continuing improvement of air quality in future years.

## 2.3. Relevant Guidance

2.3.1 The principal guidance for undertaking an air quality assessment for road schemes is contained in the relevant sections of the Design Manual for Roads and Bridges Volume 11 (the "DMRB") [Document 6.1.8]. This sets out an overall assessment methodology for assessing changes in pollutant concentrations, regional air quality impacts and nitrogen deposition rates. The DMRB guidance has been supplemented by Highways Agency (now Highways England) Interim Advice Notes (IANs). Three IANs have been used in this assessment:

a) IAN 174/13 – Updated Advice for Evaluating Significant Local Air Quality Effects [Document 8.2.5]
b) IAN 170/12v3 – Updated Air Quality Advice on the Assessment of Future NOx and $NO_2$ Projections [Document 8.2.6]
c) IAN 185/15 - Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into 'speed-bands' [Document 8.2.8]

2.3.2 The IANs above have not been adopted in Wales, however in the absence of other relevant Welsh guidance, it was agreed with the Welsh Government that they would be used to inform the method of assessment.

2.3.3 Further assistance is available in the Guidance produced for local authorities for their Air Quality Management responsibilities, guidance on the technical approach and policy is given in the Defra documents LAQM.TG(09) [Document 8.2.3] and LAQM.PG(09) [Document 8.2.2] respectively. It should be noted that since the assessment was carried out these documents have been updated and are now referred to as

LAQM.TG(16) [Document 8.2.11] and LAQM.PG(16) [Document 8.2.9] but the relevant sections of the updated guidance remain the same.

2.3.4 Guidance produced by the Institute of Air Quality Management (IAQM) [Document 8.2.7] for the assessment of construction dust impacts has been used for this assessment. Full details of this approach are detailed in the Environmental Statement [Document 2.3.2].

## 2.4. Assessment of Baseline Conditions

2.4.1 The existing air quality in the study area has been assessed in three ways. Firstly a desk based review of relevant reports and air quality monitoring data has been undertaken using the following sources:

a) Local authority review and assessment reports and local air quality monitoring data;
b) The Welsh Air Quality Forum website;
c) The Defra Website;
d) The Air Pollution Information System (APIS) website; and
e) Natural Resources Wales website.

2.4.2 Secondly, a scheme specific air quality monitoring survey was undertaken by my team at 24 locations within the study area. The monitoring was carried out between September 2013 and September 2015. This monitoring was set up to establish baseline conditions and to provide information to verify the air quality model used for the assessment. I reviewed and approved each of the monitoring locations used in this exercise.

2.4.3 Finally, detailed air quality modelling of the base year (2014) was carried out both to provide further information on air quality over the study area and to allow the performance of the model to be assessed by the process of model verification.

## 2.5. Construction Impact Assessment

2.5.1 Air quality impacts during construction can occur as a result of dust emitted from the construction activities, gaseous emissions from the exhausts of construction equipment and exhaust emissions from construction traffic.

2.5.2 Construction dust impacts have been assessed using the methodology outlined in the IAQM document [Document 8.2.7] "Guidance on the assessment of dust from demolition and construction". After screening in whether an assessment is required or not, the risk of adverse dust impacts is assessed by considering the magnitude of dust emissions and the sensitivity of the area for four generic construction activities – demolition, earthworks, construction and trackout (trackout is the transport of dust from construction sites onto roads on the vehicles of vehicles). Depending on the level of risk assessed, appropriate mitigation measures are applied to reduce the risk to acceptable levels. With the application of this mitigation it is expected that there would be no significant residual effects.

2.5.3 I do not expect that emissions from on-site construction machinery would result in significant air quality impacts as the numbers involved and the emission limits applied would not result in sufficiently large emissions to result in significant air quality impacts.

2.5.4 The assessment of impacts from the exhaust emissions from construction traffic has been undertaken using a dispersion model known as ADMS-Roads. This is a commonly applied model widely used in the UK and internationally. Further details of the modelling procedure are given in the next section of this Proof of Evidence describing the methodology for operational impacts.

## 2.6. Operational Impact Assessment

2.6.1 The air quality impacts during operation have been assessed using the ADMS-Roads model. This is a dispersion model that takes as input information regarding the location of the road links and receptors to be included in the model, traffic and associated pollutant emission data for each road link, meteorological data and terrain height information.

2.6.2 The model has been run for five scenarios as follows:

a) 2014 baseline scenario
b) 2022 (opening year) without the Scheme (do-minimum)
c) 2022 with completed Scheme (do-something)
d) 2037 (future year, 15 years after opening) without the Scheme (do-minimum)
e) 2037 with completed Scheme (do-something)

2.6.3 Although NOx emissions are expected to reduce in the future there is some uncertainty regarding the rate of improvement as some vehicle emission controls have not performed as well as anticipated. Therefore a sensitivity assessment has been carried out which examines a more pessimistic scenario than that assumed in the Defra Emission Factor Toolkit normally used for air quality assessments. This sensitivity assessment has been carried out using the methodology detailed in IAN 170/12v3 [Document 8.2.6]. Two further modelling scenarios have been carried out as required by the IAN 170/12v3 methodology, this is with the 2014 baseline year traffic data but with opening and future year emission factors and background pollutant concentration data. Where I report predicted concentrations in this Proof of Evidence, they are all from the results using the more pessimistic approach following the IAN 170/12v3 methodology.

2.6.4 The study area (see Figure 7.1 of the Environmental Statement [Document 2.3.2]) has been determined by identification of those roads where either the road alignment changes or traffic flows or speeds change by more than a set threshold defined in the DMRB. Roads that meet these criteria are known as the Affected Road Network (ARN). The DMRB criteria are based on the difference in highway alignment or traffic data between the do-minimum (without Scheme) and the do-something (with Scheme) for both the opening and future year. The criteria are as follows:

a) The road alignment will change by 5 metres or more
b) Daily traffic flows (two way) will change by 1000 Annual Average Daily Traffic (AADT) or more
c) Heavy Duty Vehicle (HDV) flows (two way) will change by 200 AADT or more
d) Daily average speed (two way) will change by 10 kph or more
e) Peak hour speed will change by 20 kph or more.

2.6.5 Representative receptors are selected within 200m of the ARN to determine changes in air quality in the study area. Two types of receptors are selected, those where people are exposed (e.g. houses, nursing homes) and those where there are sensitive ecological receptors.

2.6.6 For assessment of the total regional pollutant emissions, the road network included is defined in the DMRB as roads where the difference between the do-minimum and do-something scenarios meet any of the following three thresholds:

a) Daily traffic flows (AADT, two way) will change by 10% or more
b) HDV flows (AADT, two way) will change by 10% AADT or more
c) Daily average speed (two way) will change by 20 kph or more

2.6.7 The model requires meteorological data from a station using high quality equipment equivalent to that used at Met Office monitoring sites. There are only a limited number of these sites in the UK and in this case data for the model has been obtained from the Rhoose airport meteorological station. This consisted of hourly observations for the latest year of complete data available at the time of the assessment (2014). This station was considered to be the most representative of conditions in the study area.

2.6.8 Traffic data were provided for a wide area around the Scheme for the AM, Inter-Peak, PM, and Off-Peak periods and for a full day as AADT. A vehicle class breakdown (car, light goods vehicle, rigid HGV articulated HGV, and buses/coaches) was also included. This data was taken from the Saturn traffic model, the details of which are discussed in Mr Bryan Whittaker's Proof of Evidence [WG 1.2.1].

2.6.9 Pollutant emission data was taken from IAN 185/15 [Document 8.2.8], this is based on operations within different speed bands and allows for changes in emissions owing to stop start conditions in congestion to be assessed more robustly. The use of this methodology allows the assessment of the congested conditions present during the do-minimum scenario as well as the improvement in congestion during the do-something scenario. IAN 185/15 provides emission rates for each year up to 2030, therefore for the future year scenario of 2037 the data for the year 2030 was used.

2.6.10 As I noted earlier, there is uncertainty regarding how quickly pollutant emissions will fall particularly as previous emission controls have not reduced NOx emissions as much as expected. Whilst the well-known VW emission scandal brought this matter to the public attention in 2015, it has been known since 2011 that diesel engine cars were emitting higher levels of NOx than expected. The advice in IAN 170/12v3 [Document 8.2.6] responds to this by providing more

pessimistic assumptions regarding the rate of reduction in emissions from the UK fleet. My assessment has therefore taken a relatively pessimistic assumption regarding the future improvements in emissions from the UK vehicle fleet.

2.6.11 The ADMS-Roads model has been used to predict concentrations of NOx and $PM_{10}$ arising from emissions from the road network. These have been combined with the background concentrations of these pollutants. These background concentrations have been obtained from modelling undertaken on behalf of Defra that predicted background concentrations for each kilometre square in the UK. To determine $NO_2$ concentrations, advice from LAQM.TG(09) [Document 8.2.3] has been used and a NOx to $NO_2$ calculator (v4.1) available on the Defra website has been used, which was the most up to date version of this tool at the time of assessment.

2.6.12 For assessment of the impact on ecological receptors, the nitrogen deposition rate has been calculated based on the $NO_2$ concentrations predicted by the modelling process. This has been carried out at all the designated sites in the study area.

2.6.13 Full details of the approach to the assessment have been provided in the Environmental Statement [Document 2.3.2].

# 3. Results Of Assessment

## 3.1. Existing Air Quality

3.1.1 The ARN extends into six local planning authority areas – Newport City Council, Monmouthshire County Council, Cardiff Council, Torfaen County Borough Council, South Gloucestershire Council and Forest of Dean District Council. Each of these local authorities has regularly reviewed air quality within their administrative areas as part of their air quality management duties under the Environment Act 1995. Where they consider that areas are likely to have pollutant concentrations above the relevant air quality objective level, they must declare an AQMA. Of the six authorities, only Newport City Council has designated AQMAs as a result of the existing M4 corridor. Newport City Council has also designated AQMAs within the city centre which have the potential to be affected by the Scheme. All the AQMAs designated by Newport City Council have been declared on the basis of an exceedance of the annual mean $NO_2$ objective. The locations of these AQMAs are shown in Figure 7.7 of the Environmental Statement [Document 2.3.2]. No other AQMAs designated by the other councils have the potential to be affected by the Scheme.

3.1.2 Air quality monitoring in the study area shows that, as would be expected, pollutant concentrations are elevated near to busy roads. Monitoring within the AQMAs shows that $NO_2$ concentrations were very close to the objective levels in most cases (i.e. within 5% of the objective level). The highest concentration measured within any AQMA potentially affected by the Scheme in 2014 was 46µg/$m^3$.

3.1.3 Measured $NO_2$ and $PM_{10}$ concentrations away from busy roads were well below the relevant objective levels.

3.1.4 The Defra estimated background pollutant concentrations for the study area are summarised in Table 4. This shows that background pollutant concentrations in the area meet the annual mean standards for NOx (30µg/$m^3$), $NO_2$ (40µg/$m^3$) and $PM_{10}$ (40µg/$m^3$).

**Table 4 Estimated Background Data (2014) from Defra Background Maps**

| Local authority | Pollutant | Average Concentration ($\mu g/m^3$) | Max Concentration ($\mu g/m^3$) | Min Concentration ($\mu g/m^3$) |
|---|---|---|---|---|
| Newport City Council | NOx | 17.0 | 25.9 | 11.9 |
| | $NO_2$ | 12.7 | 18.6 | 9.1 |
| | $PM_{10}$ | 13.2 | 15.1 | 12.3 |
| Monmouthshire County Council | NOx | 18.6 | 26.9 | 13.7 |
| | $NO_2$ | 13.7 | 19.1 | 10.4 |
| | $PM_{10}$ | 14.7 | 18.3 | 12.8 |

3.1.5 A comparison was made between the Defra modelled data and monitored information from background and urban background locations available from Newport City Council and the Scheme specific monitoring survey. It was found that at the majority of comparable monitoring locations, the Defra modelled data concentrations were higher. Therefore, as a pessimistic approach, the Defra values were used in the assessment.

3.1.6 Background pollutant values are expected to reduce in the future as a result of vehicle emissions and other controls. The Defra background pollutant estimates are available for future years and these have been used in the assessment. For assessment of the impact of construction traffic, the year of 2018 was used. For assessment of the operational impacts, the years 2022 and 2037 have been used for the opening and future years (note that background maps are only available up to the year 2030 and therefore 2030 information was used for the future year scenario of 2037).

3.1.7 Within the designated sites the existing nitrogen deposition rates have been reduced by 2% a year to determine the likely deposition rates in the opening and future years. This approach follows advice in the DMRB which accounts for improvements in nitrogen deposition rates with time. The IAN170/12v3 sensitivity test has also been carried out for nitrogen deposition rates at designated sites.

## 3.2. Assessment of Construction Impacts

3.2.1 The assessments of air quality impacts reported in the Environmental Statement [Document 2.3.2] and Environmental Statement Supplement [Document 2.4.4] include a comprehensive assessment of impacts during construction. Changes and updates to the Scheme discussed in the Environmental Statement Supplement December 2016 [Document 2.4.14] have no impact on the assessment of air quality impacts during construction. I have summarised the outcome of the construction phase assessment below.

3.2.2 Construction involves a number of activities that can give rise to dust and other atmospheric emissions. These include excavation and earth moving, demolition, handling of fine materials such as sand and cement, construction of bunds and stockpiles and vehicles moving over unsurfaced haul roads.

3.2.3 The assessment method considered the sensitivity of the area affected by each of the four main activities, demolition earthworks, construction and trackout (trackout is the carriage of dusty materials onto public roads from vehicles using construction sites). The sensitivities may be different as different areas will be affected by each of the activities. The sensitivity is assessed with respect to dust soiling, human health and ecological receptors. The outcome of the assessment of sensitivity of the area is shown in Table 5.

**Table 5 Assessed Sensitivity of the Area**

| **Activity** | **Sensitivity of the surrounding area** | | | |
|---|---|---|---|---|
| | **Demolition** | **Earthworks** | **Construction** | **Trackout** |
| Dust soiling | High | High | High | High |
| Human Health | Low | Low | Low | Low |
| Ecological | High | High | High | High |

3.2.4 The next step of the assessment is to determine the likely magnitude of dust emissions for each of the activities. Given the scale of the Scheme, all activities were assessed to have a “Large” dust emission

magnitude. The sensitivity of the area and the magnitude of dust emission are then used to determine the dust risk for each activity and the outcome is shown in Table 6.

**Table 6 Summary Dust Risk Assessment Outcome**

| Activity | Dust Emission Magnitude | Dust Soiling Risk | Human Health Risk | Ecological Risk |
|---|---|---|---|---|
| Demolition | Large | High risk | Medium risk | High risk |
| Earthworks | Large | High risk | Low risk | High risk |
| Construction | Large | High risk | Low risk | High risk |
| Trackout | Large | High risk | Low risk | High risk |

3.2.5 Given the assessed high risk in several cases, a range of mitigation measures are proposed in the Pre-Construction Environmental Management Plan contained within Appendix 3.2 of the Environmental Statement [Document 2.3.2]. These measures are very effective at reducing dust emissions and the IAQM guidance notes that with their application, it is not expected that the residual dust impacts would be significant. I therefore consider that dust impacts can be effectively controlled during construction with the application of the mitigation measures proposed.

3.2.6 The air quality impact of construction traffic was also considered by modelling the predicted changes in $NO_2$ and $PM_{10}$ concentrations at selected receptors representative of locations likely to be most affected. The results are reported in detail in Appendix R7.3 of the Environmental Statement Supplement September 2016 [Document 2.4.4]. The assessment contained in the Environmental Statement Supplement included the vehicles considered in the Environmental Statement (heavy goods vehicles carrying material to and from the site) as well as staff movements travelling to and from construction sites and compounds. The results show that at most of the receptors assessed the predicted changes in $NO_2$ and $PM_{10}$ concentrations were negligible. The highest predicted increases in concentration at human receptors were 1.5µg/m$^3$ and 0.3µg/m$^3$ for $NO_2$ and $PM_{10}$

respectively and would be considered a minor adverse and negligible impact at worst. No exceedances of air quality standards are predicted.

3.2.7 Examining the ecological receptors it can be seen from the results in reported in Table 7.3.2 in Appendix RS7.3 of the Environmental Statement Supplement September 2016 [Document 2.4.4] that the limit value of 30µg/$m^3$ is met at all locations except Llanmartin Meadows SSSI and the Severn Estuary. At these locations the predicted NOx concentrations are above the limit value at locations approximately 20m from the centreline of the motorway carriageway with or without the Scheme construction traffic.

3.2.8 At nearly all of the ecological receptors assessed, the predicted impact was negligible to minor adverse (i.e. an increase of less than 2 µg/$m^3$). The exception being at one receptor (Eco 75, see Figure 7.5k in Environmental Statement [Document 2.3.2]) in the Severn Estuary SPA/SAC/Ramsar where the predicted increase was 1.6µg/$m^3$ which is considered a moderate adverse impact. In the vicinity of the Severn Bridge, the habitats for which the Severn Estuary is designated are marine and intertidal habitats which are not considered by the Scheme ecologist to be sensitive to changes in oxides of nitrogen. However it should be noted that construction vehicle movements were applied to all road links in the study area of the air quality assessment to allow a worst case assessment as the routeing of construction traffic has not been finalised at this stage. It is considered that the majority of movements associated with the Scheme will take place in South Wales and therefore it is highly unlikely that all vehicles assessed would cross the Severn Bridge and therefore have an effect on the Severn Estuary SPA/SAC/Ramsar.

3.2.9 The additional HGV movements associated with the construction phase are not predicted to result in any significant changes in total nitrogen deposition at any designated sites. The maximum increase in total nitrogen deposition is 0.1 kgN/ha/yr and is predicted at the River

Usk SAC/SSSI, Redwick and Llandevenny SSSI, Nedern Brook Wetlands SSSI, Severn Estuary SPA/SAC/Ramsar and River Wye SAC/SSSI at locations up to 20m from the nearest road or the haul road which will follow the alignment of the proposed new section of motorway (See Figure 7.5a-7.5l in the Environmental Statement [Document 2.3.2]).

3.2.10 As the predicted impacts are mainly negligible and minor adverse with the exception of one receptor which at worst would be considered "moderate adverse" I do not consider that the air quality impacts during construction would be significant.

## 3.3. Assessment of Operational Impact – Human Receptors

3.3.1 As I described earlier, the assessment of operational impacts has been carried out for the opening and future years (2022 and 2037 respectively). Because of the expected continuing reduction in pollutant emissions from vehicles the highest predicted concentrations would be expected for the opening year case. For the future year predicted pollutant concentrations are lower as the reduction in emissions compensates for the increase in traffic volumes.

3.3.2 An overview of the results for the opening year (2022) is provided in Figure 7.11 of the Environmental Statement [Document 2.3.2]. As would be expected, pollutant concentrations reduce along the existing M4 corridor around Newport and increase at receptors near to the proposed new section of motorway. However, the assessment has also included receptors located away from the M4 in the centre of Newport and all of these are predicted to experience an improvement. It should also be noted that the assessment shows that predicted concentrations of $NO_2$ at receptors are lower in the opening year than the current year at all receptors even those located next to the new section of the M4. This is due to the expected reductions in pollutant emissions as a result of emission controls discussed in Section 2.2.

3.3.3 The predicted $NO_2$ concentrations at each receptor are provided in Table A1 in Appendix A of this Proof of Evidence, which replaces Table 7.3.4 of Appendix SR7.3 of the Environmental Statement Supplement December 2016 [Document 2.4.14]. This table provides results of the opening and future years using both the standard IAN 185/15 emission factors and the IAN 170/12v3 approach for calculating concentrations. It is important to note that there are no predicted exceedances of the annual mean $NO_2$ objective at any receptor and predicted concentrations are well below the 40 µg/$m^3$ objective throughout the study area. Significant improvements in air quality are predicted near to the route of the current M4 where decreases in annual mean $NO_2$ concentrations are up to 6.9µg/$m^3$ in 2022. This level of improvement is considered to be a major beneficial change.

3.3.4 $NO_2$ concentrations are predicted to increase at some locations around the proposed new section of motorway, the highest increase within 200m of the motorway is 1.5µg/$m^3$ at Fair Orchard Farm off Lighthouse Road. This is considered to be a minor adverse impact using the impact descriptors in IAN 174/13 [Document 8.2.5] as described in Para 7.3.89 of the Environmental Statement [Document 2.3.2].

3.3.5 $PM_{10}$ concentrations follow a similar trend as $NO_2$ across the study area. Predicted $PM_{10}$ concentrations at each receptor are provided in Table A2 in Appendix A of this Proof of Evidence. There are no predicted exceedances of the annual mean or daily mean $PM_{10}$ objective in either the opening or future year.

3.3.6 Generally the Scheme results in an improvement in air quality in the more populated areas and a deterioration in the less populated areas near to the proposed new section of motorway. To assess the changes in exposure I have examined all houses within 200m of the ARN and modelled the $NO_2$ concentrations for the opening year do-minimum and do-something scenarios. Using this information I have

determined the number of properties experiencing an improvement or deterioration in concentrations as 29,266 and 1,598 respectively. To provide more information on the scale of the change in air quality I have also calculated the number of properties within each magnitude of impact band (as described in IAN 174/13). This is shown in Table 7. This clearly demonstrates that the overall population exposure to $NO_2$ will reduce as a result of the Scheme.

3.3.7 Air quality in the AQMAs is predicted to improve; a minor to major beneficial impact is predicted at AQMAs adjacent to the M4 and a minor beneficial impact is predicted at AQMAs within Newport city centre. Although concentrations in the do-minimum and do-something scenarios are predicted to fall below the objective value, there are still minor to major improvements in air quality in the current AQMAs which can be expected to be the areas that are most polluted, the improvements are summarised in Table 8. As discussed above, where the Scheme results in a deterioration in air quality, pollutant concentrations are predicted to remain below the relevant air quality objectives. Therefore, no new AQMAs would need to be declared as a result of the Scheme.

**Table 7 Number of properties in each impact band descriptor**

| 4 Change in $NO_2$ concentration | 5 Magnitude Descriptor | 6 Number of Properties |
|---|---|---|
| Increase >4µg/m$^3$ | 7 Major Adverse | 8 0 |
| Increase >2 – 4 µg/m$^3$ | 9 Moderate Adverse | 10 0 |
| Increase >0.4 – 2 µg/m$^3$ | 11 Minor Adverse | 12 117 |
| Increase < 0.4 µg/m$^3$ | 13 Negligible | 14 1,481 |
| Minor Change in Concentrations <0.1µg/m$^3$ | | 15 6,436 |
| Decrease < 0.4 µg/m$^3$ | 16 Negligible | 17 16,791 |

| | | |
|---|---|---|
| Decrease > 0.4 – 2.0 µg/m$^3$ | 18 Minor Beneficial | 19 11,963 |
| Decrease >2.0- 4.0 µg/m$^3$ | 20 Moderate Beneficial | 21 500 |
| Decrease > 4.0 µg/m$^3$ | 22 Major Beneficial | 23 12 |

**Table 8 Summary of air quality changes in AQMAs**

| AQMA Name | Predicted Changes |
|---|---|
| ***AQMAs adjacent to existing M4*** | |
| Glasllwch | Predicted decrease in $NO_2$ concentrations of 4.5-5.5 µg/m$^3$ |
| Shaftesbury/Crindau | Predicted decrease in $NO_2$ concentrations of 3.5-2.1 µg/m$^3$ |
| St Julians | Predicted decrease in $NO_2$ concentrations of 2.3 µg/m$^3$ |
| Royal Oak Hill | Predicted decrease in $NO_2$ concentrations of 6.9µg/m$^3$ |
| ***AQMAs elsewhere in Newport*** | |
| Malpas Road South | Predicted decrease in $NO_2$ concentrations of 2.4 µg/m$^3$ |
| Caerleon Road | Predicated decrease in $NO_2$ concentrations of 0.4 µg/m$^3$ |
| Chepstow Road | Predicted decrease in $NO_2$ concentrations of 1.6 µg/m$^3$ |

### 3.4. Assessment of Operational Impacts – Designated Sites

3.1.4 The modelling has examined the predicted NOx concentrations at the designated sites in the study area. It should be noted that this limit value does not apply to any of the designated sites as they are within 20km of a town with more than 250,000 inhabitants. However, as a precautionary approach, the predicted concentrations have been compared with the limit value. At the majority of the designated sites the annual mean NOx limit value of 30 µg/m$^3$ would be met in the opening year of 2022 with or without the Scheme. However, at two sites, Langstone-Llanmartin SSSI (Figure 7.5g in Environmental Statement [Document 2.3.2]) and Severn Estuary SSSI/SAC/SPA/Ramsar site (Figure 7.5k of Environmental Statement [Document 2.3.2]) NOx concentrations exceed the limit value within 20m of the centreline of the motorway carriageway in the Do-Minimum scenario (i.e. without the Scheme).

3.1.5 At Langstone-Llanmartin, there is predicted to be a large improvement in NOx concentrations with a predicted reduction of 11.2µg/$m^3$ and resulting concentrations with the Scheme are well below the limit value of 30µg/$m^3$. This is a Major Beneficial impact. At the Severn Estuary there is a predicted increase in NOx concentrations of 1.5µg/$m^3$ within 10m of the centreline of the motorway carriageway; Predicted concentrations are above 30µg/$m^3$ in the do-minimum and do-something scenarios and there is predicted to be a Moderate Adverse impact. However, the Severn Estuary is designated for marine and intertidal habitats which are not considered by the Scheme ecologist to be sensitive to changes in NOx concentrations.

3.1.6 The largest increase in predicted annual mean NOx concentrations is at the Gwent Levels – Redwick and Llandevenny SSSI with an increase of 9.9µg/$m^3$. Slightly smaller increases are predicted at St Brides SSSI, Gwent levels Whitson SSSI and Gwent levels Nash & Goldcliff SSSI, but in all these cases predicted concentrations remain below the limit value of 30µg/$m^3$ at all of these designated sites.

3.1.7 My assessment has also examined nitrogen deposition rates at the designated sites. Although the Scheme would result in an increase at all the designated sites (with the exception of Langstone – Llanmartin SSSI), the modelling indicates that the critical loads will not be exceeded at any site.

3.1.8 Chapter 7 of the Environmental Statement [Document 2.3.2] and the Environmental Statement Supplement December 2016 [Document 2.4.14] outlines the predicted impacts at designated ecological receptors and determines that these are not significant following discussion with the Scheme ecologists. Further information regarding the significance of effects in relation to air quality impacts on designated sites and habitats are discussed in Proof of Evidence presented by Dr Keith Jones [WG 1.18.1].

### 3.5. Regional Air Quality Assessment

3.5.1 I have also examined the air quality impacts of the Scheme in relation to the total changes of local air pollutant emissions across the ARN. The overall changes in emissions are shown in Table 9.

**Table 9 Change in Total Mass Emission as a results of the Scheme**

| Pollutant | Changes in emissions ( Tonnes/Year) | |
|---|---|---|
| | Opening Year (2022) | Future Year (2037) |
| NOx | -206 | -185 |
| $PM_{10}$ | -20 | -24 |

3.5.2 The Scheme will result in a decrease of emissions in both the opening year and future years. The proposed new section of motorway is 2.8 km shorter than the existing route and vehicles would be operating at more efficient speeds in the do-something scenario. The savings in emissions are lower in the future year compared to the opening year as a result of the additional traffic using the road which outweighs the improvement in vehicle emissions with time.

3.5.3 Having compared the changes in emissions as a result of the Scheme with national emissions from the transport sector in Wales (See Table 10), I conclude that changes in regional emissions as a result of the Scheme are very small and are not significant.

**Table 10 Comparison with National Transport Emissions**

| Pollutant | National Emissions From the Transport Sector | Changes in emissions ( Tonnes/Year) | | Percentage Change of National Transport Emissions | |
|---|---|---|---|---|---|
| | | Opening Year (2022) | Future Year (2037) | Opening Year (2022) | Future Year (2037) |
| NOx | 22,300 | -206 | -185 | -0.9% | -0.9% |
| $PM_{10}$ | 1,380 | -20 | -24 | -1.4% | -1.7% |

## 3.6. Evaluation of Overall Significance

3.6.1 To evaluate the overall significance of the air quality changes I have followed the advice in IAN 174/13, this considers five different issues:

a) Is there a risk that environmental standards will be breached?
b) Will there be a large change in environmental conditions?
c) Will the effect continue for a long time and will many people be affected?
d) Will it be difficult to avoid, reduce or repair or compensate for the effect?
e) Is there a risk that designated sites, areas or features will be affected?

3.6.2 My conclusions in response to each of these questions are summarised in below. The assessment methodology outlined in IAN 174/13 will only result in significant beneficial impacts if an exceedance is predicted in the do-minimum scenario and a Scheme results in an improvement in concentrations below the objective in the do-something scenario, which is not the case in this instance. However, it is clear that major beneficial impacts do occur along the existing M4 corridor as a result of the Scheme.

**Table 11 Evaluation of Significance**

| Criteria | Response |
|---|---|
| Is there a risk that environmental standards will be breached | The modelling shows that there is not a risk of breach of $NO_2$ and $PM_{10}$ standards. The environmental standard for annual mean NOx concentrations does not strictly apply in this instance, however the effect of the Scheme on designated sites is discussed below. |
| Will there be a large change in environmental conditions | There are no increases in pollutant concentrations that would be considered to be large. There are some decreases in concentrations that would be considered to be large (i.e. beneficial changes) in $NO_2$ concentrations. |
| Will the effect continue for a long time and will many people be affected? | The effects of the Scheme would be permanent although because of the continuing improvements in emission controls it can be expected that pollutant concentrations will continue to fall in the future |
| Will it be difficult to avoid, reduce or repair or compensate for the effect? | The Scheme is not predicted to have any adverse effects during the operational phase that require mitigation. |
| Is there a risk that designated sites, areas or features will be affected | There are some increases in NOx concentrations at some designated sites that are significant however, there is no exceedance of critical loads. |

3.6.3 Having considered each of the criteria I have concluded that the Scheme would not have a significant impact on air quality.

# 4. Response to Natural Resources Wales Comments Regarding Air Quality

4.1 Following submission of the Environmental Statement [Document 2.3.2], Natural Resources Wales' response was received outlining clarification questions and comments regarding the air quality assessment. An email was provided to Natural Resources Wales outlining our response to their queries, it was considered that the only comment which required further modelling and assessment to be undertaken related to inter-annual variability testing of the meteorological data used in the air quality assessment. The results of this testing are presented in Appendix SS7.1 of the Environmental Statement Supplement December 2016 [Document 2.4.14].

4.2 Following further discussion with Natural Resources Wales it is considered that those clarification questions and comments provided on the Environmental Statement are now closed out. Email correspondence with Natural Resources Wales on air quality is provided in Appendix B of this Proof of Evidence.

# 5. Response to Objections Concerned About an Increase in Air Pollution or Dust During Construction (Objs 15, 96, 229, 254)

5.2 The risks of adverse impacts during construction have been assessed using an approach developed by the Institute of Air Quality Management (IAQM) [Document 8.2.7]. This is an independent body representing air quality professionals. The approach assesses the level of risk from dust impacts and then suggests mitigation measures to reduce the risk to an acceptable level.

5.3 The guidance from the IAQM notes that with the application of appropriate mitigation measures there are unlikely to be significant adverse impacts.

5.4 The mitigation measures proposed are included in the Pre-Construction Environmental Management Plan (Appendix 3.2 of Volume 3 of the Environmental Statement) [Document 2.3.2]. These measures are commonly applied at construction sites in the UK, these are robust measures and are simple to apply – for instance watering of haul roads and enclosure of dust sources. They have been shown to be highly effective and easy to monitor. A Register of Environmental Commitments has been populated with these measures and is included in Appendix R18.1 of the Environmental Statement Supplement [Document 2.4.4] and this is discussed further in Dr Peter Ireland's Proof of Evidence [WG 1.7.1].

5.5 With the application of the mitigation measures in the Pre-Construction Environmental Management Plan no significant adverse impacts would be expected.

# 6. Response to Objections Generally Concerned about an Increase in Air Pollution During Operation (Objs 4, 5, 28, 34, 45, 91, 102, 106, 122, 126,139, 150,153, 165, 196, 197, 202, 203, 208, 216, 243, 261, 226, 281, 286, 288, 294, 299)

6.1 The air quality impacts have been assessed following best practice using an approach detailed in the DMRB and with the latest advice from the Welsh Government that sets out that we should use the additional Interim Advice Notes (IANs) from Highways England. The assessment has looked at the baseline year (2014) and that with and without the Scheme in the opening year 2022 and 15 years after opening (2037).

6.2 Air quality has improved and is expected to continue to improve as a result of various stages of emissions controls being introduced as a result of European Directives. There are further improvements to emission control that are entering the vehicle fleet now and will continue to reduce pollutant emissions. As a result, air quality is expected to continue to improve in the future and nitrogen dioxide concentrations are expected to meet the air quality objectives by the opening year with or without the Scheme.

6.3 The population exposure to pollutants will decrease in the future as a result of the Scheme. This is because the Scheme reduces traffic in the more populated areas of Newport where existing air quality is poorer. Near to the proposed new section of motorway pollutant levels will inevitably increase, but these will remain well within the EU limits and concentrations will decrease in the future as the improvements in emission controls reduce pollutant emissions further.

6.4 Table **7** of my Proof of Evidence provides the details of the numbers of properties experiencing an increase and decrease in pollutant levels.

6.5 The air quality in all the current AQMAs affected by the Scheme, including within the city centre and adjacent to the M4, will improve as a result of the Scheme.

6.6 Air quality has been examined at the designed sites in the area. Strictly the air quality standard for NOx for the protection of vegetation does not apply in this area as it is within 20km of a town with a population of more than 250,000. However, this standard is met at all designated sites with one exception, where there is a small increase in NOx concentrations of 0.5µg/$m^3$. At all designated sites except the Severn Estuary, total NOx concentrations will be below the limit value of 30µg/$m^3$. At the Severn Estuary NOx concentrations are already greater than 30µg/$m^3$ without the Scheme in place and as this is a marine habitat, it does not include any vegetation sensitive to changes in NOx concentrations. Nitrogen deposition rates would not exceed the critical loads and the increases are below 5%.

6.7 There is not predicted to be a risk of breaching relevant air quality standards and the Scheme results in an improvement in air quality in the most polluted areas.

6.8 Following IAN174/13, there is not predicted to be a significant adverse impact on air quality and the majority of the local population would experience an improvement in air quality.

# 7. Monitoring During Construction (Objection 22)

7.1 Monitoring will be a feature of the Pre-Construction Environmental Management Plan (Appendix 3.2 of the Environmental Statement) [Document 2.3.2]. Depending on the risk of adverse dust impacts, monitoring could vary from visual methods to verify the application of the required dust control measures to fully instrumented approaches. It is expected that visual inspection would be appropriate for most areas. This is included in the Register of Environmental Commitments at Appendix R18.1 of the Environmental Statement Supplement [Document 2.4.4] and discussed in Dr Peter Ireland's Proof of Evidence [WG 1.7.1]

# 8. Friends of the Earth (Objection 125)

8.1 The air quality limit values are met in the opening year (2022) with or without the Scheme but the Scheme reduces pollutant exposure in the most populated areas by relocating traffic. As discussed above, 29,266 properties are predicted to experience an improvement in air quality as a result of the Scheme compared with 1,598 which experience a deterioration in air quality. The scale of change and impact descriptor associated with modelled concentrations at all receptors is shown in Table 7 of this Proof of Evidence. Although it has been shown that air quality limit values and objectives will be met without the Scheme in place, one of the objectives of the Scheme is "Improved air quality in areas next to the M4 around Newport", which does include AQMAs, however the objective is not to ensure air quality limit values or objectives are met. As can be seen from the above, the number of properties which would experience improved air quality is much larger than the number of properties which would experience a deterioration. Therefore the Scheme reduces population exposure to areas of elevated pollutant concentrations. In addition, this improvement assists in meeting a further requirement of the European Air Quality Directive which is to improve air quality even when limit values are met.

8.2 The Scheme does meet the objective to improve air quality in areas next to the M4 around Newport and contributes to overall improvements in air quality which will complement other measures to be taken by the local authorities to meet the relevant air quality objectives. The assessment shows that the Scheme would have a beneficial effect on Air Quality Management Areas within Newport City Centre and at those adjacent to the existing M4 corridor (see Figure 7.7 in Environmental Statement). The Friends of the Earth objection considers that improvements in AQMAs result in improvements of air

quality at a limited number of properties. It is agreed that the AQMAs affected by the Scheme have relatively few properties but as shown in Table **12** the Scheme results in an improvement in concentrations at 100% of these properties. In addition, as shown above and in Table 7 of my Proof of Evidence significantly more properties experience an improvement in air quality across the entire study area than a deterioration.

**Table 12 Number of Properties Located in** AQMAs Affected by the **Scheme**

| **AQMA Name** | **Total Number of Properties** | **Improvement/Deterioration** |
|---|---|---|
| ***AQMAs adjacent to existing M4*** | | |
| Glasllwch | 2 | All properties Improve |
| Shaftesbury/Crindau | 4 | All properties Improve |
| St Julians | 2 | All properties Improve |
| Royal Oak Hill | 1 | All properties Improve |
| ***AQMAs elsewhere in Newport*** | | |
| Malpas Road South | 34 | All properties Improve |
| Caerleon Road | 5 | All properties Improve |
| Chepstow Road | 18 | All properties Improve |

8.3 Model verification/correction has been carried out in an appropriate manner and the assessment recognises and discusses the underprediction at two receptors in para 7.3.74 of the Environmental Statement [Document 2.3.2]. These are locations that are not affected by the Scheme but their inclusion in the model verification exercise results in better model performance. The annual mean $NO_2$ concentrations presented for Scheme specific monitoring locations in the objection response have been taken incorrectly from Table 7.2.8 in Appendix 7.2 of Volume 3 of the Environmental Statement [Document 2.3.2] as the uncorrected results. The bias-adjusted monitored annual mean $NO_2$ concentrations for Spytty Lane and

Lampost Badminton Road show concentrations are below the annual mean $NO_2$ objective.

## 9. Lifespan Shortened by Vehicle Fumes (Objection 139)

9.1 Air quality is expected to improve in the future with or without the Scheme. The Scheme also results in an overall reduction in population exposure to air pollutants and therefore would have an overall positive impact on health in the area.

## 10. Scheme Spreads out Air Pollution (Objection 144)

10.1 The overall emissions,of local air pollutants reduces as a result of the Scheme in 2022. Air quality will be improved in the areas with the poorest air quality including those where AQMAs have been declared. Pollutant concentrations do increase near to the proposed new section of motorway but remain well within relevant air quality standards and do not require any AQMAs to be declared. However, these increases in concentrations have to be considered alongside the significant improvements in pollutant concentrations seen in more populated areas.

## 11. Potential Dust Impacts From Stone Extraction (Objection 241)

11.1 The temporary use of the south of the holding (Upper Grange Farm), labelled 16/3s in the CPO, and adjoining plots in others ownership is for top soil storage and access only. No stone extraction is proposed for land adjacent to the property from which the objection has been received. Mitigation measures are provided in the Pre-Construction Environmental Management Plan (Appendix 3.2. of the Environmental Statement [Document 2.3.2]) to minimise dust impacts associated with soil storage.

# 12. Adverse Impacts On Trees (Objection 271)

12.1 An assessment of construction dust impacts was undertaken as part of the air quality assessment and is included in Chapter 7 of the Environmental Statement [Document 2.3.2]. The outcome of this assessment provided recommendations for mitigation measures to be included in the Pre-Construction Environmental Management Plan (Appendix 3.2 of the Environmental Statement [Document 2.3.2]) to minimise impacts from dust. This assessment covered both human and ecological receptors and therefore mitigation would be applied even in those areas of the Scheme which are not populated but where designated ecological receptors exist. The IAQM guidance [Document 8.2.7] for the assessment of dust from demolition and construction which has been used as part of the assessment states that ecological receptors have the potential to be affected if they lie within 50m of dust generating activities. Notwithstanding the areas of ancient woodland which are directly lost or damaged as a result of construction activities, the majority of designated ancient woodland sites lie more than 50m from dust generating activities. In addition, mitigation measures included in the pre-Construction Environmental Management Plan are designed to suppress dust at the source reducing potential dispersion off site therefore no significant impacts are anticipated at designated ancient woodland sites, or any other ecological receptor, as a result of dust during construction.

12.2 The response provided by the Woodland Trust noted that one of the primary pollutant from vehicle emission is oxides of nitrogen (NOx) and that increasing nitrogen can alter the outcome of competitive interactions, changing the character of woodland vegetation, in terms of species competition. An assessment of NOx concentrations at designated sites (SSSI, SAC ,SPA and Ramsar) across the study area as required by the DMRB [Document 6.1.8] ) is included in the

Chapter 7 of the Environmental Statement. There are air quality objectives and EU limit values for NOx for the protection of vegetation, however these do not strictly apply in the study area given the mixed urban and industrial nature of the area. The assessment concluded that at designated sites adjacent to the proposed new section of motorway there are no significant impacts from changes in NOx concentrations. The same conclusion for other designated sites as discussed above can be applied to ancient woodland sites within 200m of the proposed new section of motorway.

## 13. Conclusions

13.1 I have supervised the air quality assessment for the proposed new section of motorway around Newport. This assessment has followed all the relevant advice and used a methodology widely applied to similar road schemes in the UK. This assessment has examined the air quality impacts during the construction and operational phases of the Scheme. I have considered the impacts both on human and ecological receptors in the assessment.

13.2 The assessment has initially examined the existing air quality in the study area. There are several locations where concentrations of nitrogen dioxide exceed the air quality objective of 40µg/$m^3$ and consequently these areas have been designated as Air Quality Management Areas. Pollutant concentrations are expected to reduce in the future (with or without the Scheme) as a result of improvements in emission controls for vehicle exhausts. By the opening year, it is not expected that the air quality objectives would be exceeded.

13.3 There are two ecological sites where existing NOx concentrations currently exceed the limit value of 30µg/$m^3$ close to the motorway, both locations are affected by the existing M4 corridor.

13.4 During construction, emissions of dust and other pollutants would be controlled by mitigation measures that are detailed in the Pre-Construction Environmental Management Plan. These measures have been designed to reduce the impacts from construction so that they are not significant. The assessment also examined the air quality impacts from exhaust emissions from construction traffic. At most receptors assessed the impacts were negligible and the impacts were minor adverse at worst for changes in nitrogen dioxide concentrations. These changes were considered not to be significant.

13.5 During operation the Scheme will move traffic away from the more populated areas of Newport and consequently the population exposure to air pollutants will inevitably reduce. Air quality would generally improve in the more populated areas reducing overall exposure to air pollutants but inevitably reduce in areas alongside the proposed new section of motorway. However, no exceedance of air quality standards would be expected and air quality would particularly improve in the areas that are currently the most polluted including the Air Quality Management Areas. The population exposure to pollutants will reduce considerably with more than 29,266 properties experiencing a reduction in pollutant concentrations (compared with less than 1,598 experiencing an increase).

13.6 I have also examined the operational impacts on ecological receptors and concluded that the changes in NOx concentrations and nitrogen deposition are small and considered not to be significant. At one SSSI there is a major beneficial impact from the Scheme.

13.7 I have examined and addressed the objections which relate to air quality. No issues have been raised that affect the conclusions of the assessment in the Environmental Statement [Document 2.3.2].

13.8 My Proof of Evidence includes all facts which I regard as being relevant to the opinions which I have expressed and the Public Local Inquiry's attention has been drawn to any matter which would affect the validity of that opinion.

13.9 I believe the facts which I have stated in this Proof of Evidence are true and that the opinions expressed are correct.

13.10 I understand my duty to the Public Local Inquiry to assist it with matters within my expertise and I believe that I have complied with that duty.

## Appendix A - Operational Air Quality Impacts

### Table A1: Annual Mean $NO_2$ Concentrations at Human Health Receptors Assessed

| ID | | IAN 185/15 | | | IAN 170/12 | | | IAN 185/15 | | | IAN 170/12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2014 | 2022 | | | 2022 | | | 2037 | | | 2037 | | |
| | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| HH1 | 22.8 | 15.6 | 15.7 | Negligible | 17.3 | 17.4 | Negligible | 14.3 | 14.6 | Negligible | 16.0 | 16.3 | Negligible |
| HH2 | 23.0 | 16.1 | 16.3 | Negligible | 17.4 | 17.7 | Negligible | 14.7 | 14.9 | Negligible | 16.0 | 16.3 | Negligible |
| HH3 | 25.4 | 17.4 | 17.9 | Minor Adverse | 19.2 | 19.8 | Minor Adverse | 15.9 | 16.3 | Negligible | 17.9 | 18.4 | Minor Adverse |
| HH4 | 20.5 | 14.9 | 15.3 | Negligible | 15.4 | 15.9 | Minor Adverse | 13.7 | 14.2 | Minor Adverse | 14.0 | 14.5 | Minor Adverse |
| HH5 | 23.5 | 16.4 | 16.4 | Negligible | 17.7 | 17.8 | Negligible | 15.0 | 15.1 | Negligible | 16.4 | 16.4 | Negligible |
| HH6 | 23.3 | 16.7 | 16.6 | Negligible | 17.4 | 17.3 | Negligible | 15.3 | 15.1 | Negligible | 16.0 | 15.9 | Negligible |
| HH7 | 26.2 | 16.6 | 16.4 | Negligible | 18.8 | 18.7 | Negligible | 15.1 | 15.0 | Negligible | 17.8 | 17.7 | Negligible |
| HH8 | 26.5 | 20.7 | 20.5 | Negligible | 20.7 | 20.5 | Negligible | 20.1 | 19.9 | Negligible | 20.1 | 19.9 | Negligible |
| HH9 | 35.0 | 23.3 | 19.6 | Moderate Beneficial | 28.0 | 23.5 | Major Beneficial | 20.8 | 17.7 | Moderate Beneficial | 26.5 | 22.6 | Moderate Beneficial |
| HH10 | 41.4 | 26.1 | 21.6 | Major Beneficial | 32.3 | 26.8 | Major Beneficial | 23.0 | 19.4 | Moderate Beneficial | 30.9 | 26.1 | Major Beneficial |
| HH11 | 28.1 | 20.6 | 20.1 | Minor | 21.5 | 21.0 | Minor | 19.2 | 18.8 | Negligible | 19.7 | 19.3 | Negligible |

| ID | | IAN 185/15 | | | IAN 170/12 | | | IAN 185/15 | | | IAN 170/12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2014 | 2022 | | | 2022 | | | 2037 | | | 2037 | | |
| | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| | | | | Beneficial | | | Beneficial | | | | | | |
| HH12 | 15.5 | 12.4 | 13.0 | Minor Adverse | 12.4 | 13.0 | Minor Adverse | 12.1 | 12.6 | Minor Adverse | 12.1 | 12.6 | Minor Adverse |
| HH13 | 15.5 | 12.4 | 13.9 | Minor Adverse | 12.4 | 13.9 | Minor Adverse | 12.1 | 13.3 | Minor Adverse | 12.1 | 13.3 | Minor Adverse |
| HH14 | 32.3 | 21.3 | 19.4 | Minor Beneficial | 24.6 | 22.5 | Moderate Beneficial | 18.9 | 17.8 | Minor Beneficial | 22.8 | 21.4 | Minor Beneficial |
| HH15 | 38.9 | 24.7 | 21.8 | Moderate Beneficial | 29.8 | 26.3 | Moderate Beneficial | 21.6 | 19.7 | Minor Beneficial | 27.9 | 25.4 | Moderate Beneficial |
| HH16 | 39.4 | 29.2 | 27.7 | Minor Beneficial | 29.8 | 28.2 | Minor Beneficial | 27.3 | 26.0 | Minor Beneficial | 27.5 | 26.1 | Minor Beneficial |
| HH17 | 26.0 | 19.9 | 19.6 | Negligible | 19.9 | 19.6 | Negligible | 19.0 | 18.8 | Negligible | 19.0 | 18.8 | Negligible |
| HH18 | 35.1 | 23.9 | 22.1 | Minor Beneficial | 26.9 | 24.9 | Minor Beneficial | 21.5 | 20.3 | Minor Beneficial | 24.8 | 23.4 | Minor Beneficial |
| HH19 | 34.5 | 24.2 | 23.8 | Negligible | 26.5 | 26.0 | Minor Beneficial | 21.9 | 21.5 | Negligible | 24.7 | 24.3 | Negligible |
| HH20 | 42.0 | 27.9 | 25.9 | Minor Beneficial | 32.5 | 30.1 | Moderate Beneficial | 24.8 | 23.3 | Minor Beneficial | 30.5 | 28.7 | Minor Beneficial |

| ID | | IAN 185/15 | | | IAN 170/12 | | | IAN 185/15 | | | IAN 170/12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2014 | 2022 | | | 2022 | | | 2037 | | | 2037 | | |
| | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| HH21 | 43.0 | 28.6 | 26.6 | Minor Beneficial | 33.4 | 31.1 | Moderate Beneficial | 25.3 | 23.9 | Minor Beneficial | 31.4 | 29.6 | Minor Beneficial |
| HH22 | 32.3 | 22.7 | 22.2 | Minor Beneficial | 24.5 | 24.0 | Minor Beneficial | 20.6 | 20.2 | Minor Beneficial | 22.6 | 22.2 | Minor Beneficial |
| HH23 | 29.4 | 21.2 | 19.6 | Minor Beneficial | 22.3 | 20.7 | Minor Beneficial | 19.5 | 18.4 | Minor Beneficial | 20.5 | 19.4 | Minor Beneficial |
| HH24 | 35.2 | 25.1 | 24.5 | Minor Beneficial | 26.5 | 25.9 | Minor Beneficial | 23.0 | 22.3 | Minor Beneficial | 24.5 | 23.8 | Minor Beneficial |
| HH25 | 30.0 | 22.4 | 22.0 | Negligible | 22.5 | 22.1 | Negligible | 20.9 | 20.5 | Negligible | 20.9 | 20.5 | Negligible |
| HH26 | 35.4 | 24.3 | 20.5 | Moderate Beneficial | 28.1 | 23.7 | Major Beneficial | 22.1 | 19.3 | Moderate Beneficial | 26.3 | 23.0 | Moderate Beneficial |
| HH27 | 25.6 | 18.5 | 18.1 | Negligible | 19.3 | 19.0 | Negligible | 17.4 | 17.1 | Negligible | 17.6 | 17.4 | Negligible |
| HH28 | 27.0 | 22.7 | 22.7 | Negligible | 22.7 | 22.7 | Negligible | 22.6 | 22.6 | Negligible | 22.6 | 22.6 | Negligible |
| HH29 | 37.2 | 25.3 | 20.8 | Major Beneficial | 29.9 | 24.6 | Major Beneficial | 23.0 | 19.7 | Moderate Beneficial | 28.1 | 24.1 | Moderate Beneficial |
| HH30 | 15.8 | 12.8 | 13.7 | Minor Adverse | 12.8 | 13.7 | Minor Adverse | 12.5 | 13.3 | Minor Adverse | 12.5 | 13.3 | Minor Adverse |
| HH31 | 26.5 | 20.6 | 20.3 | Negligible | 20.6 | 20.3 | Negligible | 19.6 | 19.5 | Negligible | 19.6 | 19.5 | Negligible |

| ID | | IAN 185/15 | | | IAN 170/12 | | | IAN 185/15 | | | IAN 170/12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2014 | 2022 | | | 2022 | | | 2037 | | | 2037 | | |
| | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| HH32 | 39.3 | 26.0 | 20.4 | Major Beneficial | 32.1 | 25.2 | Major Beneficial | 23.2 | 19.2 | Moderate Beneficial | 30.4 | 25.2 | Major Beneficial |
| HH33 | 13.9 | 10.9 | 11.5 | Minor Adverse | 10.9 | 11.5 | Minor Adverse | 10.6 | 11.1 | Minor Adverse | 10.6 | 11.1 | Minor Adverse |
| HH34 | 22.6 | 16.6 | 16.2 | Minor Beneficial | 17.2 | 16.7 | Minor Beneficial | 15.5 | 15.2 | Negligible | 15.7 | 15.3 | Negligible |
| HH35 | 21.4 | 15.4 | 14.8 | Minor Beneficial | 16.1 | 15.4 | Minor Beneficial | 14.4 | 13.9 | Minor Beneficial | 14.8 | 14.2 | Minor Beneficial |
| HH36 | 31.4 | 20.5 | 16.5 | Moderate Beneficial | 24.8 | 20.0 | Major Beneficial | 18.5 | 15.5 | Moderate Beneficial | 23.2 | 19.4 | Moderate Beneficial |
| HH37 | 11.3 | 8.8 | 9.6 | Minor Adverse | 8.8 | 9.6 | Minor Adverse | 8.5 | 9.2 | Minor Adverse | 8.5 | 9.2 | Minor Adverse |
| HH38 | 21.8 | 14.4 | 12.0 | Moderate Beneficial | 17.1 | 14.2 | Moderate Beneficial | 13.2 | 11.3 | Minor Beneficial | 15.9 | 13.6 | Moderate Beneficial |
| HH39 | 14.5 | 11.4 | 11.8 | Negligible | 11.4 | 11.8 | Negligible | 11.2 | 11.6 | Negligible | 11.2 | 11.6 | Negligible |
| HH40 | 14.5 | 11.4 | 12.1 | Minor Adverse | 11.4 | 12.1 | Minor Adverse | 11.2 | 11.8 | Minor Adverse | 11.2 | 11.8 | Minor Adverse |
| HH41 | 15.8 | 12.4 | 13.2 | Minor Adverse | 12.4 | 13.2 | Minor Adverse | 12.0 | 12.7 | Minor Adverse | 12.0 | 12.7 | Minor |

| ID | | IAN 185/15 | | | IAN 170/12 | | | IAN 185/15 | | | IAN 170/12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2014 | 2022 | | | 2022 | | | 2037 | | | 2037 | | |
| | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| | | | | | | | | | | | | | Adverse |
| HH42 | 16.0 | 12.6 | 13.1 | Minor Adverse | 12.6 | 13.1 | Minor Adverse | 12.1 | 12.6 | Minor Adverse | 12.1 | 12.6 | Minor Adverse |
| HH43 | 16.6 | 12.7 | 13.2 | Minor Adverse | 12.7 | 13.2 | Minor Adverse | 12.4 | 12.8 | Negligible | 12.4 | 12.8 | Negligible |
| HH44 | 16.9 | 12.8 | 13.7 | Minor Adverse | 12.8 | 13.7 | Minor Adverse | 12.5 | 13.2 | Minor Adverse | 12.5 | 13.2 | Minor Adverse |
| HH45 | 17.9 | 13.3 | 14.1 | Minor Adverse | 13.6 | 14.4 | Minor Adverse | 12.9 | 13.5 | Minor Adverse | 12.9 | 13.5 | Minor Adverse |
| HH46 | 23.7 | 16.2 | 15.4 | Minor Beneficial | 18.6 | 17.7 | Minor Beneficial | 15.7 | 14.7 | Minor Beneficial | 17.8 | 16.7 | Minor Beneficial |
| HH47 | 15.2 | 10.9 | 11.0 | Negligible | 11.5 | 11.6 | Negligible | 10.3 | 10.4 | Negligible | 10.5 | 10.6 | Negligible |
| HH48 | 15.6 | 11.7 | 11.6 | Negligible | 11.7 | 11.6 | Negligible | 11.2 | 11.1 | Negligible | 11.2 | 11.1 | Negligible |
| HH49 | 15.6 | 11.4 | 11.9 | Minor Adverse | 11.8 | 12.3 | Minor Adverse | 10.7 | 11.2 | Minor Adverse | 10.7 | 11.2 | Minor Adverse |
| HH50 | 17.4 | 12.4 | 13.3 | Minor Adverse | 13.3 | 14.2 | Minor Adverse | 11.5 | 12.6 | Minor Adverse | 12.2 | 13.3 | Minor Adverse |
| HH51 | 17.9 | 12.6 | 13.9 | Minor Adverse | 13.5 | 14.9 | Minor Adverse | 11.6 | 13.0 | Minor Adverse | 12.4 | 13.8 | Minor Adverse |

| ID | | IAN 185/15 | | | IAN 170/12 | | | IAN 185/15 | | | IAN 170/12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2014 | 2022 | | | 2022 | | | 2037 | | | 2037 | | |
| | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| HH52 | 16.8 | 12.0 | 12.6 | Minor Adverse | 12.7 | 13.2 | Minor Adverse | 11.2 | 11.9 | Minor Adverse | 11.6 | 12.3 | Minor Adverse |

## Table A2: Annual Mean $PM_{10}$ Concentrations at Human Health Receptors Assessed

| ID | 2014 | 2022 | | | 2037 | | |
|---|---|---|---|---|---|---|---|
| | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| HH1 | 17.1 | 16.1 | 16.1 | Negligible | 16.2 | 16.2 | Negligible |
| HH2 | 16.5 | 15.4 | 15.4 | Negligible | 15.5 | 15.5 | Negligible |
| HH3 | 18.7 | 17.7 | 17.7 | Negligible | 17.9 | 17.9 | Negligible |
| HH4 | 18.1 | 17.1 | 17.2 | Negligible | 17.2 | 17.3 | Negligible |
| HH5 | 18.4 | 17.4 | 17.4 | Negligible | 17.5 | 17.5 | Negligible |
| HH6 | 16.3 | 15.1 | 15.1 | Negligible | 15.3 | 15.2 | Negligible |
| HH7 | 18.1 | 17.0 | 17.0 | Negligible | 17.2 | 17.2 | Negligible |
| HH8 | 18.7 | 17.6 | 17.6 | Negligible | 17.8 | 17.7 | Negligible |
| HH9 | 19.1 | 17.8 | 17.3 | Minor Beneficial | 18.0 | 17.5 | Minor Beneficial |
| HH10 | 19.9 | 18.3 | 17.6 | Minor Beneficial | 18.6 | 17.8 | Minor Beneficial |
| HH11 | 18.9 | 17.8 | 17.7 | Negligible | 18.2 | 18.0 | Negligible |

| ID | 2014 | 2022 | | | 2037 | | |
|---|---|---|---|---|---|---|---|
| | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| HH12 | 14.4 | 13.5 | 13.6 | Negligible | 13.5 | 13.6 | Negligible |
| HH13 | 14.4 | 13.6 | 13.8 | Negligible | 13.5 | 13.8 | Negligible |
| HH14 | 19.0 | 17.8 | 17.5 | Negligible | 18.0 | 17.7 | Negligible |
| HH15 | 19.7 | 18.3 | 17.8 | Minor Beneficial | 18.6 | 18.0 | Minor Beneficial |
| HH16 | 17.5 | 16.3 | 16.2 | Negligible | 16.5 | 16.3 | Negligible |
| HH17 | 17.3 | 16.3 | 16.2 | Negligible | 16.5 | 16.4 | Negligible |
| HH18 | 19.0 | 17.7 | 17.6 | Negligible | 17.9 | 17.7 | Negligible |
| HH19 | 18.6 | 17.5 | 17.4 | Negligible | 17.6 | 17.6 | Negligible |
| HH20 | 19.9 | 18.5 | 18.1 | Negligible | 18.7 | 18.4 | Negligible |
| HH21 | 19.9 | 18.5 | 18.2 | Negligible | 18.8 | 18.4 | Negligible |
| HH22 | 19.2 | 17.9 | 17.8 | Negligible | 18.1 | 18.0 | Negligible |
| HH23 | 18.6 | 17.5 | 17.3 | Negligible | 17.6 | 17.4 | Negligible |
| HH24 | 16.9 | 15.7 | 15.7 | Negligible | 15.8 | 15.7 | Negligible |
| HH25 | 16.6 | 15.4 | 15.4 | Negligible | 15.5 | 15.5 | Negligible |
| HH26 | 18.2 | 16.9 | 16.3 | Minor Beneficial | 17.1 | 16.5 | Minor Beneficial |
| HH27 | 16.9 | 15.8 | 15.7 | Negligible | 15.9 | 15.8 | Negligible |
| HH28 | 18.6 | 17.5 | 17.5 | Negligible | 17.8 | 17.8 | Negligible |
| HH29 | 18.1 | 16.8 | 16.1 | Minor Beneficial | 17.0 | 16.3 | Minor Beneficial |
| HH30 | 14.8 | 13.9 | 14.0 | Negligible | 13.9 | 14.0 | Negligible |

| ID | 2014 | 2022 | | | 2037 | | |
|---|---|---|---|---|---|---|---|
| | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| HH31 | 16.5 | 15.5 | 15.4 | Negligible | 15.6 | 15.5 | Negligible |
| HH32 | 18.4 | 17.0 | 16.1 | Minor Beneficial | 17.2 | 16.4 | Minor Beneficial |
| HH33 | 14.2 | 13.3 | 13.4 | Negligible | 13.3 | 13.4 | Negligible |
| HH34 | 15.8 | 14.8 | 14.7 | Negligible | 14.9 | 14.8 | Negligible |
| HH35 | 18.6 | 17.5 | 17.4 | Negligible | 17.6 | 17.5 | Negligible |
| HH36 | 19.6 | 18.4 | 17.7 | Minor Beneficial | 18.6 | 17.8 | Minor Beneficial |
| HH37 | 13.6 | 12.8 | 12.9 | Negligible | 12.7 | 12.8 | Negligible |
| HH38 | 17.2 | 16.2 | 15.8 | Negligible | 16.2 | 15.8 | Minor Beneficial |
| HH39 | 13.8 | 12.9 | 12.9 | Negligible | 12.8 | 12.9 | Negligible |
| HH40 | 13.8 | 12.9 | 13.0 | Negligible | 12.8 | 12.9 | Negligible |
| HH41 | 15.0 | 14.1 | 14.2 | Negligible | 14.1 | 14.2 | Negligible |
| HH42 | 15.0 | 14.1 | 14.2 | Negligible | 14.1 | 14.2 | Negligible |
| HH43 | 16.4 | 15.5 | 15.6 | Negligible | 15.5 | 15.6 | Negligible |
| HH44 | 16.4 | 15.5 | 15.6 | Negligible | 15.5 | 15.7 | Negligible |
| HH45 | 16.5 | 15.6 | 15.7 | Negligible | 15.6 | 15.8 | Negligible |
| HH46 | 17.1 | 16.0 | 15.9 | Negligible | 16.2 | 16.0 | Negligible |
| HH47 | 14.3 | 13.3 | 13.4 | Negligible | 13.3 | 13.3 | Negligible |
| HH48 | 16.5 | 15.6 | 15.6 | Negligible | 15.6 | 15.6 | Negligible |
| HH49 | 17.3 | 16.4 | 16.4 | Negligible | 16.4 | 16.5 | Negligible |

| ID | 2014 | 2022 | | | 2037 | | |
|---|---|---|---|---|---|---|---|
| | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| HH50 | 17.5 | 16.5 | 16.6 | Negligible | 16.6 | 16.7 | Negligible |
| HH51 | 17.6 | 16.6 | 16.7 | Negligible | 16.6 | 16.8 | Negligible |
| HH52 | 17.4 | 16.5 | 16.6 | Negligible | 16.5 | 16.6 | Negligible |

## Table A3: Annual Mean NOx Concentrations at Assessed Designated Sites

| ID | Designated Site | 2014 | 2022 | | | 2037 | | |
|---|---|---|---|---|---|---|---|---|
| | | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| Eco1 | Fforestganol A Chwm Nofydd - A | 26.4 | 18.4 | 18.4 | Negligible | 17.0 | 17.1 | Negligible |
| Eco2 | Fforestganol A Chwm Nofydd - B | 25.5 | 17.9 | 17.9 | Negligible | 16.5 | 16.6 | Negligible |
| Eco3 | St Brides North - A | 25.6 | 20.1 | 29.2 | Major Adverse | 19.7 | 27.8 | Major Adverse |
| Eco4 | St Brides North - B | 25.6 | 20.1 | 23.1 | Major Adverse | 19.7 | 22.4 | Moderate Adverse |
| Eco5 | St Brides North - C | 25.6 | 20.1 | 21.9 | Moderate Adverse | 19.7 | 21.3 | Moderate Adverse |
| Eco6 | St Brides North - D | 25.6 | 20.2 | 21.3 | Minor Adverse | 19.7 | 20.8 | Minor Adverse |
| Eco7 | St Brides South - A | 25.5 | 20.1 | 28.5 | Major Adverse | 19.7 | 27.1 | Major Adverse |
| Eco8 | St Brides South - B | 25.5 | 20.1 | 22.7 | Moderate Adverse | 19.7 | 22.0 | Moderate Adverse |
| Eco9 | St Brides South - C | 25.5 | 20.1 | 21.6 | Minor Adverse | 19.7 | 21.0 | Minor Adverse |
| Eco10 | St Brides South - D | 25.4 | 20.0 | 21.1 | Minor Adverse | 19.7 | 20.6 | Minor Adverse |
| Eco11 | River Usk North - A | 29.3 | 23.7 | 24.4 | Minor Adverse | 23.4 | 24.1 | Minor Adverse |
| Eco12 | River Usk North - B | 29.3 | 23.7 | 24.4 | Minor Adverse | 23.4 | 24.1 | Minor Adverse |
| Eco13 | River Usk North - C | 29.4 | 23.7 | 24.4 | Minor Adverse | 23.4 | 24.1 | Minor Adverse |
| Eco14 | River Usk North - D | 29.4 | 23.7 | 24.4 | Minor Adverse | 23.4 | 24.1 | Minor Adverse |
| Eco15 | River Usk North - E | 24.8 | 19.4 | 20.1 | Minor Adverse | 18.9 | 19.5 | Minor Adverse |
| Eco16 | River Usk South - A | 29.3 | 23.6 | 24.4 | Minor Adverse | 23.4 | 24.1 | Minor Adverse |

| ID | Designated Site | 2014 | 2022 | | | 2037 | | |
|---|---|---|---|---|---|---|---|---|
| | | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| Eco17 | River Usk South - B | 29.3 | 23.6 | 24.3 | Minor Adverse | 23.4 | 24.0 | Minor Adverse |
| Eco18 | River Usk South - C | 29.2 | 23.6 | 24.3 | Minor Adverse | 23.4 | 24.0 | Minor Adverse |
| Eco19 | River Usk South - D | 29.2 | 23.6 | 24.3 | Minor Adverse | 23.4 | 24.0 | Minor Adverse |
| Eco20 | River Usk South - E | 29.2 | 23.6 | 24.2 | Minor Adverse | 23.3 | 23.9 | Minor Adverse |
| Eco21 | Nash & Goldcliff North - A | 18.9 | 14.5 | 23.0 | Major Adverse | 14.0 | 21.8 | Major Adverse |
| Eco22 | Nash & Goldcliff North - B | 18.9 | 14.5 | 17.2 | Moderate Adverse | 14.0 | 16.4 | Moderate Adverse |
| Eco23 | Nash & Goldcliff North - C | 19.0 | 14.5 | 16.1 | Moderate Adverse | 14.0 | 15.4 | Minor Adverse |
| Eco24 | Nash & Goldcliff North - D | 19.0 | 14.5 | 15.6 | Minor Adverse | 14.0 | 15.1 | Minor Adverse |
| Eco25 | Nash & Goldcliff North - E | 19.0 | 14.5 | 15.4 | Minor Adverse | 14.0 | 14.9 | Minor Adverse |
| Eco26 | Nash & Goldcliff South - A | 18.9 | 14.5 | 23.9 | Major Adverse | 14.0 | 22.6 | Major Adverse |
| Eco27 | Nash & Goldcliff South - B | 18.9 | 14.4 | 17.6 | Major Adverse | 14.0 | 16.9 | Moderate Adverse |
| Eco28 | Nash & Goldcliff South - | 18.8 | 14.4 | 16.4 | Moderate Adverse | 13.9 | 15.7 | Moderate Adverse |

| ID | Designated Site | 2014 | 2022 | | | 2037 | | |
|---|---|---|---|---|---|---|---|---|
| | | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| | C | | | | | | | |
| Eco29 | Nash & Goldcliff South - D | 18.8 | 14.4 | 15.8 | Minor Adverse | 13.9 | 15.2 | Minor Adverse |
| Eco30 | Nash & Goldcliff South - E | 18.8 | 14.4 | 15.6 | Minor Adverse | 13.9 | 15.1 | Minor Adverse |
| Eco31 | Whitson North - A | 14.9 | 11.2 | 20.9 | Major Adverse | 10.8 | 19.7 | Major Adverse |
| Eco32 | Whitson North - B | 15.0 | 11.2 | 14.4 | Major Adverse | 10.8 | 13.7 | Moderate Adverse |
| Eco33 | Whitson North - C | 15.0 | 11.3 | 13.1 | Moderate Adverse | 10.8 | 12.5 | Moderate Adverse |
| Eco34 | Whitson North - E | 15.1 | 11.3 | 12.3 | Minor Adverse | 10.9 | 11.8 | Minor Adverse |
| Eco35 | Whitson North - D | 15.0 | 11.3 | 12.6 | Minor Adverse | 10.8 | 12.0 | Minor Adverse |
| Eco36 | Whitson South - A | 14.9 | 11.2 | 18.9 | Major Adverse | 10.8 | 17.8 | Major Adverse |
| Eco37 | Whitson South - B | 14.9 | 11.2 | 13.9 | Moderate Adverse | 10.8 | 13.2 | Moderate Adverse |
| Eco38 | Whitson South - C | 14.8 | 11.2 | 12.8 | Moderate Adverse | 10.7 | 12.2 | Minor Adverse |
| Eco39 | Whitson South - D | 14.8 | 11.2 | 12.3 | Minor Adverse | 10.7 | 11.8 | Minor Adverse |
| Eco40 | Whitson South - E | 14.8 | 11.2 | 12.1 | Minor Adverse | 10.7 | 11.6 | Minor Adverse |
| Eco41 | Llanmartin Meadows - A | 52.3 | 36.6 | 25.4 | Major Beneficial | 31.5 | 23.0 | Major Beneficial |
| Eco42 | Llanmartin Meadows - B | 30.4 | 20.3 | 17.2 | Major Beneficial | 18.2 | 15.8 | Moderate Beneficial |
| Eco43 | Llanmartin Meadows - C | 26.0 | 17.7 | 15.9 | Moderate Beneficial | 16.4 | 15.0 | Minor Beneficial |
| Eco44 | Llanmartin Meadows - D | 24.1 | 16.7 | 15.5 | Minor Beneficial | 15.6 | 14.6 | Minor Beneficial |

| ID | Designated Site | 2014 | 2022 | | | 2037 | | |
|---|---|---|---|---|---|---|---|---|
| | | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| Eco45 | Llanmartin Meadows - E | 23.3 | 16.3 | 15.3 | Minor Beneficial | 15.2 | 14.5 | Minor Beneficial |
| Eco46 | Redwick and Llandevenny - A | 15.5 | 11.7 | 19.8 | Major Adverse | 11.3 | 18.8 | Major Adverse |
| Eco47 | Redwick and Llandevenney - B | 15.2 | 11.3 | 14.0 | Moderate Adverse | 10.9 | 13.3 | Moderate Adverse |
| Eco48 | Redwick and Llandevenny - C | 15.6 | 11.4 | 13.1 | Moderate Adverse | 11.0 | 12.5 | Minor Adverse |
| Eco49 | Redwick and Llandevenny - D | 19.2 | 13.8 | 15.0 | Minor Adverse | 13.5 | 14.3 | Minor Adverse |
| Eco50 | Redwick and Llandevenny - E | 20.7 | 14.4 | 15.2 | Minor Adverse | 14.1 | 14.5 | Minor Adverse |
| Eco51 | Redwick and Llandevenny South - A | 15.4 | 11.6 | 21.5 | Major Adverse | 11.2 | 20.2 | Major Adverse |
| Eco52 | Redwick and Llandevenny South - B | 15.3 | 11.6 | 14.6 | Major Adverse | 11.2 | 13.9 | Moderate Adverse |
| Eco53 | Redwick and Llandevenny South - C | 15.3 | 11.6 | 13.3 | Moderate Adverse | 11.2 | 12.8 | Moderate Adverse |
| Eco54 | Redwick and Llandevenny South - D | 15.2 | 11.5 | 12.7 | Minor Adverse | 11.1 | 12.2 | Minor Adverse |

| ID | Designated Site | 2014 | 2022 | | | 2037 | | |
|---|---|---|---|---|---|---|---|---|
| | | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| Eco55 | Redwick and Llandevenny South - E | 15.2 | 11.5 | 12.5 | Minor Adverse | 11.1 | 12.0 | Minor Adverse |
| Eco56 | Magor and Undy - A | 20.8 | 15.8 | 15.6 | Negligible | 15.4 | 15.3 | Negligible |
| Eco57 | Magor and Undy - B | 20.1 | 15.4 | 15.4 | Negligible | 15.0 | 15.1 | Negligible |
| Eco58 | Magor and Undy - C | 19.9 | 15.3 | 15.4 | Negligible | 14.9 | 15.0 | Negligible |
| Eco59 | Magor and Undy - D | 19.8 | 15.2 | 15.3 | Negligible | 14.9 | 15.0 | Negligible |
| Eco60 | Nedern Brook Wetlands North - A | 25.8 | 17.3 | 18.0 | Minor Adverse | 15.9 | 18.1 | Moderate Adverse |
| Eco61 | Nedern Brook Wetlands North - B | 17.7 | 12.8 | 13.0 | Negligible | 12.2 | 12.5 | Minor Adverse |
| Eco62 | Nedern Brook Wetlands North - C | 16.9 | 12.4 | 12.5 | Negligible | 11.8 | 12.0 | Negligible |
| Eco63 | Nedern Brook Wetlands North - D | 16.6 | 12.3 | 12.3 | Negligible | 11.7 | 11.8 | Negligible |
| Eco64 | Nedern Brook Wetlands North - E | 16.4 | 12.2 | 12.2 | Negligible | 11.6 | 11.7 | Negligible |
| Eco65 | Nedern Brook Wetlands South - A | 23.7 | 16.3 | 16.8 | Minor Adverse | 15.2 | 16.4 | Minor Adverse |
| Eco66 | Nedern Brook Wetlands | 18.0 | 13.1 | 13.2 | Negligible | 12.4 | 12.7 | Minor Adverse |

| ID | Designated Site | 2014 | 2022 | | | 2037 | | |
|---|---|---|---|---|---|---|---|---|
| | | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| | South - B | | | | | | | |
| Eco67 | Nedern Brook Wetlands South - C | 17.1 | 12.6 | 12.6 | Negligible | 11.9 | 12.1 | Negligible |
| Eco68 | Nedern Brook Wetlands South - D | 16.8 | 12.4 | 12.4 | Negligible | 11.8 | 11.9 | Negligible |
| Eco69 | Nedern Brook Wetlands South - E | 16.6 | 12.3 | 12.3 | Negligible | 11.7 | 11.8 | Negligible |
| Eco70 | Severn Estuary North - A | 47.2 | 32.9 | 33.8 | Minor Adverse | 28.6 | 28.7 | Negligible |
| Eco71 | Severn Estuary North - B | 30.5 | 20.3 | 20.7 | Minor Adverse | 19.3 | 19.3 | Negligible |
| Eco72 | Severn Estuary North - C | 26.5 | 18.4 | 18.6 | Negligible | 17.6 | 17.6 | Negligible |
| Eco73 | Severn Estuary North - D | 24.8 | 17.6 | 17.8 | Negligible | 16.9 | 16.9 | Negligible |
| Eco74 | Severn Estuary North - E | 24.0 | 17.2 | 17.3 | Negligible | 16.5 | 16.5 | Negligible |
| Eco75 | Severn Estuary South - A | 62.1 | 44.3 | 45.8 | Moderate Adverse | 39.3 | 39.7 | Minor Adverse |
| Eco76 | Severn Estuary South - B | 28.9 | 19.6 | 19.9 | Negligible | 18.6 | 18.7 | Negligible |
| Eco77 | Severn Estuary South - C | 25.2 | 17.7 | 17.9 | Negligible | 17.0 | 17.0 | Negligible |
| Eco78 | Severn Estuary South - D | 23.7 | 17.0 | 17.1 | Negligible | 16.3 | 16.4 | Negligible |
| Eco79 | Severn Estuary South - E | 22.9 | 16.6 | 16.7 | Negligible | 16.0 | 16.1 | Negligible |
| Eco80 | River Wye - A | 25.5 | 19.3 | 18.6 | Minor Beneficial | 18.0 | 18.4 | Minor Adverse |
| Eco81 | River Wye - B | 17.6 | 13.4 | 13.2 | Negligible | 12.9 | 13.0 | Negligible |

| ID | Designated Site | 2014 | 2022 | | | 2037 | | |
|---|---|---|---|---|---|---|---|---|
| | | Base | Do Minimum | Do Something | Magnitude of Impact | Do Minimum | Do Something | Magnitude of Impact |
| Eco82 | River Wye - C | 16.4 | 12.6 | 12.5 | Negligible | 12.1 | 12.2 | Negligible |
| Eco83 | River Wye - D | 15.9 | 12.2 | 12.1 | Negligible | 11.7 | 11.8 | Negligible |
| Eco84 | River Wye - E | 15.6 | 12.0 | 11.9 | Negligible | 11.6 | 11.6 | Negligible |

## Table A4: 2022 Opening Year Nitrogen Deposition Rates (kg N/ha/yr)

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| Eco1 | Fforestganol A Chwm Nofydd - A | 14.4 | 14.4 | 0.0 | 14.4 | 14.4 | 0.0 |
| Eco2 | Fforestganol A Chwm Nofydd - B | 14.4 | 14.4 | 0.0 | 14.4 | 14.4 | 0.0 |
| Eco3 | St Brides North - A | 8.0 | 8.5 | 0.5 | 8.0 | 8.5 | 0.5 |
| Eco4 | St Brides North - B | 8.0 | 8.2 | 0.2 | 8.0 | 8.2 | 0.2 |
| Eco5 | St Brides North - C | 8.0 | 8.1 | 0.1 | 8.0 | 8.1 | 0.1 |
| Eco6 | St Brides North - D | 8.0 | 8.1 | 0.1 | 8.0 | 8.1 | 0.1 |
| Eco7 | St Brides South - A | 8.0 | 8.5 | 0.5 | 8.0 | 8.5 | 0.5 |
| Eco8 | St Brides South - B | 8.0 | 8.2 | 0.2 | 8.0 | 8.2 | 0.2 |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| Eco9 | St Brides South - C | 8.0 | 8.1 | 0.1 | 8.0 | 8.1 | 0.1 |
| Eco10 | St Brides South - D | 8.0 | 8.1 | 0.1 | 8.0 | 8.1 | 0.1 |
| Eco11 | River Usk North - A | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco12 | River Usk North - B | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco13 | River Usk North - C | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco14 | River Usk North - D | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco15 | River Usk North - E | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco16 | River Usk South - A | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco17 | River Usk South - B | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco18 | River Usk South - C | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco19 | River Usk South - D | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco20 | River Usk South - E | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco21 | Nash & Goldcliff North - A | 12.8 | 13.3 | 0.5 | 12.8 | 13.3 | 0.5 |
| Eco22 | Nash & Goldcliff North - B | 12.8 | 13.0 | 0.2 | 12.8 | 13.0 | 0.2 |
| Eco23 | Nash & Goldcliff North - C | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco24 | Nash & Goldcliff North - D | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco25 | Nash & Goldcliff North - E | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco26 | Nash & Goldcliff South - A | 12.8 | 13.3 | 0.5 | 12.8 | 13.3 | 0.5 |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| Eco27 | Nash & Goldcliff South - B | 12.8 | 13.0 | 0.2 | 12.8 | 13.0 | 0.2 |
| Eco28 | Nash & Goldcliff South - C | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco29 | Nash & Goldcliff South - D | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco30 | Nash & Goldcliff South - E | 12.8 | 12.9 | 0.1 | 12.8 | 12.9 | 0.1 |
| Eco31 | Whitson North - A | 11.9 | 12.4 | 0.5 | 11.9 | 12.4 | 0.5 |
| Eco32 | Whitson North - B | 11.9 | 12.1 | 0.2 | 11.9 | 12.1 | 0.2 |
| Eco33 | Whitson North - C | 11.9 | 12.0 | 0.1 | 11.9 | 12.0 | 0.1 |
| Eco34 | Whitson North - E | 11.9 | 12.0 | 0.1 | 11.9 | 12.0 | 0.1 |
| Eco35 | Whitson North - D | 11.9 | 12.0 | 0.1 | 11.9 | 12.0 | 0.1 |
| Eco36 | Whitson South - A | 11.9 | 12.3 | 0.4 | 11.9 | 12.3 | 0.4 |
| Eco37 | Whitson South - B | 11.9 | 12.1 | 0.2 | 11.9 | 12.1 | 0.2 |
| Eco38 | Whitson South - C | 11.9 | 12.0 | 0.1 | 11.9 | 12.0 | 0.1 |
| Eco39 | Whitson South - D | 11.9 | 12.0 | 0.1 | 11.9 | 12.0 | 0.1 |
| Eco40 | Whitson South - E | 11.9 | 12.0 | 0.1 | 11.9 | 12.0 | 0.1 |
| Eco41 | Llanmartin Meadows - A | 13.2 | 12.8 | -0.4 | 13.7 | 13.2 | -0.5 |
| Eco42 | Llanmartin Meadows - B | 12.7 | 12.5 | -0.2 | 12.9 | 12.7 | -0.2 |
| Eco43 | Llanmartin Meadows - C | 12.6 | 12.5 | -0.1 | 12.7 | 12.6 | -0.1 |
| Eco44 | Llanmartin Meadows - D | 12.5 | 12.5 | 0.0 | 12.6 | 12.5 | -0.1 |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| Eco45 | Llanmartin Meadows - E | 12.5 | 12.5 | 0.0 | 12.6 | 12.5 | -0.1 |
| Eco46 | Redwick and Llandevenny - A | 12.6 | 13.0 | 0.4 | 12.6 | 13.0 | 0.4 |
| Eco47 | Redwick and Llandevenney - B | 12.6 | 12.8 | 0.2 | 12.6 | 12.8 | 0.2 |
| Eco48 | Redwick and Llandevenny - C | 12.6 | 12.7 | 0.1 | 12.6 | 12.7 | 0.1 |
| Eco49 | Redwick and Llandevenny - D | 12.7 | 12.7 | 0.0 | 12.7 | 12.7 | 0.0 |
| Eco50 | Redwick and Llandevenny - E | 12.7 | 12.8 | 0.1 | 12.7 | 12.8 | 0.1 |
| Eco51 | Redwick and Llandevenny South - A | 12.6 | 13.1 | 0.5 | 12.6 | 13.1 | 0.5 |
| Eco52 | Redwick and Llandevenny South - B | 12.6 | 12.8 | 0.2 | 12.6 | 12.8 | 0.2 |
| Eco53 | Redwick and Llandevenny South - C | 12.6 | 12.7 | 0.1 | 12.6 | 12.7 | 0.1 |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| Eco54 | Redwick and Llandevenny South - D | 12.6 | 12.7 | 0.1 | 12.6 | 12.7 | 0.1 |
| Eco55 | Redwick and Llandevenny South - E | 12.6 | 12.7 | 0.1 | 12.6 | 12.7 | 0.1 |
| Eco56 | Magor and Undy - A | 12.7 | 12.7 | 0.0 | 12.7 | 12.7 | 0.0 |
| Eco57 | Magor and Undy - B | 12.6 | 12.6 | 0.0 | 12.6 | 12.6 | 0.0 |
| Eco58 | Magor and Undy - C | 12.6 | 12.6 | 0.0 | 12.6 | 12.6 | 0.0 |
| Eco59 | Magor and Undy - D | 12.6 | 12.6 | 0.0 | 12.6 | 12.6 | 0.0 |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| Eco60 | Nedern Brook Wetlands North - A | 12.2 | 12.2 | 0.0 | 12.3 | 12.4 | 0.1 |
| Eco61 | Nedern Brook Wetlands North - B | 12.0 | 12.0 | 0.0 | 12.0 | 12.0 | 0.0 |
| Eco62 | Nedern Brook Wetlands | 11.9 | 12.0 | 0.1 | 11.9 | 12.0 | 0.1 |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| | North - C | | | | | | |
| Eco63 | Nedern Brook Wetlands North - D | 11.9 | 11.9 | 0.0 | 11.9 | 11.9 | 0.0 |
| Eco64 | Nedern Brook Wetlands North - E | 11.9 | 11.9 | 0.0 | 11.9 | 11.9 | 0.0 |
| Eco65 | Nedern Brook Wetlands South - A | 12.1 | 12.2 | 0.1 | 12.3 | 12.3 | 0.0 |
| Eco66 | Nedern Brook Wetlands South - B | 12.0 | 12.0 | 0.0 | 12.0 | 12.0 | 0.0 |
| Eco67 | Nedern Brook Wetlands South - C | 12.0 | 12.0 | 0.0 | 12.0 | 12.0 | 0.0 |
| Eco68 | Nedern Brook Wetlands South - D | 11.9 | 11.9 | 0.0 | 11.9 | 11.9 | 0.0 |
| Eco69 | Nedern Brook Wetlands South - E | 11.9 | 11.9 | 0.0 | 11.9 | 11.9 | 0.0 |
| Eco70 | Severn Estuary North - A | 10.3 | 10.3 | 0.0 | 10.7 | 10.8 | 0.1 |
| Eco71 | Severn Estuary North - B | 9.9 | 9.9 | 0.0 | 10.0 | 10.0 | 0.0 |
| Eco72 | Severn Estuary North - C | 9.8 | 9.8 | 0.0 | 9.8 | 9.9 | 0.1 |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| Eco73 | Severn Estuary North - D | 9.7 | 9.7 | 0.0 | 9.8 | 9.8 | 0.0 |
| Eco74 | Severn Estuary North - E | 9.7 | 9.7 | 0.0 | 9.7 | 9.7 | 0.0 |
| Eco75 | Severn Estuary South - A | 10.6 | 10.7 | 0.1 | 11.3 | 11.4 | 0.1 |
| Eco76 | Severn Estuary South - B | 9.8 | 9.9 | 0.1 | 9.9 | 10.0 | 0.1 |
| Eco77 | Severn Estuary South - C | 9.7 | 9.8 | 0.1 | 9.8 | 9.8 | 0.0 |
| Eco78 | Severn Estuary South - D | 9.7 | 9.7 | 0.0 | 9.7 | 9.7 | 0.0 |
| Eco79 | Severn Estuary South - E | 9.7 | 9.7 | 0.0 | 9.7 | 9.7 | 0.0 |
| Eco80 | River Wye - A | 14.7 | 14.7 | 0.0 | 14.9 | 14.8 | -0.1 |
| Eco81 | River Wye - B | 14.4 | 14.4 | 0.0 | 14.4 | 14.4 | 0.0 |
| Eco82 | River Wye - C | 14.4 | 14.4 | 0.0 | 14.4 | 14.4 | 0.0 |
| Eco83 | River Wye - D | 14.4 | 14.4 | 0.0 | 14.4 | 14.4 | 0.0 |
| Eco84 | River Wye - E | 14.3 | 14.3 | 0.0 | 14.3 | 14.3 | 0.0 |

## Table A5: 2037 Future Year Nitrogen Deposition Rates (kg N/ha/yr)

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| Eco1 | Fforestganol A Chwm Nofydd - A | 10.7 | 10.7 | 0.0 | 10.7 | 10.7 | 0.0 |
| Eco2 | Fforestganol A Chwm Nofydd - B | 10.7 | 10.7 | 0.0 | 10.7 | 10.7 | 0.0 |
| Eco3 | St Brides North - A | 5.9 | 6.3 | 0.4 | 5.9 | 6.3 | 0.4 |
| Eco4 | St Brides North - B | 5.9 | 6.1 | 0.2 | 5.9 | 6.1 | 0.2 |
| Eco5 | St Brides North - C | 5.9 | 6.0 | 0.1 | 5.9 | 6.0 | 0.1 |
| Eco6 | St Brides North - D | 5.9 | 6.0 | 0.1 | 5.9 | 6.0 | 0.1 |
| Eco7 | St Brides South - A | 5.9 | 6.3 | 0.4 | 5.9 | 6.3 | 0.4 |
| Eco8 | St Brides South - B | 5.9 | 6.0 | 0.1 | 5.9 | 6.0 | 0.1 |
| Eco9 | St Brides South - C | 5.9 | 6.0 | 0.1 | 5.9 | 6.0 | 0.1 |
| Eco10 | St Brides South - D | 5.9 | 6.0 | 0.1 | 5.9 | 6.0 | 0.1 |
| Eco11 | River Usk North - A | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco12 | River Usk North - B | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco13 | River Usk North - C | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco14 | River Usk North - D | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco15 | River Usk North - E | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco16 | River Usk South - A | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| Eco17 | River Usk South - B | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco18 | River Usk South - C | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco19 | River Usk South - D | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco20 | River Usk South - E | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco21 | Nash & Goldcliff North - A | 9.5 | 9.9 | 0.4 | 9.5 | 9.9 | 0.4 |
| Eco22 | Nash & Goldcliff North - B | 9.5 | 9.6 | 0.1 | 9.5 | 9.6 | 0.1 |
| Eco23 | Nash & Goldcliff North - C | 9.5 | 9.6 | 0.1 | 9.5 | 9.6 | 0.1 |
| Eco24 | Nash & Goldcliff North - D | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco25 | Nash & Goldcliff North - E | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco26 | Nash & Goldcliff South - A | 9.5 | 9.9 | 0.4 | 9.5 | 9.9 | 0.4 |
| Eco27 | Nash & Goldcliff South - B | 9.5 | 9.6 | 0.1 | 9.5 | 9.6 | 0.1 |
| Eco28 | Nash & Goldcliff South - C | 9.5 | 9.6 | 0.1 | 9.5 | 9.6 | 0.1 |
| Eco29 | Nash & Goldcliff South - D | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco30 | Nash & Goldcliff South - E | 9.5 | 9.5 | 0.0 | 9.5 | 9.5 | 0.0 |
| Eco31 | Whitson North - A | 8.8 | 9.3 | 0.5 | 8.8 | 9.3 | 0.5 |
| Eco32 | Whitson North - B | 8.8 | 9.0 | 0.2 | 8.8 | 9.0 | 0.2 |
| Eco33 | Whitson North - C | 8.8 | 8.9 | 0.1 | 8.8 | 8.9 | 0.1 |
| Eco34 | Whitson North - E | 8.8 | 8.9 | 0.1 | 8.8 | 8.9 | 0.1 |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| Eco35 | Whitson North - D | 8.8 | 8.9 | 0.1 | 8.8 | 8.9 | 0.1 |
| Eco36 | Whitson South - A | 8.8 | 9.2 | 0.4 | 8.8 | 9.2 | 0.4 |
| Eco37 | Whitson South - B | 8.8 | 8.9 | 0.1 | 8.8 | 8.9 | 0.1 |
| Eco38 | Whitson South - C | 8.8 | 8.9 | 0.1 | 8.8 | 8.9 | 0.1 |
| Eco39 | Whitson South - D | 8.8 | 8.9 | 0.1 | 8.8 | 8.9 | 0.1 |
| Eco40 | Whitson South - E | 8.8 | 8.8 | 0.0 | 8.8 | 8.8 | 0.0 |
| Eco41 | Llanmartin Meadows - A | 9.8 | 9.4 | -0.4 | 10.4 | 9.9 | -0.5 |
| Eco42 | Llanmartin Meadows - B | 9.4 | 9.2 | -0.2 | 9.5 | 9.4 | -0.1 |
| Eco43 | Llanmartin Meadows - C | 9.3 | 9.2 | -0.1 | 9.3 | 9.3 | 0.0 |
| Eco44 | Llanmartin Meadows - D | 9.2 | 9.2 | 0.0 | 9.3 | 9.2 | -0.1 |
| Eco45 | Llanmartin Meadows - E | 9.2 | 9.2 | 0.0 | 9.2 | 9.2 | 0.0 |
| Eco46 | Redwick and Llandevenny - A | 9.3 | 9.7 | 0.4 | 9.3 | 9.7 | 0.4 |
| Eco47 | Redwick and Llandevenney - B | 9.3 | 9.4 | 0.1 | 9.3 | 9.4 | 0.1 |
| Eco48 | Redwick and Llandevenny - C | 9.3 | 9.4 | 0.1 | 9.3 | 9.4 | 0.1 |
| Eco49 | Redwick and Llandevenny - | 9.4 | 9.4 | 0.0 | 9.4 | 9.4 | 0.0 |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| | D | | | | | | |
| Eco50 | Redwick and Llandevenny - E | 9.4 | 9.4 | 0.0 | 9.4 | 9.4 | 0.0 |
| Eco51 | Redwick and Llandevenny South - A | 9.3 | 9.8 | 0.5 | 9.3 | 9.8 | 0.5 |
| Eco52 | Redwick and Llandevenny South - B | 9.3 | 9.5 | 0.2 | 9.3 | 9.5 | 0.2 |
| Eco53 | Redwick and Llandevenny South - C | 9.3 | 9.4 | 0.1 | 9.3 | 9.4 | 0.1 |
| Eco54 | Redwick and Llandevenny South - D | 9.3 | 9.4 | 0.1 | 9.3 | 9.4 | 0.1 |
| Eco55 | Redwick and Llandevenny South - E | 9.3 | 9.4 | 0.1 | 9.3 | 9.4 | 0.1 |
| Eco56 | Magor and Undy - A | 9.3 | 9.3 | 0.0 | 9.3 | 9.3 | 0.0 |
| Eco57 | Magor and Undy - B | 9.3 | 9.3 | 0.0 | 9.3 | 9.3 | 0.0 |
| Eco58 | Magor and Undy - C | 9.3 | 9.3 | 0.0 | 9.3 | 9.3 | 0.0 |
| Eco59 | Magor and Undy - D | 9.3 | 9.3 | 0.0 | 9.3 | 9.3 | 0.0 |
| Eco60 | Nedern Brook Wetlands | 9.1 | 9.2 | 0.1 | 9.2 | 9.3 | 0.1 |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| | North - A | | | | | | |
| Eco61 | Nedern Brook Wetlands North - B | 8.9 | 8.9 | 0.0 | 8.9 | 8.9 | 0.0 |
| Eco62 | Nedern Brook Wetlands North - C | 8.9 | 8.9 | 0.0 | 8.9 | 8.9 | 0.0 |
| Eco63 | Nedern Brook Wetlands North - D | 8.8 | 8.9 | 0.1 | 8.8 | 8.9 | 0.1 |
| Eco64 | Nedern Brook Wetlands North - E | 8.8 | 8.8 | 0.0 | 8.8 | 8.8 | 0.0 |
| Eco65 | Nedern Brook Wetlands South - A | 9.0 | 9.1 | 0.1 | 9.1 | 9.2 | 0.1 |
| Eco66 | Nedern Brook Wetlands South - B | 8.9 | 8.9 | 0.0 | 8.9 | 8.9 | 0.0 |
| Eco67 | Nedern Brook Wetlands South - C | 8.9 | 8.9 | 0.0 | 8.9 | 8.9 | 0.0 |
| Eco68 | Nedern Brook Wetlands South - D | 8.9 | 8.9 | 0.0 | 8.9 | 8.9 | 0.0 |
| Eco69 | Nedern Brook Wetlands | 8.8 | 8.9 | 0.1 | 8.8 | 8.9 | 0.1 |

| ID | Designated Site | IAN 185/15 | | | IAN170/12 | | |
|---|---|---|---|---|---|---|---|
| | | Do Minimum | Do Something | Change in Nitrogen deposition | Do Minimum | Do Something | Change in Nitrogen deposition |
| | South - E | | | | | | |
| Eco70 | Severn Estuary North - A | 7.7 | 7.7 | 0.0 | 8.1 | 8.1 | 0.0 |
| Eco71 | Severn Estuary North - B | 7.3 | 7.3 | 0.0 | 7.4 | 7.4 | 0.0 |
| Eco72 | Severn Estuary North - C | 7.2 | 7.2 | 0.0 | 7.3 | 7.3 | 0.0 |
| Eco73 | Severn Estuary North - D | 7.2 | 7.2 | 0.0 | 7.2 | 7.2 | 0.0 |
| Eco74 | Severn Estuary North - E | 7.2 | 7.2 | 0.0 | 7.2 | 7.2 | 0.0 |
| Eco75 | Severn Estuary South - A | 8.0 | 8.0 | 0.0 | 8.7 | 8.7 | 0.0 |
| Eco76 | Severn Estuary South - B | 7.3 | 7.3 | 0.0 | 7.4 | 7.4 | 0.0 |
| Eco77 | Severn Estuary South - C | 7.2 | 7.2 | 0.0 | 7.2 | 7.2 | 0.0 |
| Eco78 | Severn Estuary South - D | 7.2 | 7.2 | 0.0 | 7.2 | 7.2 | 0.0 |
| Eco79 | Severn Estuary South - E | 7.2 | 7.2 | 0.0 | 7.2 | 7.2 | 0.0 |
| Eco80 | River Wye - A | 10.9 | 10.9 | 0.0 | 11.1 | 11.1 | 0.0 |
| Eco81 | River Wye - B | 10.7 | 10.7 | 0.0 | 10.7 | 10.7 | 0.0 |
| Eco82 | River Wye - C | 10.6 | 10.6 | 0.0 | 10.6 | 10.6 | 0.0 |
| Eco83 | River Wye - D | 10.6 | 10.6 | 0.0 | 10.6 | 10.6 | 0.0 |
| Eco84 | River Wye - E | 10.6 | 10.6 | 0.0 | 10.6 | 10.6 | 0.0 |

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**Appendix B – Email correspondence with Natural Resources Wales**

Dear Peter,

Thank you for providing feedback on the comments which NRW raised with respect to air quality in our letter of 4 May 2016.

**Inter-annual variability** - we note the comment made that *"it is common practice to include inter-annual variability for point source emissions but it is not considered necessary for modelling road sources as these are generally at ground level and less sensitive to changes in met data by year"*. We disagree with this premise as we are of the view that modelling predictions, from both a ground level source and an elevated source, would be affected by the changes in met data. However we also note the statement that the "*predicted concentrations are well below the relevant air quality objectives in the opening year of the Scheme*". Provided that this statement is correct, NRW have no further comment or issue with respect to inter-annual variability, but note that, as we have not seen the detailed modelling information including modelling files, we are unable to verify the modelling prediction results.

**Other issues** - we note the information provided with respect to all our other queries, which satisfies the issues we had raised in our 4 May 2016 letter.

In summary, provided that the statement that the "*predicted concentrations are well below the relevant air quality objectives in the opening year of the Scheme"* is supported by the detailed modelling results, NRW's issues with respect to possible air quality impacts on designated sites have been addressed.

Best wishes, Jess

Jessica Poole
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**Yn falch o arwain y ffordd at ddyfodol gwell i Gymru trwy reoli'r amgylchedd ac adnoddau naturiol yn gynaliadwy.**

**Proud to be leading the way to a better future for Wales by managing the environment and natural resources sustainably.**

Croesewir gohebiaeth yn y Gymraeg a'r Saesneg / Correspondence welcomed in both Welsh and English.

**From:** Peter Ireland [mailto:IrelandP@rpsgroup.com]
**Sent:** 11 October 2016 18:26
**To:** Poole, Jessica <jessica.poole@cyfoethnaturiolcymru.gov.uk>
**Cc:** Keith Jones (Oxford) <JonesK@rpsgroup.com>; Julia Tindale <TindaleJ@rpsgroup.com>
**Subject:** M4CaN response to air quality queries

Jess

Further to today's liaison meeting please see below our response to NRW's comments on air quality:

Pg 40, *Has the inter-annual variation of meteorological data been considered?* – Sensitivity testing has not been undertaken using various years of meteorological data, it is common practice to include interannual variability for point source emissions but it is not considered necessary for modelling road sources as these are generally at ground level and less sensitive to changes in met data by year. It is considered that 2014 met data was the most appropriate for use as monitoring data and traffic data used in the assessment was representative of 2014 levels. As predicted concentrations are well below the relevant air quality objectives in the opening year of the Scheme it is likely that any change as a result of using different meteorological data would not be large enough to alter the conclusions of the assessment.

Pg 40, *Evidence required to justify statement "IAN 170/12v3 represents a more pessimistic future scenario prediction, these results have been used in the assessment of significance"*- IAN 170/12v3 provides a pessimistic approach to future emission trends, it compares the emission trends expected as a result of the improvements in emission controls with a much more pessimistic approach which assumes that concentrations decline at the same rate as currently observed (i.e. with no further improvement in emission controls even though Euro 6/VI emission controls are entering the fleet now).

IAN 170/12v3 then assumes that the worst case is an intermediate case between the two extremes examined. The IAN notes that this is a pessimistic assumption and that they expect to revise the methodology. We are therefore confident that the approach in IAN 175/12v3 is based on pessimistic assumptions.

Pg 40, *calculation of short term statistics* – The Local Air Quality Management Technical Guidance (TG(09)) was revised in April 2016 and retains the same approach – i.e. if annual mean concentrations do not exceed 60 µg/$m^3$, then it is unlikely the short term objective would be exceeded. Continuous monitoring data available across the study area was used in addition to the approach considered in para 7.3.64 of the ES to determine whether any exceedences of the hourly mean $NO_2$ objective had been recorded. No exceedances of the short term objective were recorded at the continuous monitoring station adjacent to the M4 which monitored annual mean concentrations of 55 and 59µg/$m^3$ in 2013 and 2014 respectively and only 12 and 0 hours where the hourly mean was greater than 200µg/$m^3$ in 2013 and 2014 respectively. Noting that the objective allows 18 hours where hourly mean $NO_2$ concentrations are greater than 200µg/$m^3$ before there is an exceedence. As predicted annual mean $NO_2$ concentrations in the opening and future years are well below 40µg/$m^3$, it is highly unlikely that any exceedences of the hourly mean objective would be anticipated.

Pg 40, ref 7.3.74 of ES – *verification factor in Newport City Centre*
The verification factor for Newport City Centre was derived following the methodology outlined in Local Air Quality Management Technical Guidance which states that where modelled concentrations are within 25% of monitored concentrations the model is considered to be performing well. The two receptors with the largest degree of under-prediction strictly did not need to be included in the verification process as some of the roads nearby are not included in the model and they are between 85 and 105m from other roads included. By including these two receptors in the verification process, a larger

verification factor was obtained – i.e. it increased the predicted concentrations. The paragraph from which the excerpt has been quoted goes on to explain why the two locations with an underprediction of 37 and 40% occur and why these are not considered to be significant. It should be noted that at the location where the highest concentration is monitored (48 Malpas Road) the model over predicts concentrations by 2%. Predicted concentrations at all ecological receptors included in the ES have been calculated using the Scheme wide verification factors shown in Table 7.1.6 of Appendix 7.1, as these were located outside of Newport City Centre.

You will also need to read Section 4.3 of the September ES Supplement to get the most up to date picture on technical and relevant LPA related air quality matters.
Best wishes,

Peter

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**Dr Peter Ireland** | M4CaN Environmental Coordinator

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