Adur District Council

Local Plan Air Quality Inputs

Dispersion Modelling Assessment

October 2024

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Executive Summary

ES 1. Bureau Veritas UK Ltd has been commissioned by Adur District Council to assess the impact of the notional Local Plan Scenario 3 with Strategies ('Scenario 3S) on air quality. The Local Plan covers the proposed development within the Adur Local Plan area, the modelling assessment has therefore included all major roads and roads that are relevant to the proposed development sites. This is not inclusive of parts of the district within the South Downs National Park. The Adur Local Plan area is presented in Appendix C.

ES 2. The assessment of air quality effects in relation to the proposed land allocations outlined in the Local Plan has been undertaken in accordance with the impact designations presented within the EPUK/IAQM Guidance. The assessment considered ambient NO_2, PM_{10} and $PM_{2.5}$ concentrations to which existing and future receptors may be exposed to if the Scenario 3S were to proceed. This was based on a review of current site boundary plans, pollutant concentrations and the predicted traffic associated with the land allocations, supported by the relevant guidance. This assessment is part of the background evidence which will inform the review of the Local Plan.

ES 3. Baseline modelling was completed for year 2023 in order to calculate a verification factor to apply to the future year modelling.

ES 4. The assessment led to the following conclusions concerning the impact of the Scenario 3S:

- Annual mean NO_2 concentrations were predicted to be comfortably below the Air Quality Strategy (AQS) Objective of 40µg/m^3 at all modelled existing and future receptors. The maximum increase in concentration associated with the Scenario was 0.3µg/m^3. The impact of the Scenario on annual mean NO_2 concentrations was classified as negligible in IAQM/EPUK terms.
- Similarly annual mean PM_{10} concentrations were predicted to be below the AQS Objective of 40µg/m^3 at all modelled existing and future receptors, with maximum increase predicted to be 0.5µg/m^3. The impact of the Scenario on annual mean PM_{10} concentrations was also classified as negligible.
- Regarding $PM_{2.5}$, impacts of the 3S Scenario were assessed against the future AQS Objective of 10µg/m^3 which will come into effect in 2040. Future concentrations were predicted to be above this objective at a majority of receptors. It is important to note that background concentrations represent the majority of total concentrations at all receptors. Additionally, the assessment used background concentrations for 2030 as these are the latest currently available. The largest increase in annual mean concentrations associated with the 3S Scenario was 0.3 µg/m^3. In IAQM/EPUK terms impacts were considered substantial at two receptors, moderate at 91 receptors, slight at 55 receptors, and negligible at all remaining 353 modelled receptors.
- The assessment has also considered emissions of Nitrogen (as NO_X) from road traffic at existing ecological receptor locations. Annual mean concentrations are below the relevant AQS metric at all receptor locations, with the PC attributed to the Scenario 3S below 1µg/m^3 at all receptor locations. The impact of Scenario 3S on annual mean NO_X concentrations can therefore be regarded as negligible.
- In terms of 24-hours mean NO_X, slight exceedances of the AQS metric of 75µg/m^3 were predicted at the first two transect points at Adur Estuary SSSI receptors 1 and 2, (i.e. 0m and 10m from the kerb of the road) with an increase associated with the Scenario 3S less than 2.5% of the relevant AQS metric. As the PC represents more than 1% of the AQS, further assessment is required in line with the IAQM guidance with input recommended by ecologists to identify locations of potentially sensitive habitats and whether these align with areas predicted to experience an increase in pollutant concentrations.
- Regarding nitrogen deposition rates, there were no exceedances of the CL_{min} predicted at any sites. The impact of the Scenario 3S on nitrogen deposition can therefore be regarded as negligible.

- A NO_X source apportionment exercise was undertaken for Scenario 3S at future modelled receptors. The assessment demonstrates with the Scenario 3S, a largely consistent ranking of contributing vehicle classes with Petrol Cars (inclusive of Petrol Hybrid and Petrol Plugin Hybrid Cars) and Diesel LGVs found to be the main contributors to total road NO_X concentrations.

1 Introduction

1.1 Bureau Veritas UK Ltd has been commissioned by Adur District Council ('the Council') to complete a detailed dispersion modelling assessment to inform the Adur Local Plan update.

1.2 The new Adur Local Plan will provide a clear strategy for development within the Adur Local Plan area. As per the Sustainability Appraisal Scoping Report, some key sustainability issues facing the council were identified as follows:

- There is a continued need to provide housing to meet the needs of existing and future residents.
- There is a high demand for both flats and houses.
- The demand for housing (both affordable and market tenures) continues to exceed supply.

1.3 The Strategic Housing Land Availability Assessment (SHLAA) has identified multiple sites across the District that are suitable, available and achievable for housing and economic development uses. The dispersion modelling assessment has been undertaken to assess the impact of the proposed development sites on the air quality that current and future residents will be subject to.

1.4 The SHLAA Site locations are illustrated in Figure 4-2. Sites are split between the following categories:

- Existing allocations;
- Potential allocations; and
- Committed sites.

1.1 Scope of Assessment

1.5 Based upon the requirements provided by the Council, the main objectives of this assessment are as follows:

- To model future NO_2, PM_{10} and $PM_{2.5}$ annual mean concentrations in order to ascertain the likely air quality impacts associated with the allocation of land for housing;
- Quantify any likely air quality impacts associated with developments taking place on the potential land allocations across Adur and provide recommendations for mitigation if required;
- Identify the main sources of pollutant concentrations; and,
- Consideration of internationally designated sites and sensitive ecological receptor locations to determine whether they will be negatively impacted by any proposed development in the region.

1.6 The approach adopted in this assessment to evaluate the impact of road traffic emissions on air quality has utilised Cambridge Environmental Research Consultants (CERC) ADMS-Roads™ dispersion model (version 5.0.1) with the latest vehicle emission factors released by the Department for Environment, Food and Rural Affairs (Defra) Emissions Factors Toolkit (EFT) version 12.0.1, focusing on NO_2 PM_{10} and $PM_{2.5}$ These pollutants are the main pollutants of concern associated with traffic emissions for comparison against the relevant Air Quality Standard (AQS) objectives, both nationally and within the Council's administrative area. Further general information in relation to these pollutants and urban pollution is provided in Appendix A.

1.7 In order to provide consistency with the Council's own work on air quality, the guiding principles for air quality assessments as set out in the latest guidance and tools provided by Defra (LAQM TG(22)[1]) have been used where relevant.

[1] LAQM Technical Guidance LAQM TG(22) – August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.

2 Legislation, Policy and Guidance

2.1 Legislation

2.1 The Air Quality Standards Regulations 2010 (as amended)2 set limit values for concentrations in outdoor air of major air pollutants.

2.2 The Air Quality Strategy Volume 13, provides the over-arching strategic framework for air quality management in the UK and contains national air quality standards (AQS) and objectives established by the UK Government and Devolved Administrations to protect human health.

2.3 A revised Air Quality Strategy for England4, sets out the actions that Defra expects local authorities to take in support of long-term air quality goals, including new $PM_{2.5}$ targets. It provides a framework to enable local authorities to make the best use of their powers and make improvements for their communities.

2.4 The AQS objectives apply at locations outside buildings or other natural or man-made structures above or below ground, where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period. Typically, these include residential properties and schools/care homes for long-term (i.e., annual mean) pollutant objectives and streets or amenity areas for short-term (i.e., 1-hour) pollutant objectives. Table 2.1, taken from LAQM TG(22)5, provides an indication of those locations that may or may not be relevant for each averaging period.

2.5 This assessment focuses on NO_2, PM_{10} and $PM_{2.5}$ as these are the pollutants of most concern within the UK. The AQS objectives for these pollutants are presented in Table 2.1.

Table 2.1 – Examples of where the AQS Objectives should apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean and 8-hour mean	All locations where the annual mean objectives would apply, together with hotels. Gardens or residential properties[1].	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might	Kerbside sites where the public would not be expected to have regular access.

[2] The National Archives (2010) The Air Quality Standards Regulations 2010.
[3] Defra (2011) The air quality strategy for England, Scotland, Wales and Northern Ireland: Volume 1.
[4] Defra (2023) Air Quality Strategy - Framework for local authority delivery.
[5] LAQM Technical Guidance LAQM TG(22) – August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
	reasonably be expected to spend one hour or more. Any outdoor locations at which the public may be expected to spend one hour or longer.	
15-minute mean	All locations where members of the public might reasonably be expected to spend a period of 15 minutes or longer.	
Notes: [1] For gardens and playgrounds, such locations should represent parts of the garden where relevant public exposure is likely, for example where there is seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied.		

Table 2.2 – Relevant AQS Objectives for the Assessed Pollutants in the UK

Pollutant	AQS Objective	Concentration Measured as:	Date for Achievement
Nitrogen Dioxide (NO_2)	200 µg/m³ not to be exceeded more than 18 times per year	1-hour mean	31 December 2005
	40 µg/m³	Annual mean	31 December 2005
Particulate Matter (PM_{10})	50 µg/m³ not to be exceeded more than 35 times per year	24-hour mean	1 January 2005
	40 µg/m³	Annual mean	1 January 2005
Particulate Matter ($PM_{2.5}$)	20µg/m³	Annual Mean	1 January 2020
	12µg/m³	Annual Mean	January 2028
	10 µg/m³ not to be exceeded at any relevant monitoring station	Annual Mean	31st December 2040

2.2 Policy

2.2.1 Local Air Quality Management (LAQM)

2.6 Part IV of the Environment Act 1995, amended in 2021[6] places a statutory duty on local authorities to periodically review and assess the current and future air quality within their area and determine whether they are likely to meet the AQS objectives set down by Government for a number of pollutants – a process known as LAQM. The AQS objectives that apply to LAQM are defined for seven pollutants: benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, sulphur dioxide and particulate matter.

2.7 Local Authorities are required to review concentrations of these pollutants annually. Where the AQS objectives are identified to be exceeded for any of these pollutants within this annual report, a local authority is required to define and declare an Air Quality Management Area (AQMA).

2.8 Where an authority has declared an AQMA, and development is proposed to take place either within or near the declared area, further deterioration to air quality resulting from a proposed development can be a potential barrier to gaining consent for the development proposal. Similarly, where a development would lead to an increase of the population within an AQMA,

[6] Environment Act (2021), Part IV. Published by the UK Government. Available at: https://www.legislation.gov.uk/ukpga/2021/30/part/4/enacted

the protection of residents against the adverse long-term impacts of exposure to existing poor air quality can provide the barrier to consent.

2.9 Adur District Council has currently no AQMA declared, as detailed in section 3.1.

2.2.2 National Planning Policy

2.10 The National Planning Policy Framework7 (NPPF) sets out government's planning policies for England and how these are expected to be applied. It states that the planning system should contribute to and enhance the natural, built and historic environment, by preventing new development from contributing or being adversely affected by unacceptable concentrations of air pollution and development should, wherever possible, help to improve local environmental conditions such as air and water quality. In specific relation to the air quality policy, the document states:

2.11 186. "Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan".

2.2.3 National Planning Practice Guidance

2.12 The National Planning Practice Guidance (NPPG)8 provides guidance on how planning can take account of the impact of new development on air quality. It is stated in the NPPG that air quality is relevant to planning applications when the development could "Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality."

2.2.4 Local Planning Policies

2.13 The current Local Plan was adopted in December 2017 and sets the strategic development and land-use priorities for Adur up to 2032[9].

2.14 The plan intends to address a number of issues including "The need to address road congestion and related pollution, air and noise, whilst improving the existing transport network and facilitating the development of sustainable transport measures. Parts of Adur experience road congestion and there is a high level of car dependence. This, along with anticipated future development, could worsen congestion and lead to poorer air quality by 2032 (especially in Air Quality Management Areas) unless measures are taken to mitigate these impacts, and encourage modal shift".

2.15 Policy 34 on Pollution and Contamination also states that "Development should not result in pollution or hazards which prejudice the health and safety of the local community and the environment, including nature conservation interests and the water environment. New development in Adur will be located in areas most suitable to the use of that development to avoid risks from noise, air, odour or light pollution. Mitigation measures will need to be implemented for developments that could increase levels of pollution or have a negative

[7] National Planning Policy Framework (2023), available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2
[8] National Planning Practice Guidance – Air Quality (2019), available at: https://www.gov.uk/guidance/air-quality--3
[9] https://www.adur-worthing.gov.uk/adur-local-plan/

impact on drinking water supplies in Adur. Where there are significant levels of increased pollution that cannot be mitigated, development will be refused. Where appropriate, air quality assessments and/or noise assessments will be required in conjunction with development proposals".

2.3 Relevant Guidance

2.3.1 Land-Use Planning & Development Control: Planning for Air Quality

2.16 Although no formal procedure exists for classifying the magnitude and significance of air quality effects from a new development, the EPUK and IAQM guidance document 'Land-Use Planning and Development Control: Planning for Air Quality'10 provides a decision-making process which assists with the understanding or air quality impacts and implications as a result of development proposals. The guidance includes a method for screening the requirement for an air quality assessment, the undertaking of an air quality assessment, the determination of an air quality impact associated with a development proposal and whether this impact is significant.

2.17 The EPUK/IAQM Guidance details the magnitude of impact due to an increase in annual mean NO_2, PM_{10} and other pollutants, using the criteria in Table 2-3.

Table 2-3 – Impact Descriptors for Changes in Pollutant Concentrations at a Receptor

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

Explanation

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

[10] https://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf

2.3.2 Local Air Quality Guidance

2.18 The Sussex-air Partnership published 'Air quality and emissions mitigation guidance for Sussex (2021)'[11]. The guidance initially provides detail on when an air quality assessment is required to accompany a planning application, and following this provides a comprehensive overview of the approach(es) to be taken within any air quality assessment to be completed.

2.19 The key concern with regard to the air quality impacts of a development is the likely effect on human health. It is important that an air quality assessment evaluates modelled air quality in terms of changes in pollution concentrations where there is relevant public exposure.

2.3.3 IAQM Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites

2.20 This guidance[12] aims to provide clarity on the methodology to determine impacts to designated sites. This guidance discusses the policy and legal background underpinning the proposed methodology, including the impact of the Wealden Judgement[13]. It outlines the way in which air quality consultants and ecologists should work together, highlighting the responsibilities of each when carrying out Habitats Regulations Assessments.

2.3.4 Air Pollution Information System (APIS) for Assessment of Air Quality on Sensitive Habitats

2.21 The APIS website provides specific information on the potential effects of nitrogen and acid deposition on various habitats and species. This information, relevant to habitats of some of the ecological receptors considered in this assessment, is presented in Table 2-4.

Table 2-4 - Typical Habitat and Species Information Concerning Nitrogen Deposition from APIS

Habitat and Species Specific Information	Critical Load (kg N ha^{-1} yr^{-1})	Relevant Site(s)
Coastal saltmarsh	20-30	Widewater Lagoon LNR
Calcareous grassland	5-10	Lancing Ring LNR Mill Hill LNR
Atlantic upper-mid & mid-low salt marshes	10-20	Adur Estuary SSSI

2.22 In addition, a summary of the relevant AQS Objective for ecological receptors is provided in Table 2-5.

Table 2-5 - Relevant Air Quality Standards for Ecological Receptors

Habitat and Species Specific Information	Averaging Period	Values (µg/m³)
Oxides of nitrogen (NO_X)	Annual mean	30
Oxides of nitrogen (NO_X)	Daily mean	75

2.3.5 World Health Organization (WHO) Global Air Quality Guidelines (AQGs)

2.23 The WHO updated its Global AQG in 2021[14], taking into account the latest body of evidence on the health impacts of different outdoor air pollutants. These guidelines are not legally

[11] Sussex-air (2021) Air quality and emissions mitigation guidance for Sussex (2021).
[12] IAQM (2019) A guide to the assessment of air quality impacts on designated nature conservation sites.
[13] Wealden District Council v Secretary of State for Communities and Local Government, Lewes District Council and South Downs National Park Authority [2017] EWHC 35 1.
[14] WHO, Global Air Quality Guidelines (2021).

binding standards; however, they do provide WHO Member States with an evidence-informed tool that they can use to inform legislation and policy. AQG levels are currently lower than those set in UK legislation.

3 Review and Assessment of Air Quality Undertaken by the Council

3.1 Local Air Quality Management

3.1 The Council, under its obligations in Part IV of the Environment Act 1995, has maintained a thorough annual review and assessment of air quality through their statutory reporting, the most recent Annual Status Report prepared in 2024 and including data up to 2023, was provided by the Council. The Council provided diffusion tubes annual mean data for 2023, in advance of publication of the 2024 report. The Council revoked both of its AQMAs in December 2023, which were known as follows:

- AQMA No1 (Shoreham AQMA), the High Street, Shoreham-by-Sea between the Ropetackle Roundabout and Surry Street.
- AQMA No2 (Southwick AQMA), which incorporated the Old Shoreham Road, Southwick between Kingston Lane and Lower Drive.

3.2 Both AQMAs were originally declared in 2005 due to exceedances of the annual mean AQS objective for concentrations of NO_2 but have been compliant for more than five years at the time of revocation.

3.2 Review of Air Quality Monitoring

3.2.1 Local Air Quality Monitoring

3.3 The most recent LAQM report the Council has prepared is the 2024 Air Quality Annual Status Report (ASR), inclusive of 2023 monitoring data. In 2023, NO_2 was monitored at 26 locations using passive diffusion tubes, including one triplicate site. Table 3-1 presents annual mean concentrations recorded at the automatic monitoring site in 2023 for reference. Details of monitoring locations that were used in the assessment, and the relevant 2023 pollutant concentrations are presented in Table 3-2.

3.4 It can be seen from the 2023 monitoring results that there was no exceedance of the annual mean AQS objective for NO_2. The highest NO_2 concentration at the monitoring sites used within the assessment, was recorded at S52, which is located on Grinstead Lane Roundabout which recorded an annual mean concentration of 35.2µg/m³.

Table 3-1 – 2023 Adur Continuous Monitoring

Site ID	Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Annual Mean Concentration (µg/m³) NO_2	NO_2 hourly Means in Excess of the 1 hour Objective (200µg/m³)	Annual Mean Concentration (µg/m³) $PM_{2.5}$
AD1	High Street Shoreham	Kerbside	521399	105039	21.0	0	10.7
WT2	Grove Lodge, Worthing	Roadside	514184	104963	23.4	0	8.7

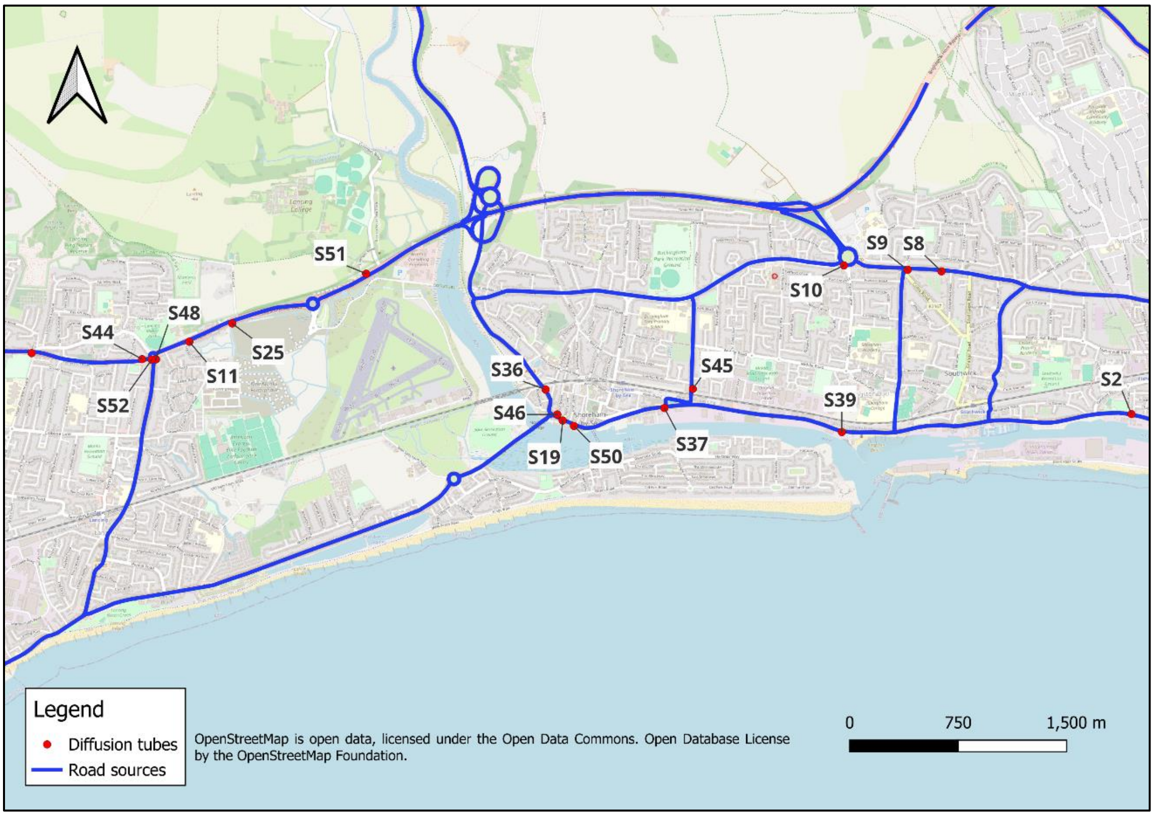
Table 3-2 – 2023 Adur NO_2 Passive Monitoring used for the assessment

Site ID	Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Annual Mean (µg/m³)
S2	Old Mill Close Fishersgate	Roadside	525330	105085	18.1
S8	Underdown Road Southwick	Roadside	524018	106070	22.4
S9	Old Shoreham Road Southwick	Roadside	523784	106081	23.6
S10	Holmbush Roundabout Shoreham	Roadside	523343	106111	18.0
S11	Lancing Manor Lancing	Roadside	518820	105584	25.2
S12	Boundstone Lane Lancing	Roadside	517731	105505	21.6
S13	Upper Brighton Road Sompting	Roadside	517291	105550	27.7
S17-19	High Street AQ station	Kerbside	521400	105040	23.3
S25	Mash Barn Lane Lancing	Roadside	519117	105710	24.4
S36	Victoria Road Footpath Shoreham	Roadside	521282	105254	17.8
S37	Humphrey's Gap Shoreham	Roadside	522103	105126	23.4
S39	Brighton Road Kingston	Kerbside	523329	104960	17.2
S44	Upper Brighton Road Lancing	Roadside	518494	105464	31.8

Site ID	Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Annual Mean (µg/m³)
S45	Dolphin Mews Shoreham	Roadside	522300	105258	14.6
S46	West Street 1 Shoreham	Roadside	521363	105082	18.6
S48	Grinstead Lane Lancing	Roadside	518590	105463	27.5
S50	High Street Shoreham	Roadside	521478	105002	20.5
S51	Sussex Pad Lancing	Kerbside	520042	106054	21.3
S52	Grinstead Lane Roundabout Lancing	Kerbside	518560	105460	35.2

3.5 Figure 3-1 shows a visual representation of the monitoring locations used within the assessment referenced against the future development sites and the modelled road links, as detailed in Section 4.

Figure 3-1 – Monitoring Locations used in the Modelling Assessment with Reference to Modelled Roads



3.2.2 Background Concentrations

3.6 DEFRA maintain a nationwide model of existing and future background air quality concentrations at a 1 km grid square resolution[15]. The data sets include annual average concentration estimates for NO_X, NO_2, PM_{10} and $PM_{2.5}$, using a base year of 2018 for future year prediction. The model used is semi-empirical in nature; it uses the national atmospheric emissions inventory (NAEI) emissions to model-predict the concentrations of pollutants at the centroid of each 1km grid square, but then calibrates these concentrations in relation to actual monitoring data.

3.7 Annual mean background concentrations have been obtained from the Defra published background maps[16], based on the 1km grid squares which cover the modelled area and the affected road network.

3.8 Due to the extent of the modelled roads (as seen in Figure 3-1) and to avoid double counting of emission sources, Defra's Background contributions from A roads (Trunk and Primary) were removed using the NO_X Sector Removal Tool[17]. Contributions from A roads are included

[15] UK AIR Background Mapping Tool. Available at: https://uk-air.defra.gov.uk/data/laqm-background-home
[16] Defra Background Maps http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html
[17] NOx Sector Removal Tool https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxsector

as part of the modelling. The background concentrations used in the modelling assessment are detailed in Table 3-3.

3.9 The modelling scenarios span across two separate years; 2023 as the baseline year and 2041 as the development opening year. Currently, Defra background maps are only available up to 2030. For the assessment of 2041 background concentrations, concentrations have been taken from 2030. As background concentrations are expected to improve year on year as vehicle emissions technology improves and as part of other UK wide initiatives, the utilisation of 2030 background concentrations provides for a conservative assessment.

Table 3-3 - Defra Background Map Concentrations used in the Modelling Assessment

Grid Reference	2023 Annual Mean Concentration (µg/m^3)				2030 Annual Mean Concentration (µg/m^3) used for 2041 future assessment year			
	NO_X	NO_2	PM_{10}	$PM_{2.5}$	NO_X	NO_2	PM_{10}	$PM_{2.5}$
516500, 105500	10.8	8.3	13.8	9.3	9.5	7.4	13.6	9.2
517500, 105500	11.5	8.8	14.5	10.1	10.0	7.8	14.3	9.9
518500, 105500	11.8	9.0	14.5	10.1	10.3	7.9	14.3	10.0
519500, 105500	11.9	9.1	14.0	9.2	10.3	7.9	13.8	9.0
519500, 106500	9.7	7.5	13.1	8.6	8.5	6.6	12.9	8.5
520500, 106500	9.9	7.6	14.0	9.1	8.6	6.7	13.8	8.9
521500, 106500	10.5	8.1	13.8	9.3	9.0	7.0	13.6	9.2
522500, 106500	10.7	8.2	13.9	9.4	9.3	7.2	13.7	9.3
523500, 106500	11.7	9.0	14.3	9.7	10.2	7.9	14.1	9.6
524500, 107500	11.0	8.5	14.3	9.8	9.5	7.4	14.1	9.6
525500, 107500	11.1	8.5	15.2	10.0	9.5	7.4	15.0	9.9
526500, 107500	11.4	8.8	14.7	10.0	9.8	7.6	14.5	9.8
517500, 104500	12.7	9.6	14.2	10.1	11.1	8.5	14.0	9.9
516500, 104500	11.9	9.1	13.8	9.5	10.5	8.1	13.6	9.3
517500, 103500	15.7	11.6	13.1	9.0	14.2	10.7	12.9	8.9
518500, 104500	12.6	9.6	14.2	10.0	11.0	8.5	14.0	9.9
518500, 103500	10.6	8.2	12.8	8.8	9.4	7.3	12.6	8.7
520500, 105500	12.0	9.2	12.8	8.7	10.3	7.9	12.6	8.5
521500, 105500	11.9	9.1	13.7	9.5	10.3	7.9	13.5	9.4
522500, 105500	13.2	10.0	13.9	9.7	11.5	8.8	13.7	9.6
524500, 106500	12.1	9.3	14.5	10.3	10.4	8.1	14.3	10.1
524500, 105500	13.7	10.3	14.3	10.1	11.7	9.0	14.1	9.9
525500, 105500	15.8	11.7	14.9	10.5	13.6	10.2	14.7	10.3
526500, 105500	26.1	18.0	14.9	10.5	23.3	16.4	14.6	10.3
519500, 103500	9.3	7.3	12.0	8.3	8.1	6.4	11.8	8.1
519500, 104500	12.0	9.2	13.3	9.1	10.3	8.0	13.1	8.9
520500, 104500	10.0	7.8	12.7	8.7	8.7	6.8	12.5	8.5
521500, 104500	9.6	7.5	12.5	8.6	8.4	6.6	12.3	8.4
523500, 104500	12.3	9.4	12.7	8.7	10.6	8.2	12.5	8.6
525500, 104500	19.9	14.3	12.7	8.7	16.8	12.3	12.5	8.6
526500, 104500	18.6	13.5	12.9	8.9	15.8	11.7	12.7	8.7
526500, 106500	14.6	10.9	14.9	10.5	12.6	9.6	14.7	10.3
523500, 105500	12.4	9.5	14.1	10.0	10.8	8.3	13.9	9.9
522500, 104500	10.1	7.8	12.7	8.7	8.8	6.9	12.5	8.6

4 Assessment Methodology

4.1 The assessment of air quality requires the prediction of the cocentration in air of different substances which can be harmful to human health. These are called ‘pollutants’. It is possible to estimate changes in pollutant concentrations using computer modelling software by inputting known sources of these pollutants or ‘emissions sources’. An example of an emissions source is from vehicle exhausts. These emissions sources then take into account wind and weather data as well as other parameters which can assess how the emissions will disperse over a wider area to allow for the prediction of pollutant concentration at specific locations. This process is called ‘dispersion modelling’.

4.2 The approach applied to this assessment has been based on quantitative prediction of ambient NO_2, NO_X, PM_{10}, and $PM_{2.5}$ concentrations, as well as nitrogen deposition, to which existing and future receptors may be exposed to upon completion of developments in 2041.

4.3 This section presents the methodology used in the dispersion model assessment, including information regarding traffic flows, selected receptors, meteorological data, and dispersion parameters.

4.1 Operational Effects – Road Traffic Emissions

4.4 Emissions from road traffic have been predicted at receptor locations using ADMS-Roads, an advanced atmospheric dispersion model that has been developed and validated by Cambridge Environmental Research Consultants (CERC). The ADMS-roads software is used extensively throughout the UK for regulatory compliance purposes and is accepted as an appropriate air quality modelling tool by the Environment Agency and local authorities.

4.5 The following scenarios have been assessed:

- 2023 Baseline – Base flows for the baseline year (2023). Used for model verification;
- 2041 Baseline (2041 DM) – Base flows for 2041 including committed schemes, for the proposed year of completion (2041); and
- 2041 Scenario 3 with Strategies (2041 3S) – Base flows for 2041 including committed schemes, with potential and existing allocations schemes for the proposed year of completion (2041);

4.6 Committed schemes included in 2041 scenarios are detailed in the Transport Study prepared by the Transport Consultant[18]. These include committed residential and employment development sites, consistent with the adopted 2017 Adur Local Plan.

4.1.1 Traffic Data

4.7 The ADMS-Roads assessment incorporates numbers of road traffic vehicles, the proportion of different vehicle classes and vehicle speeds on the local roads.

4.8 Traffic flows for all vehicles as well as the proportion of Heavy Duty Vehicles (HDVs: Heavy Goods Vehicles (HGVs) and Buses/Coaches with a total unladen weight ≥3.5 tonnes) were provided by the appointed transport consultant, WSP. Traffic speeds were estimated based on relevant speed limits. The reduction of vehicle speed at junctions and roundabouts was accounted for in the transport model in line with the LAQM.TG(22). Street canyons were included on High Street and Brighton Road, Shoreham.

[18] WSP, Adur Local Plan – Transport Study (2023).

4.9 The Emissions Factors Toolkit (EFT) version 12 developed by Defra[19] was then used to determine vehicle emissions for input into the ADMS-Roads model, based upon the traffic data inputs. As 2030 is the latest available year for calculating emission factors, this year was used for the 2041 future year scenarios. The Basic option was used that allowed the input of percentage of HDVs.

4.10 The modelled road links are presented in Figure 3-1.

4.2 Modelled Receptors

4.11 Existing receptors and future receptors (inclusive of committed sites, existing sites and proposed allocations) considered in the assessment of emissions from road traffic are presented in Figure 4-1 and 4-2, respectively. Development receptors have not been included at sites that are solely allocated for employment as the Air Quality Strategy objectives do not apply at these locations, see Table 2.2.

4.12 Residential receptors have been modelled at heights typical of human exposure i.e. 1.5m for ground level.

4.13 Designated ecological sites within 200 m of affected roads with nitrogen sensitive species present have been included as required by DMRB and IAQM guidance. A transect of points at 10 m intervals has been used to predict the potential impact to air quality at these features. Table 4-1 presents the list of ecological sites included in the assessment. Figure 4-3 presents modelled receptors locations nearest to the kerb of the road only, for ease of visualisation. Shoreham Beach LNR is located further than 200 m of affected roads and was therefore excluded from the assessment.

Table 4-1 - Ecological Receptor Locations

Ecological Site	Centre Coordinate		Ecological Designation
	X	Y	
Adur Estuary	520648	106341	SSSI
Widewater Lagoon	519897	104174	LNR
Lancing Ring	518019	106311	LNR
Mill Hill	521137	107337	LNR

[19] Defra, Emission Factors Toolkit (2024). http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

Figure 4-1 – Modelled Road Links and Existing Receptor Locations

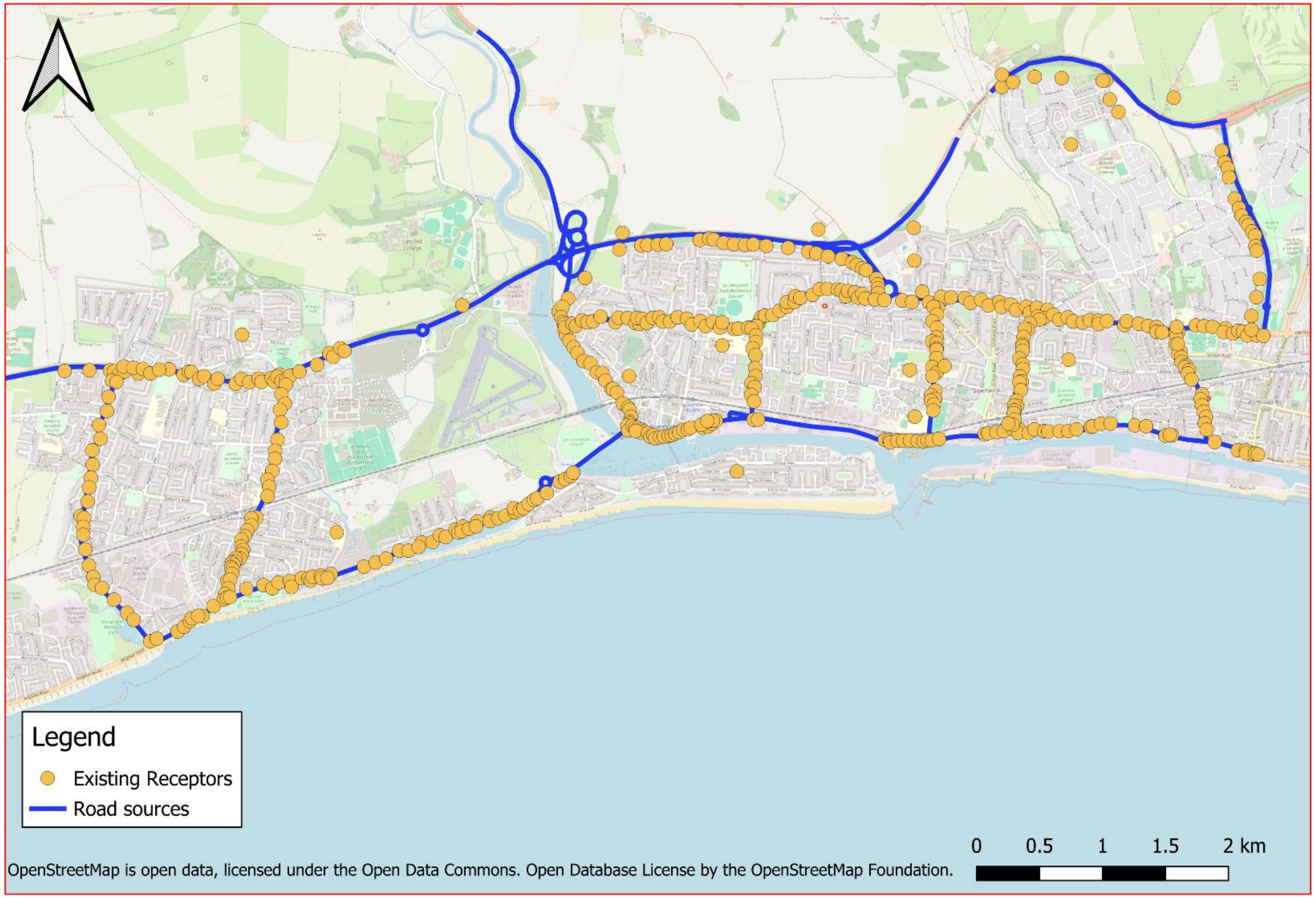


Figure 4-2 – Modelled Road Links and Future Receptor Locations

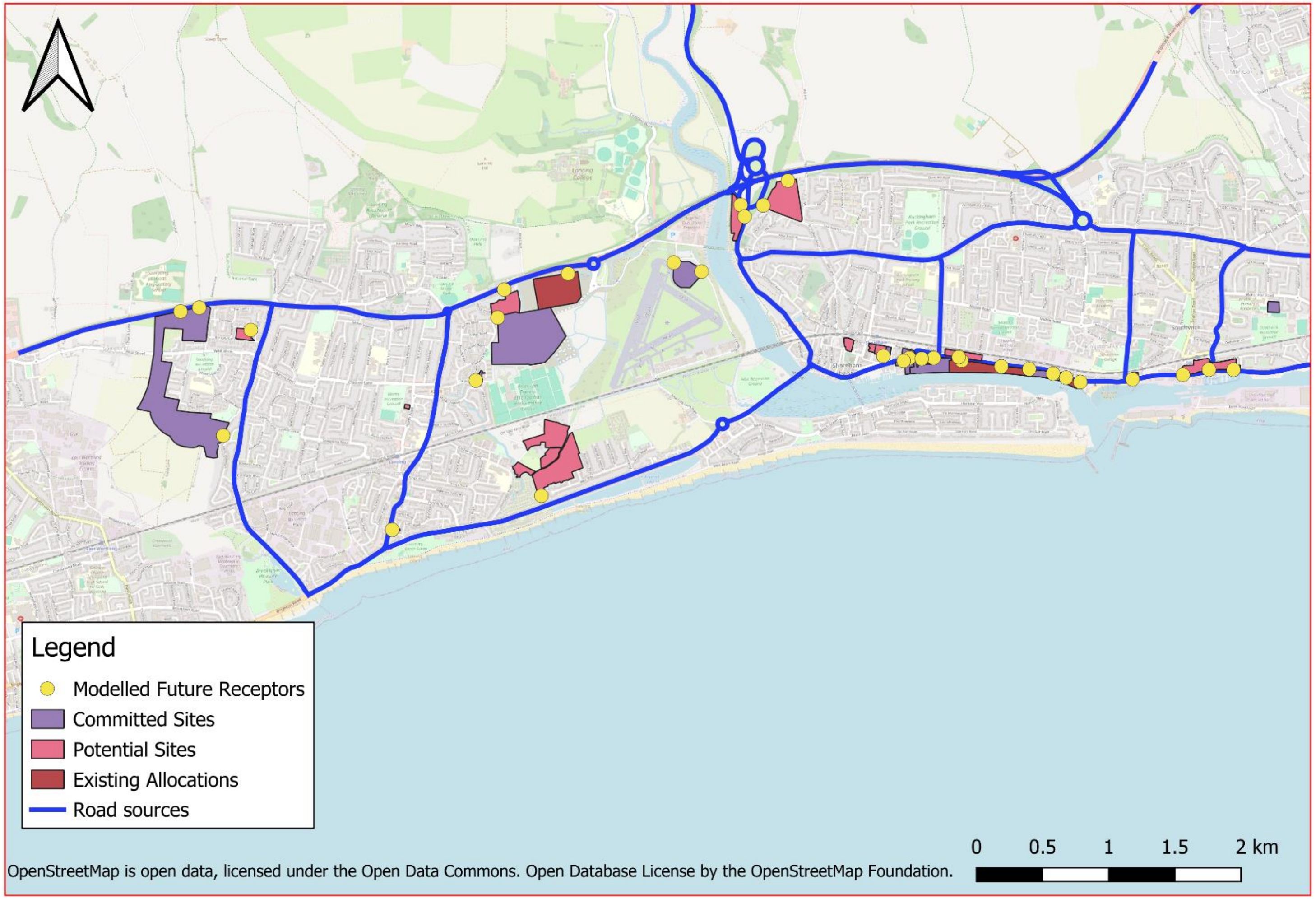
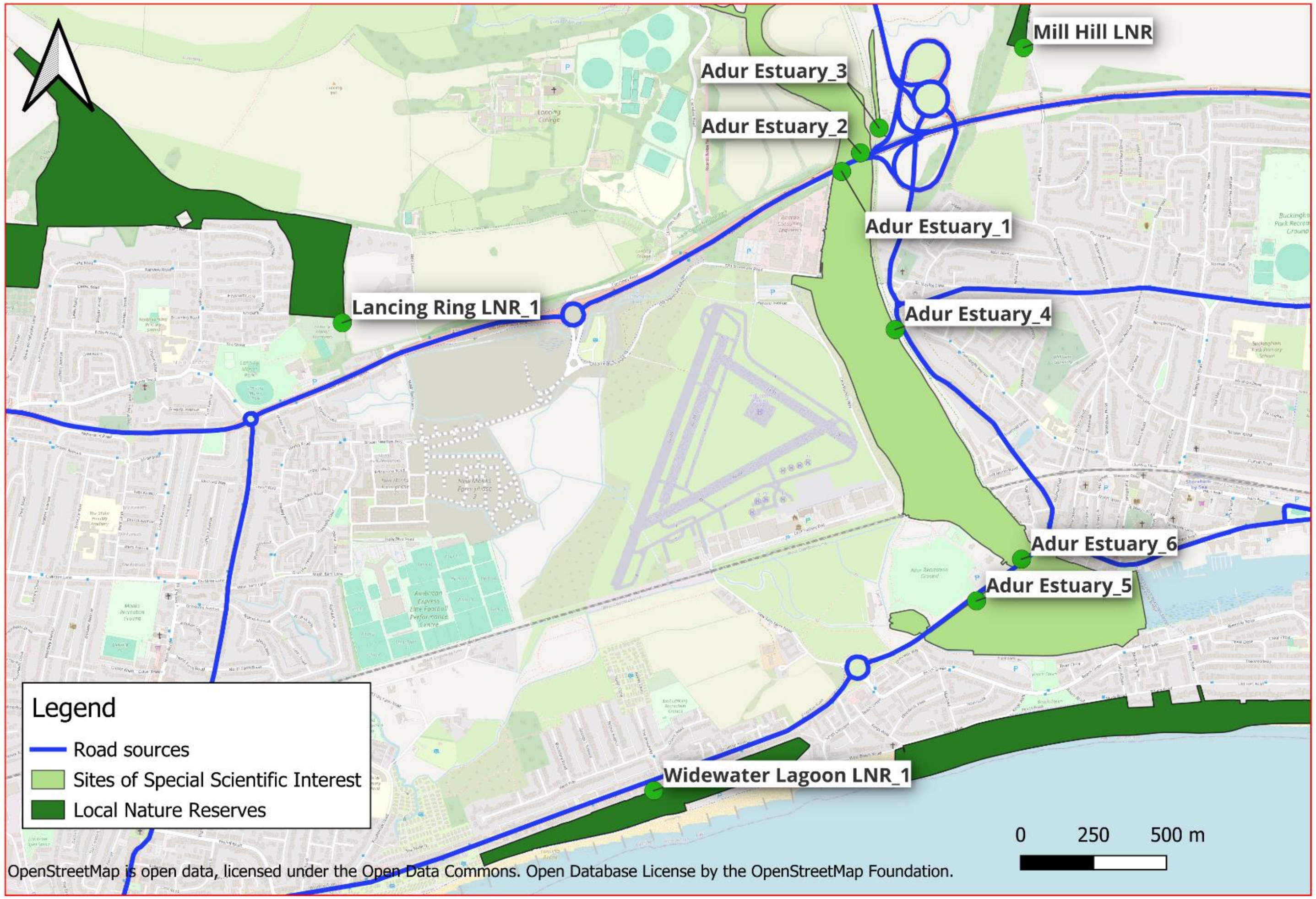


Figure 4-3 – Modelled Road Links and Ecological Receptor Locations

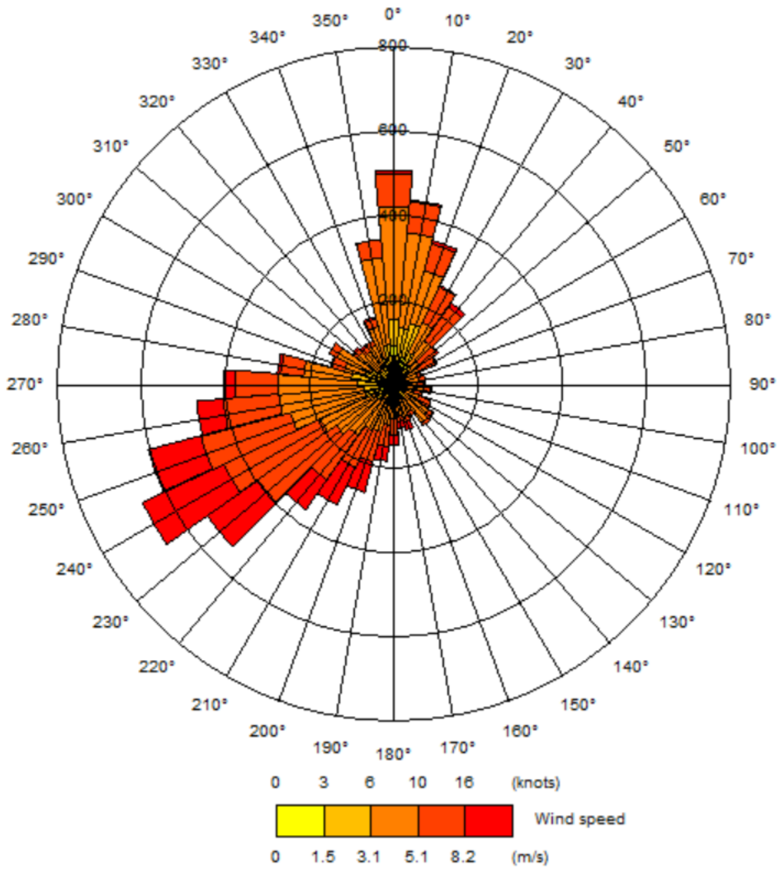


4.3 Meteorological Data

4.14 Meteorological data from a representative station to the study area is required as input to the dispersion model. 2023 meteorological data from the Shoreham weather station has been used in this assessment. A wind rose for this site for the year 2023 is shown in Figure 4-4. Most dispersion models do not use meteorological data if it relates to calm winds conditions, as dispersion of air pollutants is more difficult to calculate in these circumstances. ADMS-Roads treats calm wind conditions by setting the minimum wind speed to 0.75m/s. It is recommended in LAQM.TG(22)1 that the meteorological data file be tested within a dispersion model and the relevant output log file checked, to confirm the number of missing hours and calm hours that cannot be used by the dispersion model. This is important when considering predictions of high percentiles and the number of exceedances. LAQM.TG(22) recommends that meteorological data should only be used if the percentage of usable hours is greater than 75%, and preferably 90%. The 2023 meteorological data from Shoreham includes 8,702 lines of usable hourly data out of the total 8,760 for the year, i.e. 99.3% usable data. This is therefore suitable for the dispersion modelling exercise.

4.15 A wind rose for this site for the year 2023 is presented in Figure 4-4.

Figure 4-4 – Wind Rose for Shoreham Meteorological Data



4.4 Deposition

4.16 The predominant route by which emissions will affect land in the vicinity of a process is by deposition of atmospheric emissions. Potential ecological receptors can be sensitive to the deposition of pollutants, particularly nitrogen and sulphur compounds, which can affect the character of the habitat through eutrophication and acidification.

4.17 Deposition processes in the form of dry and wet deposition remove material from a plume and alter the plume concentration. Dry deposition occurs when particles are brought to the surface by gravitational settling (when particles settle onto surfaces because of gravity's influence) and turbulence. They are then removed from the atmosphere by deposition on the land surface. Wet deposition occurs due to rainout (within cloud) scavenging and washout (below cloud) scavenging of the material in the plume. These processes lead to a variation with downwind distance of the plume strength and may alter the shape of the vertical concentration profile as dry deposition only occurs at the surface.

4.18 Near to sources of pollutants (< 2 km), dry deposition is the predominant removal mechanism (Fangmeier et al. 1994). Dry deposition may be quantified from the near-surface plume concentration and the deposition velocity (Chamberlin and Chadwick, 1953);

$$F_d = v_d C(x, y, 0)$$

where:

F_d = dry deposition flux (μg m^{-2} s^{-1})

v_d = deposition velocity (m s^{-1})

$C(x, y, 0)$ = ground level concentration (μg/m^3)

Assuming irreversible uptake, the total wet deposition rate is found by integrating through a vertical column of air;

$$F_w = \int_0^z \Lambda C \, dz$$

where;

F_w = wet deposition flux (μg m^{-2} s^{-1})

Λ = washout co-efficient (s^{-1})

C = local airborne concentration (μg/m^3)

z = height (m)

The washout co-efficient is an intrinsic function of the rate of rainfall.

4.19 Environment Agency guidance AQTAG06 (Environment Agency, 2014) recommends deposition velocities for various pollutants, according to land use classification (Table 4-2).

Table 4-2 - Recommended Deposition Velocities

Pollutant	Deposition Velocity (m s 1)	
	Short Vegetation	Long Vegetation/Forest
NO_X	0.0015	0.003
Source: Environment Agency (2014) 'Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air', AQTAG06 Updated Version (March 2014)'		

In order to assess the impacts of deposition, habitat-specific critical loads and critical levels have been created. These are generally defined as (e.g., Nilsson and Grennfelt, 1988):

“a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge”

4.20 It is important to distinguish between a critical load and a critical level. The critical load relates to the quantity of a material deposited from air to the ground, whilst critical levels refer to the concentration of a material in air. The UK Air Pollution Information System (APIS) provides critical load data for ecological sites in the UK.

4.21 The critical loads used to assess the impact of compounds deposited to land which result in eutrophication and acidification are expressed in terms of kilograms of nitrogen deposited per hectare per year (kg N ha-1 y-1) and kilo equivalents deposited per hectare per year (keq ha-1 y-1). To enable a direct comparison against the critical loads, the modelled total wet and dry deposition flux (µg m-2 s-1) must be converted into an equivalent value.

4.22 For a continuous release, the annual deposition flux of nitrogen can be expressed as:

$$F_{NTot} = \left(\frac{K_2}{K_3}\right) \cdot t \cdot \sum_{i=1}^{T} F_i \left(\frac{M_N}{M_i}\right)$$

where:

F_{NYot} = Annual deposition flux of nitrogen (kg N ha^{-1} y^{-1})

K_2 = Conversion factor for m^2 to ha (= 1x104 m^2 ha^{-1})

K_3 = Conversion factor for µg to kg (= 1x109 µg kg^{-1})

t = Number of seconds in a year (= 3.1536x107 s y^{-1})

i = 1,2,3…….T

T = Total number of nitrogen containing compounds

F = Modelled deposition flux of nitrogen containing compound (µg m^{-2} s^{-1})

M_N = Molecular mass of nitrogen (kg)

M = Molecular mass of nitrogen containing compound (kg)

4.23 The unit eq (1 keq ≡ 1,000 eq) refers to molar equivalent of potential acidity resulting from e.g. sulphur, oxidised and reduced nitrogen, as well as base cations. Conversion units are provided in AQTAG(06):

- 1 keq ha^{-1} y^{-1} = 14 kg N ha^{-1} y^{-1}
- 1 keq ha^{-1} y^{-1} = 16 kg S ha^{-1} y^{-1}

4.24 For the purposes of this assessment, dry deposition rates of nitrogen and acidic equivalents at the identified ecological receptors have been calculated by applying the ‘short vegetation’ deposition velocities (as detailed in Table 4-2) to the modelled annual mean concentrations of NO_X. Wet deposition has not been assessed since this is not a significant contributor to total deposition over shorter ranges (Fangmeier et al. 1994; Environment Agency, 2006).

4.25 Estimated background deposition rates of nutrient nitrogen and total acid deposition for the UK are available via the Air Pollution Information Service (APIS) website (http://www.apis.ac.uk). Table 4-3 provides the estimated deposition rates for the ecological receptors considered in this study, as obtained from the APIS website. It should be noted that the level of uncertainty associated with these modelled estimates is relatively high and the results are presented from the model across the UK on a coarse 5km grid square resolution.

Table 4-3 - Estimated Background Deposition Rates

Site	Background Nitrogen Deposition (mid year 2020) (kg N ha 1 y 1)	Background Nitric Acid Deposition (keq ha 1 y 1)
Adur Estuary	7.80	0.64
Widewater Lagoon	7.70	0.63
Lancing Ring	7.48	0.61
Mill Hill	7.53	0.65
Source: Air Pollution Information Service (APIS) website (http://www.apis.ac.uk)		

4.5 Surface Roughness

4.26 Roughness length, z0, represents the aerodynamic effects of surface friction and is physically defined as the height at which the extrapolated surface layer wind profile tends to zero. This value is an important parameter used by meteorological pre-processors to interpret the vertical profile of wind speed and estimate friction velocities which are, in turn, used to define heat and momentum fluxes and, consequently, the degree of turbulent mixing.

4.27 The surface roughness length is related to the height of surface elements; typically, the surface roughness length is approximately 10% of the height of the main surface features. Thus, it follows that surface roughness is higher in urban and congested areas than in rural and open areas. CERC (2020)[20] suggests typical roughness lengths for various land use categories (Table 4-4).

Table 4-4 – Typical Surface Roughness Lengths for Various Land Use Categories

Land Use	Surface Roughness: z_0 (m)
Large urban areas	1.5
Cities, woodlands	1.0
Parkland, open suburbia	0.5
Agricultural areas (max.)	0.3
Agricultural areas (min.)	0.2
Root crops	0.1
Open grassland	0.02
Short grass	0.005
Sea	0.0001

4.28 Increasing the surface roughness length increases turbulent mixing in the lower boundary layer. This can often have conflicting impacts in terms of ground level concentrations:

- The increased mixing can bring portions of an elevated plume down towards ground level, resulting in increased ground level concentrations closer to the emission source; and

[20] CERC, ADMS-Roads V5.0 User Guide (February 2020).

- The increased mixing increases entrainment of ambient air into the plume and dilutes plume concentrations, resulting in reduced ground level concentrations further downwind from an emission source.

4.29 The overall impact on ground level concentration is, therefore, strongly correlated to the distance and orientation of a receptor from the emission source.

4.30 Surface roughness length is entered within the model for both the dispersion site (the model domain), and for the location of where the meteorological data has been measured. As detailed above, the meteorological data utilised within the modelling has been taken from the Shoreham station. The weather station is located within Brighton City airport. The surface conditions at this location have been defined as 0.5 m.

4.31 The surface roughness length for the model domain has been defined as 0.5, which is representative of the overall land use characteristics within Adur.

4.6 Minimum Monin-Obukhov Length

4.32 A Minimum Monin-Obukhov Length is used as a model input within ADMS Roads as a parameter to describe the turbulent length scale, which is dependent on meteorological conditions. A minimum length can be used to account for the urban heat island effect, whereby retained heat in cities causes convective turbulence, which prevents the formation of a very shallow boundary layer at night.

Table 4-5 – Typical Minimum Monin-Obukhov Length for Various Land Use Categories

Type of Surface	Minimum Monin Obukhov Length
Large Conurbations > 1 million	100
Cities and Large Towns	30
Mixed Urban / Industrial	30
Small Towns < 10,000	10

4.33 In accordance with CERC's ADMS Roads user guide20, a minimum Monin-Obukhov Length of 30m will be used for the ADMS Roads model to reflect the local topography of the overall model domain.

4.7 Model Outputs

4.34 The background pollutant values discussed in Section 3.2.2 have been used in the ADMS-Roads model to calculate predicted total annual mean concentrations of NO_X, NO_2 and PM_{10}.

4.35 For the prediction of annual mean NO_2 concentrations for the modelled scenarios, the output of the ADMS-Roads modelled for road-NO_X has been converted to total-NO_2 following the methodology in LAQM.TG(22) and using the NO_X to NO_2 conversion tool developed on behalf of Defra. This tool also utilises the total background NO_X and NO_2 concentrations. This assessment has utilised version 8.1 (August 2020) of the NO_X to NO_2 conversion tool. The road contribution is then added to the appropriate NO_2 background concentration value to obtain an overall total NO_2 concentration.

4.36 For the prediction of short term NO_2 impacts, LAQM.TG(22) advises that it is valid to assume that exceedances of the 1-hour mean AQS objective for NO_2 are only likely to occur where the annual mean NO_2 concentration is 60µg/m^3 or greater. This approach has thus been adopted for the purposes of this assessment.

4.37 Annual mean PM_{10} road contributions were also output from the model and processed in a similar manner, i.e. combined with the relevant background annual mean PM_{10} concentrations to obtain overall total PM_{10} concentrations.

4.38 For the prediction of short term PM_{10}, LAQM.TG(22) provides an empirical relationship between the annual mean and the number of exceedances of the 24-hour mean AQS objective for PM_{10} that can be calculated as follows:

$$Number\ of\ 24\ hour\ Mean\ Exceedences = -18.5 + 0.00145 * annual\ mean^3 + \frac{206}{annual\ mean}$$

4.39 This relationship has been adopted to determine whether exceedances of short-term PM_{10} AQS objective are likely in this assessment.

4.40 Verification of the modelled concentrations has been undertaken using 19 NO_2 diffusion tubes in total.

4.41 Full details of the model verification completed can be found in Appendix B.

4.8 Uncertainty

4.42 Due to the number of inputs that are associated with the modelling of the study area there is a level of uncertainty that has to be taken into account when drawing conclusions from the predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$. The predicted concentrations are based upon a number of inputs from a number of different sources; traffic data, background concentrations, emission factors, meteorological data and availability of monitoring data from the assessment areas.

4.43 A degree of quality assurance/quality control (QA/QC) is completed throughout the modelling process, though the inputs, modelled outputs, and processing of results, to ensure that the accuracy of the modelled predictions is of a high standard to allow conclusions to be made upon them.

4.8.1 Uncertainty in NO_X and NO_2 Trends

4.44 Analyses of historical monitoring data within the UK has identified a disparity between measured concentration data and the projected decline in concentrations associated with emission forecasts for future years[21]. The report identifies that trends in ambient concentrations of NO_X and NO_2 in many urban areas of the UK have generally shown two characteristics; a decrease in concentration from about 1996 to 2002-2004, followed by a period of more stable concentrations from 2002-2004 up until 2009. Trends in more rural, less densely trafficked areas, tend to show downward trend in either NO_X or NO_2, which are more in line with those expected.

4.45 The reason for this disparity is thought to be related to the actual on-road performance of vehicles, in particular diesel cars and vans, when compared with calculations based on the Euro emission standards. Preliminary studies suggest the following:

- NO_X emissions from petrol vehicles appear to be in line with current projections and have decreased by 96% since the introduction of 3-way catalysts in 1993;
- NO_X emissions from diesel cars, under urban driving conditions, do not appear to have declined substantially, up to and including Euro 5. There is limited evidence that the same pattern may occur for motorway driving conditions; and
- NO_X emissions from HDVs equipped with Selective Catalytic Reduction (SCR) are much higher than expected when driving at low speeds.

[21] Carslaw, D, Beevers, S, Westmoreland, E, Williams, M, Tate, J, Murrells, T, Steadman, J, Li, Y, Grice, S, Kent, A and Tsagatakis, I. 2011. Trends in NO_x and NO_2 emissions and ambient measurements in the UK. Prepared for Defra, 18th July 2011.

4.46 This disparity in the historical national data highlights the uncertainty of future year projections of both NO_X and NO_2.

4.47 Defra and the Devolved Administrations have investigated these issues and have since published an updated version of the Emissions Factors Toolkit (EFT Version 12.0) utilising COPERT 5.6 emission factors, which may go some way to addressing this disparity, but it is considered possible that a gap still remains. This assessment has used the latest EFT version 12.0 and associated tools published by Defra to help minimise any associated uncertainty when forming conclusions from this assessment.

5 Air Quality Modelling Results – Human Receptors

5.1 This assessment has considered emissions of NO_X/NO_2, PM_{10} and $PM_{2.5}$ from road traffic at existing receptor locations, future receptor locations relating to the potential land allocations, and ecological receptors. Predictions of concentrations have been carried out for three scenarios, as outlined in Section 4.1.

5.2 The results of the dispersion modelling are summarised below, for those receptor locations illustrated in Figure 4-1 and Figure 4-2.

5.1 Assessment of Nitrogen Dioxide (NO_2)

5.1.1 NO_2 Baseline Concentrations – 2023 and 2041

5.3 Baseline 2023 concentrations for NO_2 across the model domain for all existing receptor locations (i.e. excluding development receptors and ecological receptors), showed no exceedance of the annual mean AQS Objective predicted at any existing receptor location. The highest concentration of 35.1µg/m^3 was predicted at R27, located on the A27 to the east of Lancing Manor roundabout.

5.4 The 2041 Do Minimum (DM) scenario represents the future baseline scenario, i.e. assuming that the Development Plan does not proceed, but inclusive of any other known growth across the region. No exceedances of the AQS Objective for NO_2 were predicted in the 2041 DM Scenario at existing receptor locations. The highest concentration of 18.5µg/m^3 was predicted at R267, located to the south of the junction between the A293 and A270.

5.5 The empirical relationship given in LAQM.TG(22) states that exceedances of the 1-hour mean objective for NO_2 are only likely to occur where annual mean concentrations are 60µg/m^3 or above. Annual mean NO_2 concentrations at all receptor locations are below this limit for all scenarios, and therefore short-term NO_2 exposure from road traffic emissions at the assessed receptor locations is considered to be not significant.

5.6 Concentrations of NO_2 are predicted to be much lower in 2041 when compared to 2023. This is associated with the predicted change in fleet composition and shift towards Euro 6 and electric vehicles as a result of Government and EU policies and legislation to reduce pollutant emissions. The background concentrations across the UK are also predicted to decline between 2023 and 2041 due to reductions from numerous contributing sectors, including transport, industry and commercial[22]. The latest available year for predicted background maps is 2030, therefore 2030 was used in this assessment; this provides a conservative approach as background concentrations are expected to be lower in 2041 due to the aforementioned reasons.

5.1.2 NO_2 Impact of the notional Local Development Plan

5.7 The 2041 3S Scenario represents the future potential development scenario, i.e. assuming that the Development Plan proceeds alongside other known growth across the region. In the 2041 3S Scenario, no exceedances of the AQS Objective for NO_2 were recorded at any existing or future modelled receptors.

5.8 At existing receptors, the highest concentration of 18.5 µg/m^3 was predicted at R267, located to the south of the junction between the A293 and A270.

5.9 At a future modelled receptor, the highest concentration of 11.6 µg/m^3 was predicted at P2, representing potential site Land East of Manor Close, located on Old Shoreham Road.

5.10 The greatest increase in NO_2 concentrations at an existing receptor location between the two future scenarios was 0.31µg/m^3, reported at receptor R342, located on the A259 Brighton

[22] https://laqm.defra.gov.uk/documents/2018-based-background-maps-user-guide-v1.0.pdf

Road, Shoreham, to the east of East Street. The predicted total annual mean NO_2 concentration at this location in the 2041 3S scenario is 12.4µg/m^3, which is well below the AQS Objective of 40µg/m^3.

5.11 Table 5-1 presents the annual mean NO_2 concentrations predicted at existing residential and future development receptor locations for 2023 Baseline, 2041 DM and 2041 3S scenarios, and a comparison against the 40µg/m^3 annual mean AQS Objective (in terms of the increase as well as the total 2041 3S concentrations). Due to the number of receptors, data is shown for the receptors showing the highest concentrations and impact. Impacts are classified as having a "Negligible" impact for all existing receptors, as per the criteria set out in EPUK and IAQM planning guidance[23].

5.12 Figure 5-1 presents the locations of the modelled receptor points with highest predicted concentrations or increases.

5.13 The empirical relationship given in LAQM.TG(22) states that exceedances of the 1-hour mean AQS Objective for NO_2 are only likely to occur where annual mean concentrations are 60µg/m^3 or above. Annual mean NO_2 concentrations at all receptor locations are below this limit, and therefore short-term NO_2 exposure from road traffic emissions at the assessed receptor locations is considered to be not significant.

[23] EPUK and IAQM Guidance, January 2017: http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf

Table 5-1 – Predicted Annual Mean NO_2 Concentrations at Receptors with the Highest Predicted Concentrations and Impact

ID	Annual mean NO_2 ($\mu g/m^3$)				% Change relative to AQS Objective	% of AQS in Scenario 3S	IAQM/EPUK Impact Descriptor	Location
	AQS Objective	2023 Baseline	2041 DM	2041 3S				
Existing Receptors								
R27 (maximum concentration in 2023 baseline year)	40	35.1	14.4	14.5	0.3%	36.2%	Negligible (A)	A27, to the east of Lancing Manor Roundabout
R267 (maximum concentration in 2041 assessment year)	40	29.2	18.5	18.5	0.1%	46.3%	Negligible (A)	South of the junction between the A293 and A270
R342 (maximum increase as a result of Local Plan)	40	27.5	12.1	12.4	0.8%	30.9%	Negligible (A)	A259 Brighton Road, Shoreham
Future Receptors								
P2 (maximum concentration in 2041 assessment year)	40	N/A	N/A	11.6	N/A	29.0%	N/A	Potential Site Land East of Manor Close
(A) Adverse impact (B) Beneficial impact								

5.2 Assessment of Particulate Matter (PM_{10})

5.2.1 PM_{10} Baseline Concentrations – 2023 and 2041

5.14 The baseline modelled concentrations of PM_{10} in 2023 and 2041 were all well below the annual mean AQS Objective of 40µg/m^3 at all receptors.

5.15 Baseline 2023 concentrations for PM_{10} across the model domain for all existing receptor locations (i.e. excluding development receptors and ecological receptors), showed no exceedance predicted at any existing receptor location. The highest concentration of 21.2µg/m^3 was predicted at R65, located to the north of Holmbush roundabout.

5.16 The 2041 Do Minimum (DM) scenario represents the future baseline scenario, i.e. assuming that that Development Plan does not proceed, but inclusive of any other known growth across the region. No exceedances of the AQS Objective for PM_{10} were recorded in the 2041 DM Scenario at existing receptor locations. The highest concentration of 21.5µg/m^3 was also predicted at R65.

5.2.2 PM_{10} Impact of the notional Local Development Plan

5.17 The 2041 3S Scenario represents the potential future development scenario, i.e. assuming that the Development Plan proceeds alongside any other known growth across the region.

5.18 In the 2041 3S Scenario, no exceedance of the AQS Objective for PM_{10} were recorded at any existing or future modelled receptors. At existing receptors, the highest concentration of 21.7µg/m^3 was again predicted at R65.

5.19 At a future modelled receptor, the highest concentration of 19.1µg/m^3 was predicted at P2, representing potential site Land East of Manor Close, located on Old Shoreham Road.

5.20 The greatest increase in PM_{10} concentrations at an existing receptor location between the two future scenarios was 0.48 µg/m^3, reported at receptor R342, located on the A259 Brighton Road, Shoreham, to the east of East Street. The predicted total annual mean PM_{10} concentration at this location in the 2041 3S scenario was 20.3µg/m^3, which is well below the AQS Objective of 40µg/m^3.

5.21 Impacts are classified as having a "Negligible" impact for all existing receptors, as per the criteria set out in EPUK and IAQM planning guidance.

5.22 Table 5-2 presents the annual mean PM_{10} concentrations predicted at existing residential and future development receptor locations for 2023 Baseline, 2041 DM and 2041 3S scenarios, and a comparison against the 40µg/m^3 annual mean AQS Objective (in terms of the increase as well as the total 2041 3S concentrations).

5.23 Figure 5-1 presents the locations of the modelled receptor points with highest predicted concentrations or increases.

Table 5-2 – Predicted Annual Mean PM_{10} Concentrations at Receptors with the highest concentrations and impact

ID	Annual mean PM_{10} (µg/m^3)				% Change relative to AQS Objective	% of AQS in Scenario 3S	IAQM/EPUK Impact Descriptor	Location
	AQS Objective	2023 Baseline	2041 DM	2041 3S				
Existing Receptors								
R65 (maximum concentration)	40	21.2	21.5	21.7	0.4%	54.2%	Negligible (A)	North of Holmbush Roundabout
R342 (maximum increase as a result of Local Plan)	40	19.3	19.8	20.3	1.2%	50.7%	Negligible (A)	A259 Brighton Road, Shoreham
P2 (maximum concentration in 2041 assessment year)	40	N/A	N/A	19.1	N/A	47.7%	N/A	Potential Site Land East of Manor Close
(A) Adverse impact								

5.3 Assessment of Particulate Matter ($PM_{2.5}$)

5.4 $PM_{2.5}$ Baseline Concentrations – 2023 and 2041

5.24 Modelled $PM_{2.5}$ 2023 Baseline concentrations were assessed against the annual mean AQS Objective of 20µg/m3. Baseline 2023 concentrations for $PM_{2.5}$ across the model domain for all existing receptor locations (i.e. excluding development receptors and ecological receptors), showed no exceedance predicted at any existing receptor location. The highest concentration of 13.5µg/m^3 was predicted at R65, located to the north of Holmbush roundabout.

5.25 Modelled 2041 baseline concentrations of $PM_{2.5}$ were assessed against the annual mean AQS Objective of 10µg/m^3 (not to be exceeded at any relevant monitoring stations) which will come into effect in 2040.

5.26 The 2041 Do Minimum (DM) scenario represents the future baseline scenario, i.e. assuming that that Development Plan does not proceed, but inclusive of any other known growth across the region.

5.27 Exceedances of the future AQS objective for $PM_{2.5}$ were predicted in the 2041 DM Scenario at a majority of modelled existing receptor locations. The highest concentration of 13.6µg/m^3 was also predicted at R65.

5.5 $PM_{2.5}$ Impact of the notional Local Development Plan

5.28 The 2041 3S Scenario represents the potential future development scenario, i.e. assuming that the Development Plan proceeds alongside any other known growth across the region. Modelled $PM_{2.5}$ future 2041 concentration were assessed against the future annual mean AQS Objective of 10µg/m^3 (not to be exceeded at any relevant monitoring stations).

5.29 In the 2041 3S Scenario, exceedances of the AQS Objective for $PM_{2.5}$ of 10µg/m^3 were recorded at a majority of existing and future modelled receptors. However, it is important to note that the assessment has used background concentrations for 2030. It is expected that background concentrations will reduce by 2041, continuing the existing downward trend. Background concentrations represent the largest part of the total concentration predicted at any given receptors.

5.30 Table 5-3 presents the annual mean $PM_{2.5}$ concentrations predicted at existing residential and future development receptor locations for 2023 Baseline, 2041 DM and 2041 3S scenarios, and a comparison against the 10µg/m^3 annual mean AQS Objective (in terms of the increase as well as the total 2041 3S concentrations).

5.31 Results are presented for existing receptors with a Substantial impact, as well as for the future receptor with the highest predicted concentration.

5.32 The proportion of the background concentration in relation to the total concentration is also presented for information.

5.33 The greatest increase in $PM_{2.5}$ concentrations at an existing receptor location between the two future scenarios was only of 0.3µg/m^3 (representing 2.5% of the AQS Objective), reported at receptor R342, located on the A259 Brighton Road, Shoreham, to the east of East Street. The predicted total annual mean $PM_{2.5}$ concentration at this location in the 2041 3S scenario was 13.0µg/m^3, which is slightly above the AQS Objective of 10µg/m^3.

5.34 At existing receptors, the highest concentration of 13.7µg/m^3 was again predicted at R65.

5.35 At future modelled receptors, the highest concentration of 11.6µg/m^3 was predicted at P2, representing potential site Land East of Manor Close, located on Old Shoreham Road.

5.36 As per the criteria set out in EPUK and IAQM planning guidance, impacts were classified as having a “Substantial” impact at two receptors, a “Moderate” impact at 91 receptors, a “Slight” impact at 55 receptors, and a “Negligible” at all remaining 353 modelled receptors.

5.37 It is important to note that, as seen in the below table, background concentrations represent the largest part of the total concentration (over 70%) in Scenario 2041 3S. Additionally, the assessment has used background concentrations for 2030. It is expected that background concentrations will reduce by 2041, continuing the existing downward trend. More importantly, the concentration increases associated with the notional local development plan represents a small proportion (up to 2.5%) of the AQS Objective.

5.38 Figure 5-1 presents the locations of the modelled receptor points with highest predicted concentrations or increases.

5.6 Mitigation measures

5.39 Example mitigation measures presented within the Air Quality and Emissions Mitigation Guidance for Sussex[11] aiming to minimise effects from proposed developments are presented below. Implementation of these measures would ensure minimal residual air quality effects associated with the notional Local Development Plan in regard to $PM_{2.5}$ concentrations.

5.40 Residential:

- Invest in Electric Vehicles (EV) charging infrastructure[24] within the development over and above the current recommended parking standards;
- Provide vouchers for alternatives to private car use;
- Provide public transport subsidy for residents;
- Set up a car club within the development or contribute to the cost of a local car club;
- Set up or join an existing car sharing scheme for residents Designate parking spaces for car club/car sharing vehicles;
- Designate parking spaces for low emission vehicles;
- Provide electric bikes;
- Improve cycle paths to link to the existing local cycle network; and
- Provide secure cycle storage Invest in additional evergreen infrastructure to reduce particulates and other pollutants.

5.41 Commercial/industrial (as above – plus):

- Set up differential parking charges to favour cleaner vehicles;
- Provide public transport subsidy for employees;
- Ensure all new commercial vehicles comply with the latest European Emission Standards Implement a fleet strategy that reduces emissions;
- Use zero or ultra-low emission service vehicles Invest in local walking and cycling initiatives Contribute to the cost of on-street EV charging;
- Contribute to unfunded measures identified in AQAP or Local Air Quality Strategies; and
- Implement a low emission strategy.

5.42 Additional mitigations:

- Contribute to local low or zero emission vehicle refuelling/recharging infrastructure;
- Contribute to low emission bus service provision or waste collection services;
- Contribute to local bike/e-bike hire schemes;
- Contribute to renewable fuel and energy generation projects; and

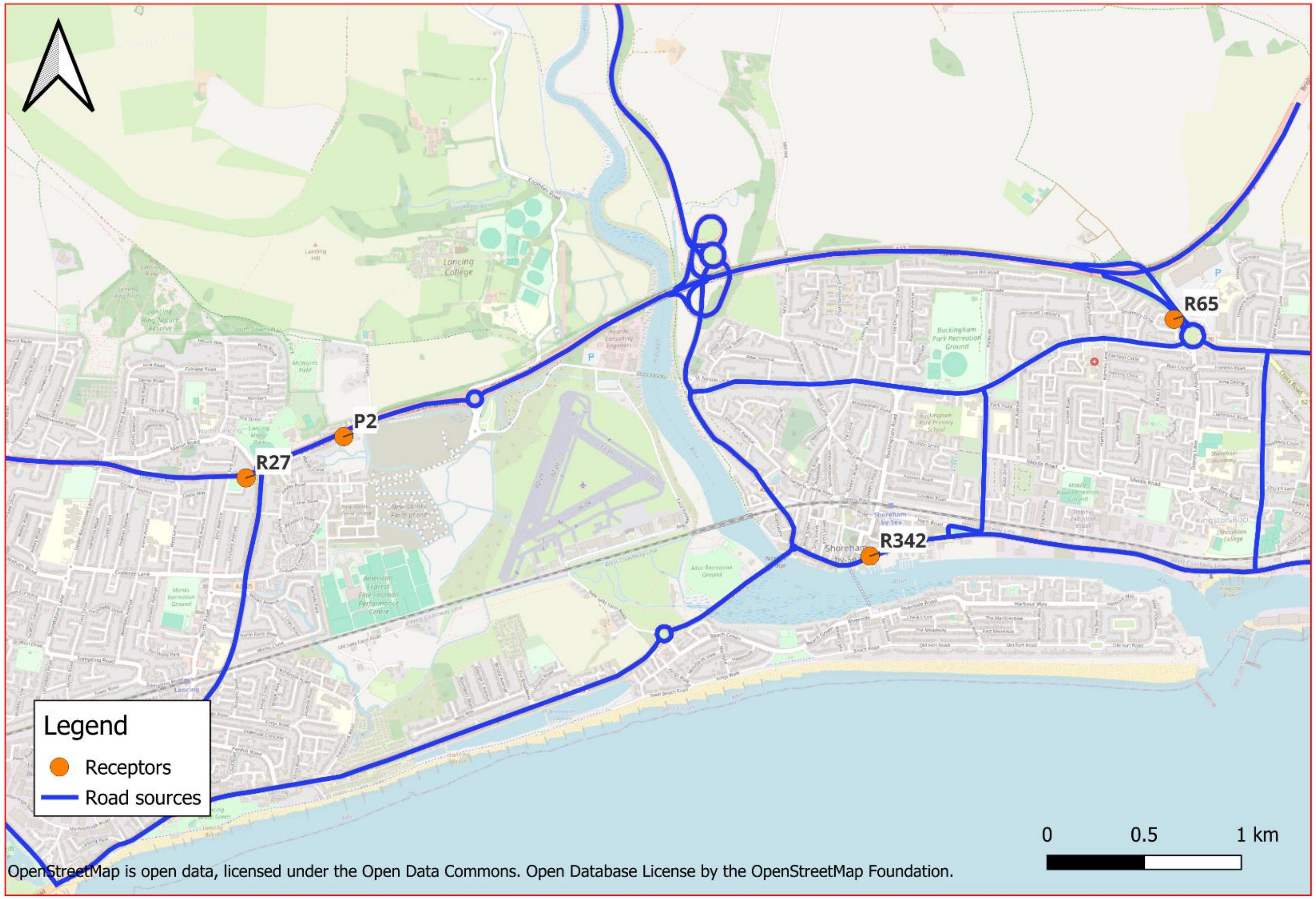
[24] Minimum 7kW (fast) charger.

- Fund incentives for the take-up of low emission technologies and fuels.

Table 5-3 – Predicted Annual Mean $PM_{2.5}$ Concentrations at Receptors with highest predicted concentrations and impacts

ID	Annual mean $PM_{2.5}$ ($\mu g/m^3$)				% Change relative to AQS Objective	% of AQS in Scenario 3S	% Background relative to total 2041 3S	IAQM/EPUK Impact Descriptor	Location
	AQS Objective (2040)	2023 Baseline	2041 DM	2041 3S					
Existing Receptors									
R65 (maximum concentration)	10	**13.5**	**13.6**	**13.7**	0.8%	**136.8%**	70.0%	Moderate (A)	North of Holmbush Roundabout
R342 (maximum increase as a result of Local Plan)	10	**12.5**	**12.7**	**13.0**	2.5%	**129.5%**	72.5%	Substantial (A)	A259 Brighton Road, Shoreham
Future Receptors									
P2 (maximum concentration in 2041 assessment year)	10	N/A	N/A	**12.5**	N/A	**125.3%**	79.5%	N/A	Potential Site Land East of Manor Close
(A) Adverse impact									

Figure 5-1 – Receptors modelled with maximum concentrations or increases



6 Assessment of Ecological Receptors

6.1 The following section considers emissions of Nitrogen (as NO_X) from road traffic at existing ecological receptor locations. The results of the dispersion modelling are provided below, for those ecological receptor locations detailed and illustrated previously (Figure 4-1 and Table 4-1). Ecological receptors have been modelled as 10m transect points, 200m from the road kerb. Due to the number of receptor points modelled, results are presented for the receptor points nearest to the road kerb only as these will experience the highest concentrations.

6.1 NO_X Impacts at Ecological Receptors

6.2 Table 6-1 and Table 6-2 detail the results of the impact assessment for NO_X annual mean and daily mean concentration, respectively.

6.3 Table 6-1 Results indicates that for annual mean concentrations, NO_X 2041 Predicted Environmental Concentration (PECs) are below the relevant AQS metric at all receptor locations. The Process Contribution (PC) attributed to the Scenario 3S is predicted to be below 1µg/m^3 at all receptor locations representing less than 1% of the AQS metric. The impact of Scenario 3S on annual mean NO_X concentrations can therefore be regarded as negligible.

Table 6-1 – Annual mean NO_X Impacts at Ecological Receptors

Receptor	AQS (µg/m^3)	2041 DM (µg/m^3)	2041 3S (PEC) (µg/m^3)	Increase (PC) (µg/m^3)	% PEC OF AQS	% PC of AQS
Adur Estuary_1	30	22.2	22.5	0.3	74.9%	0.9%
Adur Estuary_2	30	17.5	17.7	0.2	59.2%	0.7%
Adur Estuary_3	30	13.4	13.6	0.1	45.2%	0.4%
Adur Estuary_4	30	11.5	11.6	0.0	38.5%	0.1%
Adur Estuary_5	30	9.4	9.5	0.1	31.5%	0.2%
Adur Estuary_6	30	14.2	14.4	0.2	48.0%	0.8%
Lancing Ring LNR	30	11.1	11.1	<0.1	37.0%	0.1%
Mill Hill LNR	30	10.6	10.6	<0.1	35.3%	0.1%
Widewater Lagoon LNR	30	12.6	12.7	0.1	42.4%	0.4%

AQS = Air Quality Standard; EAL = Environmental Assessment Level; PC = Process Contribution (impact of the Local Plan Scenario 3S); PEC = Predicted Environmental Concentration (PC + Background)

6.4 In terms of 24-hours mean NO_X, in the 2041 3S Scenario, exceedances of the AQS metric of 75µg/m^3 were predicted at the first two transect points at Adur Estuary SSSI receptors 1 and 2, both located near to Shoreham Bypass as presented in Figure 4-3. At these four receptors points (i.e. 0m and 10m from the kerb of the road), the increase in concentration associated with the Scenario 3S is less than 2.5% of the relevant AQS. As the PC represents more than 1% of the AQS, further assessment is required in line with the IAQM guidance with input recommended by ecologists to identify locations of potentially sensitive habitats and whether these align with areas predicted to experience an increase in pollutant concentrations.

Table 6-2 – 24-hour mean NO_X Impacts at Ecological Receptors

Receptor	AQS (µg/m^3)	2041 DM (µg/m^3)	2041 3S (PEC) (µg/m^3)	Increase (PC) (µg/m^3)	% PEC OF AQS	% PC of AQS
Adur Estuary_1	75	105.4	107.1	1.7	142.8%	2.2%
Adur Estuary_2	75	98.7	100.5	1.8	134.1%	2.4%
Adur Estuary_3	75	62.4	63.5	1.1	84.7%	1.5%

Receptor	AQS ($\mu g/m^3$)	2041 DM ($\mu g/m^3$)	2041 3S (PEC) ($\mu g/m^3$)	Increase (PC) ($\mu g/m^3$)	% PEC OF AQS	% PC of AQS
Adur Estuary_4	75	28.0	28.2	0.2	37.6%	0.3%
Adur Estuary_5	75	24.9	25.3	0.4	33.7%	0.5%
Adur Estuary_6	75	51.1	53.1	2.0	70.8%	2.6%
Lancing Ring LNR	75	30.2	30.4	0.2	40.5%	0.3%
Mill Hill LNR	75	33.8	34.2	0.4	45.7%	0.6%
Widewater Lagoon LNR	75	40.0	41.1	1.1	54.8%	1.5%

AQS = Air Quality Standard ; EAL = Environmental Assessment Level; PC = Process Contribution (impact of the Local Plan Scenario 3S); PEC = Predicted Environmental Concentration (PC + Background)

6.2 Nitrogen Deposition Rates at Ecological Receptors

6.5 Table 6-3 details the results of the deposition analysis for nitrogen at modelled ecological receptors nearest to the kerb of the road.

6.6 Process Contributions (PC) representing the impact of the Local Plan Scenario 3S, are less than 0.1 kg N ha-1 yr-1 at all receptors. The PC represent less than 1% of the minimum critical load at all sites. The impact of Scenario 3S on nutrient nitrogen deposition from the road contribution can therefore be regarded as negligible.

Table 6-3 - Nitrogen Deposition Rates at Ecological Receptors

Receptor ID	CL_{min} (kg N ha^{1} yr^{1})	2041 DM (kg N ha^{1} yr^{1})	2041 3S (PEDR) (kg N ha^{1} yr^{1})	Increase (PC) (kg N ha^{1} yr^{1})	%PC of CL_{min} (%)
Adur Estuary_1	10	8.8	8.9	<0.1	<1.0%
Adur Estuary_2	10	8.5	8.5	<0.1	<1.0%
Adur Estuary_3	10	8.2	8.2	<0.1	<1.0%
Adur Estuary_4	10	7.9	7.9	<0.1	<1.0%
Adur Estuary_5	10	7.9	7.9	<0.1	<1.0%
Adur Estuary_6	10	8.1	8.1	<0.1	<1.0%
Lancing Ring LNR	5	7.5	7.5	<0.1	<1.0%
Mill Hill LNR	5	7.7	7.7	<0.1	<1.0%
Widewater Lagoon LNR	20	7.9	7.9	<0.1	<1.0%

CL = Critical load – *the CL selected for each designated site relates to its most N-sensitive habitat (or a similar surrogate) listed on the site citation for which data on Critical Loads are available and is also based on a precautionary approach using professional judgement.*
PC = Process contribution

PEDR = Predicted environmental deposition rate (= PC + background)

7 Source Apportionment

7.1 To estimate the impact of the Local Plan, a NO_X source apportionment exercise was undertaken for the future receptors, inclusive of committed sites, existing sites and potential allocations (as presented on Figure 4-2), for the following vehicle classes:

- Petrol Cars (inclusive of Petrol Hybrid and Petrol Plugin Hybrid Cars);
- Diesel Cars (inclusive of Diesel Hybrid Cars);
- Petrol LGV;
- Diesel LGV;
- HGV;
- Buses; and
- Motorcycle.

7.2 Total NO_X concentrations include background concentrations from various sources including road traffic, industry, domestic sources, aviation and rural sources.

7.3 It should be noted that emission sources of NO_2 are dominated by a combination of direct NO_2 (f-NO_2) and oxides of nitrogen (NO_X), the latter of which is chemically unstable and rapidly oxidised upon release to form NO_2. Reducing levels of NO_X emissions therefore reduces levels of NO_2. As a consequence, the source apportionment study has considered the emissions of NO_X which are assumed to be representative of the main sources of NO_2.

7.4 The sections below detail the source apportionment results for NO_X concentrations at modelled receptors for the 2041 3S Scenario:

- The average Total NO_X split across all modelled receptors. This provides useful information to understand the split between local and regional background sources as well as local road sources. In accordance with TG(22)[5]. Regional background is considered to be the emissions from background sources that the authority is unable to influence and the local background the background emissions they have some influence over. Local Sources give rise to the hotspot areas of exceedances, and the principal sources for the local authority.
- The future receptor locations where the maximum road NO_X concentration has been predicted.

7.1 2041 Scenario 3S NO_X Concentrations

7.5 When considering the average NO_X background split across all modelled future receptor locations, the following observations were found:

- Regional Background NO_X accounted for 90% (1.3µg/m^3); and
- Local Background NO_X accounted for 10% (8.9µg/m^3).

7.6 When considering the average NO_X concentration across all modelled future receptor locations, the following observations were found:

- Road traffic accounts for 3.3µg/m^3 (24%) of total NO_X (13.9µg/m^3), with background accounting for 10.5µg/m^3 (76%);
- Of the total Road NO_X, Petrol Cars and Diesel LGVs are the highest contributing vehicle classes, both accounting for 37% (1.2µg/m^3);
- Diesel Cars are found to be the third highest contributing vehicle class accounting for 14% (0.5µg/m^3);
- HGVs are the fourth highest contributing vehicle class accounting for 9% (0.3µg/m^3);
- Buses and coaches account for a total road NO_X of 3% (0.1µg/m^3)); and
- All other vehicle types account for <1%.

7.7 When considering the modelled proposed future receptor location at which the maximum road NO_X concentration has been predicted (P2, representing potential site Land East of Manor Close, located on Old Shoreham Road):

- Road traffic accounts for 40% (6.8µg/m^3) of the total NO_X (17.1µg/m^3);
- Of the total road NO_X, Petrol Cars are found to be the highest contributing vehicle class accounting for 39% (2.7µg/m^3);
- Diesel LGVs are found to be the second highest contributing vehicle class accounting for 37% (2.5µg/m^3);
- Diesel Cars are found to be the third highest contributing vehicle class accounting for 13% (0.9µg/m^3);
- HGVs account for 8% (0.5µg/m^3) of the total road NO_X;
- Buses and Coaches account for 2% (0.2µg/m^3) of the total road NO_X; and
- All other vehicle types are similarly found to contribute <1%.

7.8 When considering the modelled committed future receptor location at which the maximum road NO_X concentration has been predicted (C2, representing committed site West Sompting, located on the A27 Upper Brighton Road):

- Road traffic accounts for 39% (6.2µg/m^3) of the total NO_X (15.7µg/m^3);
- Of the total road NO_X, Petrol Cars are found to be the highest contributing vehicle class accounting for 40% (2.5µg/m^3);
- Diesel LGVs are found to be the second highest contributing vehicle class accounting for 38% (2.3µg/m^3);
- Diesel Cars are found to be the third highest contributing vehicle class accounting for 13% (0.8µg/m^3);
- HGVs account for 6% (0.4µg/m^3) of the total road NO_X;
- Buses and Coaches account for 2% (0.1µg/m^3) of the total road NO_X; and
- All other vehicle types are similarly found to contribute <1%.

7.9 When considering the modelled existing allocation future receptor location at which the maximum road NO_X concentration has been predicted (E2, representing existing allocation site Western Harbour Arm, located on Brighton Road):

- Road traffic accounts for 27% (4.3µg/m^3) of the total NO_X (15.8µg/m^3);
- Of the total road NO_X, Diesel LGVs are found to be the highest contributing vehicle class accounting for 36% (1.5µg/m^3);
- Petrol Cars are found to be the second highest contributing vehicle class accounting for 35% (1.5µg/m^3);
- Diesel Cars are found to be the third highest contributing vehicle class accounting for 14% (0.6µg/m^3);
- HGVs account for 11% (0.5µg/m^3) of the total road NO_X;
- Buses and Coaches account for 3% (0.1µg/m^3) of the total road NO_X; and
- All other vehicle types are similarly found to contribute <1%.

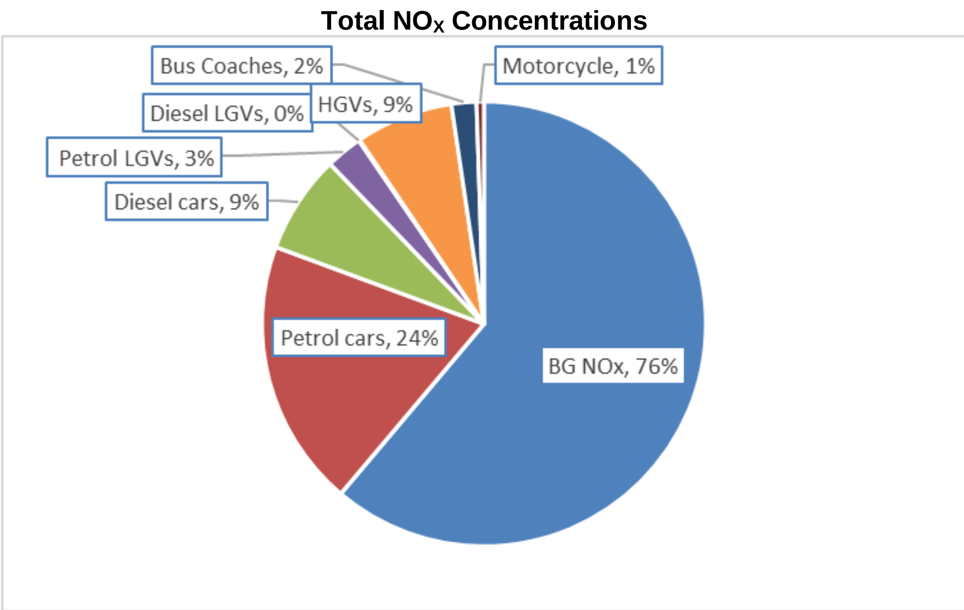
7.10 The NO_X source apportionment exercise demonstrates in 2041, with the Scenario 3S, a largely consistent ranking of contributing vehicle classes with Petrol Cars and Diesel LGVs found to be the main contributors to total road NO_X concentrations.

7.11 Table 7-1 illustrate the NO_X source apportionment results, with Figure 7-1 providing a graphical representation of the split in background concentrations, and local road source.

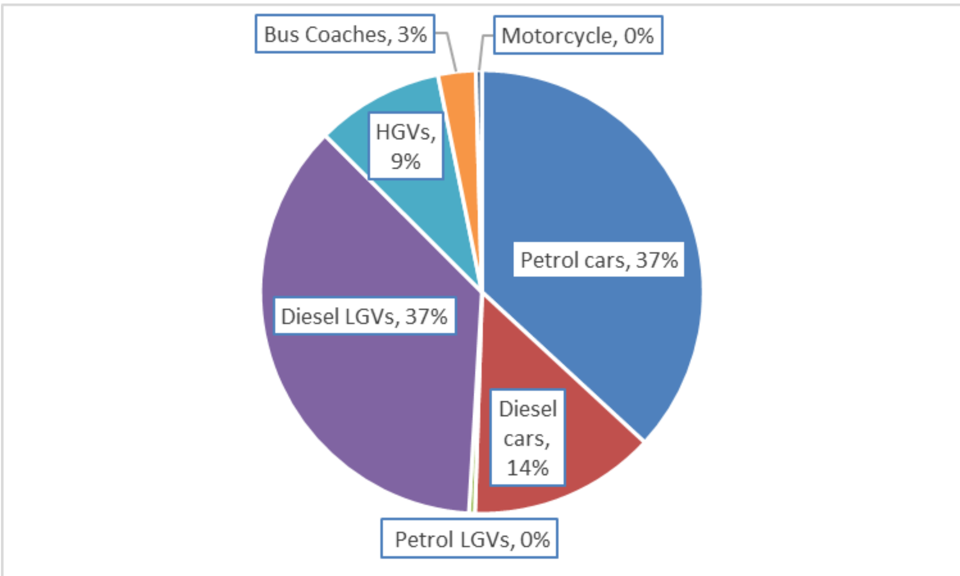
Table 7-1 – Detailed Source Apportionment of Road NO_X Concentrations

Results	*All Vehicles*	*Car Petrol*	*Car Diesel*	*LGV Petrol*	*LGV Diesel*	*HGV*	*Bus/Coach*	*Motorcycle*	*Background*
C2									
NO_X Concentration ($\mu g/m^3$)	6.2	2.5	0.8	0.0	2.3	0.4	0.1	0.0	9.5
Percentage of total NO_X	39%	16%	5%	0%	15%	2%	1%	0%	61%
Percentage Road Contribution to total NO_X	100%	40%	13%	0%	38%	6%	2%	0%	-
P2									
NO_X Concentration ($\mu g/m^3$)	6.8	2.7	0.9	0.0	2.5	0.5	0.2	0.0	10.3
Percentage of total NO_X	40%	16%	5%	0%	15%	3%	1%	0%	60%
Percentage Road Contribution to total NO_X	100%	39%	13%	0%	37%	8%	2%	0%	-
E2									
NO_X Concentration ($\mu g/m^3$)	4.3	1.5	0.6	0.0	1.5	0.5	0.1	0.0	11.5
Percentage of total NO_X	27%	10%	4%	0%	10%	3%	1%	0%	73%
Percentage Road Contribution to total NO_X	100%	35%	14%	0%	36%	11%	3%	0%	-

Figure 7-1 Source Apportionment of NO_X Concentrations – Average across all future receptors



Road-NO_X concentrations



8 Conclusions

8.1 Bureau Veritas UK Ltd has been commissioned by Adur District Council to assess the impact of the notional Local Plan Scenario 3 with Strategies ('Scenario 3S) on air quality. The Local Plan covers the proposed development within the Adur Local Plan area, the modelling assessment has therefore included all major roads and roads that are relevant to the proposed development sites.

8.2 The assessment of air quality effects in relation to the potential land allocations has been undertaken in accordance with the impact designations presented within the EPUK/IAQM Guidance. The assessment considered ambient NO_2, PM_{10} and $PM_{2.5}$ concentrations to which existing and future receptors may be exposed to if the Scenario 3S were to proceed. This was based on a review of current site boundary plans, pollutant concentrations and the predicted traffic associated with the land allocations, supported by the relevant guidance.

8.3 Baseline modelling was completed for year 2023 in order to calculate a verification factor to apply to the future year modelling.

8.4 The assessment led to the following conclusions concerning the impact of the Scenario 3S:

- Annual mean NO_2 concentrations were predicted to be comfortably below the Air Quality Strategy (AQS) Objective of 40µg/m^3 at all modelled existing and future receptors. The maximum increase in concentration associated with the Scenario was 0.3µg/m^3. The impact of the Scenario on annual mean NO_2 concentrations was classified as negligible in IAQM/EPUK terms.
- Similarly annual mean PM_{10} concentrations were predicted to be below the AQS Objective of 40µg/m^3 at all modelled existing and future receptors, with maximum increase predicted to be 0.5µg/m^3. The impact of the Scenario on annual mean PM_{10} concentrations was also classified as negligible.
- Regarding $PM_{2.5}$, impacts of the 3S Scenario were assessed against the future AQS Objective of 10µg/m^3 which will come into effect in 2040. Future concentrations were predicted to be above this objective at a majority of receptors. It is important to note that background concentrations represent the majority of total concentrations at all receptors. Additionally, the assessment used background concentrations for 2030 as these are the latest currently available. The largest increase in annual mean concentrations associated with the 3S Scenario was 0.3µg/m^3. In IAQM/EPUK terms impacts were considered substantial at two receptors, moderate at 91 receptors, slight at 55 receptors, and negligible at all remaining 353 modelled receptors.
- The assessment has also considered emissions of Nitrogen (as NO_X) from road traffic at existing ecological receptor locations. Annual mean concentrations are below the relevant AQS metric at all receptor locations, with the PC attributed to the Scenario 3S below 1µg/m^3 at all receptor locations. The impact of Scenario 3S on annual mean NO_X concentrations can therefore be regarded as negligible.
- In terms of 24-hours mean NO_X, slight exceedances of the AQS metric of 75µg/m^3 were predicted at the first two transect points at Adur Estuary SSSI receptors 1 and 2, (i.e. 0m and 10m from the kerb of the road) with an increase associated with the Scenario 3S less than 2.5% of the relevant AQS metric. As the PC represents more than 1% of the AQS, further assessment is required in line with the IAQM guidance with input recommended by ecologists to identify locations of potentially sensitive habitats and whether these align with areas predicted to experience an increase in pollutant concentrations.
- Regarding nitrogen deposition rates, there were no exceedances of the CL_{min} predicted at any sites. The impact of the Scenario 3S on nitrogen deposition can therefore be regarded as negligible.
- A NO_X source apportionment exercise was undertaken for Scenario 3S at future modelled receptors. The assessment demonstrates with the Scenario 3S, a largely consistent ranking of contributing vehicle classes with Petrol Cars (inclusive of Petrol Hybrid and Petrol Plugin Hybrid Cars) and Diesel LGVs found to be the main contributors to total road NO_X concentrations.

Glossary of Terms

Abbreviation	Description
AADT	Annual Average Daily Traffic
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
AQS	Air Quality Standard
ASR	Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by National Highways
EU	European Union
EV	Electric Vehicle
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
LNR	Local Nature Reserves
NO_2	Nitrogen Dioxide
NO_X	Nitrogen Oxides
PG	Policy Guidance
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
SSSI	Sites of Special Scientific Interest
TEA	Triethanolamine
TG	Technical Guidance
UK	United Kingdom
WHO	World Health Organization

Appendix A – Model Verification

The ADMS-Roads dispersion model has been widely validated for this type of assessment and is specifically listed in the Defra's LAQM.TG(22) guidance as an accepted dispersion model.

Model validation undertaken by the software developer (CERC) will not have included validation in the vicinity of the proposed development site. It is therefore necessary to perform a comparison of modelled results with local monitoring data at relevant locations. This process of verification attempts to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

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

- Background concentration estimates;
- Source activity data such as traffic flows and emissions factors;
- Monitoring data, including locations; and
- Overall model limitations.

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

Model setup parameters and input data were checked prior to running the models in order to reduce these uncertainties. The following were checked to the extent possible to ensure accuracy:

- Traffic data;
- Distance between sources and monitoring as represented in the model;
- Speed estimates on roads;
- Background monitoring and background estimates; and
- Checks on the monitoring data

NO_2 Verification Calculations

The verification of the modelling output was performed in accordance with the guidance provided in Chapter 7 of LAQM.TG(22).

Monitoring data provided by the Council, as presented in Section 3.2 has been used from the most recent available year of 2023. Nineteen passive NO_2 monitoring locations were used in the verification process.

As per Section 3.2.2, background NO_X and NO_2 concentrations were obtained from the relevant Defra background maps for 2023. Table A-1 below shows an initial comparison of the monitored and unverified modelled NO_2 results for the year 2023, in order to determine if verification and adjustment was required.

Table A-1 – Comparison of Unverified Modelled and Monitored NO_2 Concentrations

Site ID	Site Location	Background NO_2 (µg/m^3)	Monitored total NO_2 (µg/m^3)	Unverified Modelled total NO_2 (µg/m^3)	% Difference (modelled vs. monitored)
S2	Old Mill Close Fishersgate	11.7	18.1	16.3	-9.9
S8	Underdown Road Southwick	9.3	22.4	15.4	-31.1

Site ID	Site Location	Background NO_2 ($\mu g/m^3$)	Monitored total NO_2 ($\mu g/m^3$)	Unverified Modelled total NO_2 ($\mu g/m^3$)	% Difference (modelled vs. monitored)
S9	Old Shoreham Road Southwick	9.0	23.6	18.0	-23.9
S10	Holmbush Roundabout Shoreham	9.0	18.0	16.6	-7.8
S11	Lancing Manor Lancing	9.0	25.2	18.9	-25.0
S12	Boundstone Lane Lancing	8.8	21.6	17.8	-17.6
S13	Upper Brighton Road Sompting	8.8	27.7	18.0	-34.9
S17-19	High Street AQ station	9.1	23.3	19.6	-16.1
S25	Mash Barn Lane Lancing	9.1	24.4	18.4	-24.5
S36	Victoria Road Footpath Shoreham	9.1	17.8	13.1	-26.6
S37	Humphrey's Gap Shoreham	10.0	23.4	15.2	-35.3
S39	Brighton Road Kingston	9.4	17.2	13.6	-20.8
S44	Upper Brighton Road Lancing	9.0	31.8	19.4	-39.0
S45	Dolphin Mews Shoreham	10.0	14.6	12.7	-13.1
S46	West Street 1 Shoreham	9.1	18.6	13.8	-25.9
S48	Grinstead Lane Lancing	9.0	27.5	23.3	-15.0
S50	High Street Shoreham	9.1	20.5	13.4	-34.4
S51	Sussex Pad Lancing	7.6	21.3	14.9	-30.0
S52	Grinstead Lane Roundabout Lancing	9.0	35.2	23.9	-32.0

The model was under predicting at all of locations, all model inputs were checked to be accurate and no further improvement of the modelled results could be obtained on this occasion. The difference between modelled and monitored concentrations was greater than ±25% at half of the locations, with all locations under predicting, meaning adjustment of the results was necessary. The relevant data was then gathered to allow the adjustment factor to be calculated.

Model adjustment needs to be undertaken for roads NO_X and not NO_2. For the diffusion tube monitoring results used in the calculation of the model adjustment, NO_X was derived from NO_2; these calculations were undertaken using the NO_X to NO_2 Calculator (version 8.1) spreadsheet tool available from the LAQM website[25].

Table A-2 provides the relevant data required to calculate the model adjustment based on regression of the modelled and monitored road source contribution to NO_X.

[25] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

Figure A-1 provides a comparison of the Modelled Road Contribution NO_X versus Monitored Road Contribution NO_X, and the equation of the trend line based on linear regression through zero. The Total Monitored NO_X concentration has been derived by back-calculating NO_X from the NO_X/NO_2 empirical relationship using the spreadsheet tool available from Defra's website. The equation of the trend lines presented in Figure A-1 gives an adjustment factor for the modelled results of 1.739.

Table A-2 – Data Required for Adjustment Factor Calculation

Site ID	Monitored total NO_2 (µg/m³)	Monitored total NO_X (µg/m³)	Background NO_2 (µg/m³)	Background NO_X (µg/m³)	Monitored road contribution NO_2 (total background) (µg/m³)	Monitored road contribution NO_X (total background) (µg/m³)	Modelled road contribution NO_X (excludes background) (µg/m³)
S2	18.1	27.7	11.7	15.8	6.4	11.9	8.5
S8	22.4	37.1	9.3	12.1	13.1	25.0	11.4
S9	23.6	39.7	9.0	11.7	14.6	28.0	16.8
S10	18.0	28.5	9.0	11.7	9.0	16.8	14.1
S11	25.2	43.0	9.0	11.8	16.2	31.2	18.5
S12	21.6	35.8	8.8	11.5	12.8	24.3	16.8
S13	27.7	48.2	8.8	11.5	18.8	36.7	17.1
S17-19	23.3	39.1	9.1	11.9	14.2	27.2	19.7
S25	24.4	41.4	9.1	11.9	15.3	29.4	17.5
S36	17.8	28.2	9.1	11.9	8.7	16.3	7.3
S37	23.4	38.9	10.0	13.2	13.4	25.7	9.6
S39	17.2	26.8	9.4	12.3	7.8	14.5	7.8
S44	31.8	57.1	9.0	11.8	22.8	45.3	19.5
S45	14.6	21.7	10.0	13.2	4.6	8.5	4.9
S46	18.6	29.7	9.1	11.9	9.5	17.8	8.6
S48	27.5	47.7	9.0	11.8	18.4	35.9	27.4
S50	20.5	33.4	9.1	11.9	11.4	21.5	7.9
S51	21.3	35.7	7.6	9.9	13.7	25.9	13.4
S52	35.2	64.7	9.0	11.8	26.2	52.9	28.6

Figure A-1 – Comparison of the Modelled Road Contribution NO_X versus Monitored Road Contribution NO_X

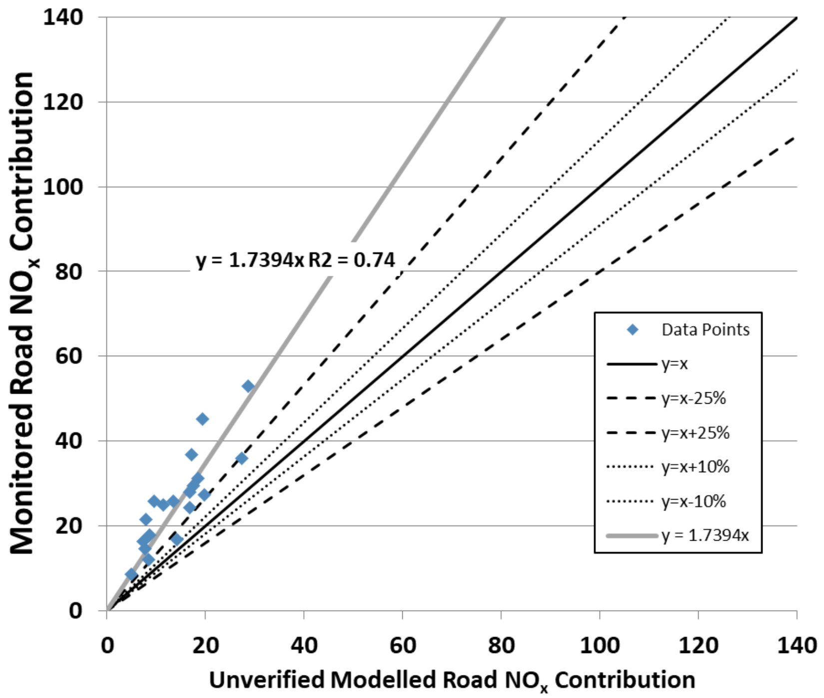


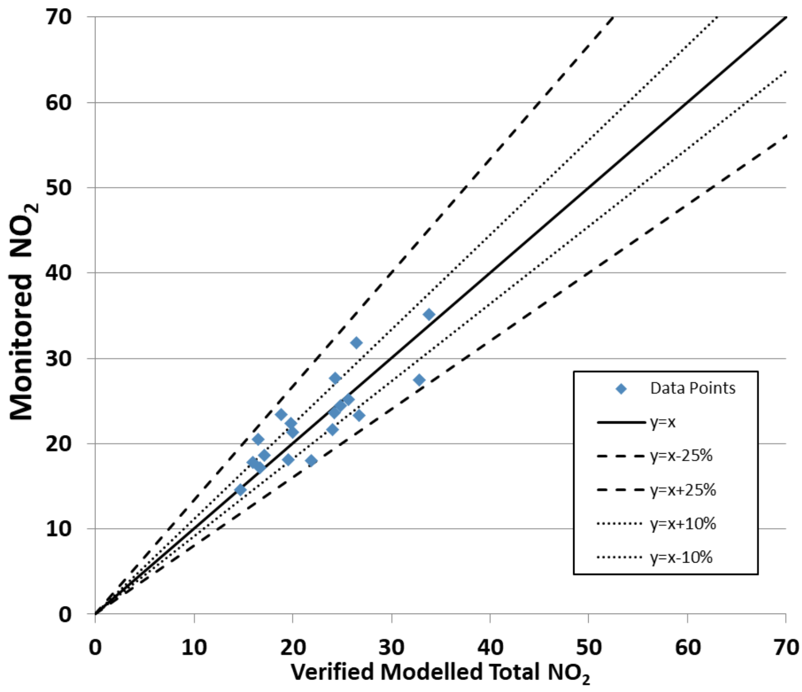
Table A-3 shows the ratios between monitored and modelled NO_2 for each monitoring location based on the above adjustment factor. Using a factor of 1.739, although all of the results are within 25% of the monitored value, the threshold deemed acceptable in TG(22). Therefore, 1.739 was deemed a suitable verification factor. Figure A-3 compares the adjusted modelled NO_2 versus monitored NO_2.

Table A-3 – Adjustment Factor and Comparison of Verified Results Against Monitoring Results

Site ID	Ratio of monitored road contribution NO_X / modelled road contribution NO_X	Adjustment factor for modelled road contribution NO_X	Adjusted modelled road contribution NO_X (µg/m³)	Adjusted modelled total NO_X (including background NO_X) (µg/m³)	Modelled total NO_2 (based upon empirical NO_X / NO_2 relationship) (µg/m³)	Monitored total NO_2 (µg/m³)	% Difference (adjusted modelled NO_2 vs. monitored NO_2)
S2	1.4	1.739	14.8	30.5	19.6	18.1	8.2
S8	2.2		19.8	32.0	19.8	22.4	-11.5
S9	1.7		29.2	40.9	24.2	23.6	2.5
S10	1.2		24.5	36.3	21.9	18.0	21.8
S11	1.7		32.2	44.0	25.7	25.2	1.9
S12	1.4		29.2	40.7	24.0	21.6	11.2
S13	2.1		29.8	41.3	24.3	27.7	-12.0
S17-19	1.4		34.3	46.2	26.8	23.3	14.7
S25	1.7		30.4	42.3	24.9	24.4	1.9

Site ID	Ratio of monitored road contribution NO_X / modelled road contribution NO_X	Adjustment factor for modelled road contribution NO_X	Adjusted modelled road contribution NO_X (µg/m³)	Adjusted modelled total NO_X (including background NO_X) (µg/m³)	Modelled total NO_2 (based upon empirical NO_X / NO_2 relationship) (µg/m³)	Monitored total NO_2 (µg/m³)	% Difference (adjusted modelled NO_2 vs. monitored NO_2)
S36	2.2		12.7	24.6	15.9	17.8	-10.6
S37	2.7		16.6	29.8	18.9	23.4	-19.5
S39	1.9		13.5	25.8	16.6	17.2	-3.0
S44	2.3		33.9	45.7	26.5	31.8	-16.7
S45	1.7		8.6	21.8	14.7	14.6	0.3
S46	2.1		15.0	26.9	17.2	18.6	-7.8
S48	1.3		47.6	59.4	32.8	27.5	19.5
S50	2.7		13.8	25.7	16.5	20.5	-19.3
S51	1.9		23.3	33.2	20.0	21.3	-6.0
S52	1.9		49.7	61.5	33.8	35.2	-4.0

Figure A-2 - Comparison of the Modelled NO_2 versus Monitored NO_2



Appendix B – Background to Air Quality

Emissions from road traffic contribute significantly to ambient pollutant concentrations in urban areas. The main constituents of vehicle exhaust emissions, produced by fuel combustion are carbon dioxide (CO_2) and water vapour (H_2O). However, combustion engines are not 100% efficient and partial combustion of fuel results in emissions of a number of other pollutants, including carbon monoxide (CO), particulate matter (PM), Volatile Organic Compounds (VOCs) and hydrocarbons (HC). For HC, the pollutants of most concern are 1,3 - butadiene (C_4H_6) and benzene (C_6H_6). In addition, some of the nitrogen (N) in the air is oxidised under the high temperature and pressure during combustion; resulting in emissions of oxides of nitrogen (NO_X). NO_X emissions from vehicles predominately consist of nitrogen oxide (NO), but also contain nitrogen dioxide (NO_2). Once emitted, NO can be oxidised in the atmosphere to produce further NO_2.

The quantities of each pollutant emitted depend upon a number of parameters; including the type and quantity of fuel used, the engine size, the vehicle speed, and the type of emissions abatement equipment fitted. Once emitted, these pollutants disperse in the air. Where there is no additional source of emission, pollutant concentrations generally decrease with distance from roads, until concentrations reach those of the background.

This air quality assessment focuses on NO_2 and PM_{10} (PM of aerodynamic diameter less than 10µm) as these pollutants are least likely to meet their respective Air Quality Strategy (AQS) objectives near roads. This has been confirmed over recent years by the outcome of the Local Air Quality Management (LAQM) regime. The most recent statistics[26] regarding Air Quality Management Areas (AQMAs) show that approximately 650 AQMAs are declared in the UK. The majority of existing AQMAs have been declared in relation to road traffic emissions.

In line with these results, the reports produced by the Council under the LAQM regime have confirmed that road traffic within their administrative area is the main issue in relation to air quality.

An overview of these two pollutants, describing briefly the sources and processes influencing the ambient concentrations, is presented below.

Particulate Matter (PM_{10})

Particulate matter is a mixture of solid and liquid particles suspended in the air. There are a number of ways in which airborne PM may be categorised. The most widely used categorisation is based on the size of particles such as $PM_{2.5}$, particles of aerodynamic diameter less than 2.5µm (micrometre = 10^{-6} metre), and PM_{10}, particles of aerodynamic diameter less than 10µm. Generically, particulate residing in low altitude air is referred to as Total Suspended Particulate (TSP) and comprises coarse and fine material including dust.

Particulate matter comprises a wide range of materials arising from a variety of sources. Examples of anthropogenic sources are carbon (C) particles from incomplete combustion, bonfire ash, recondensed metallic vapours and secondary particles (or aerosols) formed by chemical reactions in the atmosphere. As well as being emitted directly from combustion sources, man-made particles can arise from mining, quarrying, demolition and construction operations, from brake and tyre wear in motor vehicles and from road dust resuspension from moving traffic or strong winds. Natural sources of PM include wind-blown sand and dust, forest fires, sea salt and biological particles such as pollen and fungal spores.

The health impacts from PM depend upon size and chemical composition of the particles. For the purposes of the AQS objectives, PM_{10} or $PM_{2.5}$ is solely defined on size rather than chemical composition. This enables a uniform method of measurement and comparison. The short and long-term exposure to PM has been associated with increased risk of lung and heart diseases.PM may also carry surface-absorbed carcinogenic compounds. Smaller PM have a greater likelihood of penetrating the respiratory tract and reaching the lung to blood interface and causing the above adverse health effects.

In the UK, emissions of PM_{10} have declined significantly since 1980, and were estimated to be 114kt (kilotonne) in 2010[27]. Residential / public electricity and heat production and road transport are the

[26] Statistics from the UK AIR website available at https://uk-air.defra.gov.uk/aqma/summary – Figures as of November 2019
[27] National Atmospheric Emissions Inventory (NAEI) Summary Emission Estimate Datasets 2010. March 2012

largest sources of PM_{10} emissions. The road transport sector contributed 22% (25kt) of PM_{10} emissions in 2010. The main source within road transport is brake and tyre wear.

It is important to note that these estimates only refer to primary emissions, that is, the emissions directly resulting from sources and processes and do not include secondary particles. These secondary particles, which result from the interaction of various gaseous components in the air such as ammonia (NH_3), sulphur dioxide (SO_2) and NO_X, can come from further afield and impact on the air quality in the UK and vice versa.

Nitrogen Oxides (NO_X)

NO and NO_2, collectively known as NO_X, are produced during the high temperature combustion processes involving the oxidation of N. Initially, NO_X are mainly emitted as NO, which then undergoes further oxidation in the atmosphere, particularly with ozone (O_3), to produce secondary NO_2. Production of secondary NO_2 could also be favoured due to a class of compounds, VOCs, typically present in urban environments, and under certain meteorological conditions, such as hot sunny days and stagnant anti-cyclonic winter conditions.

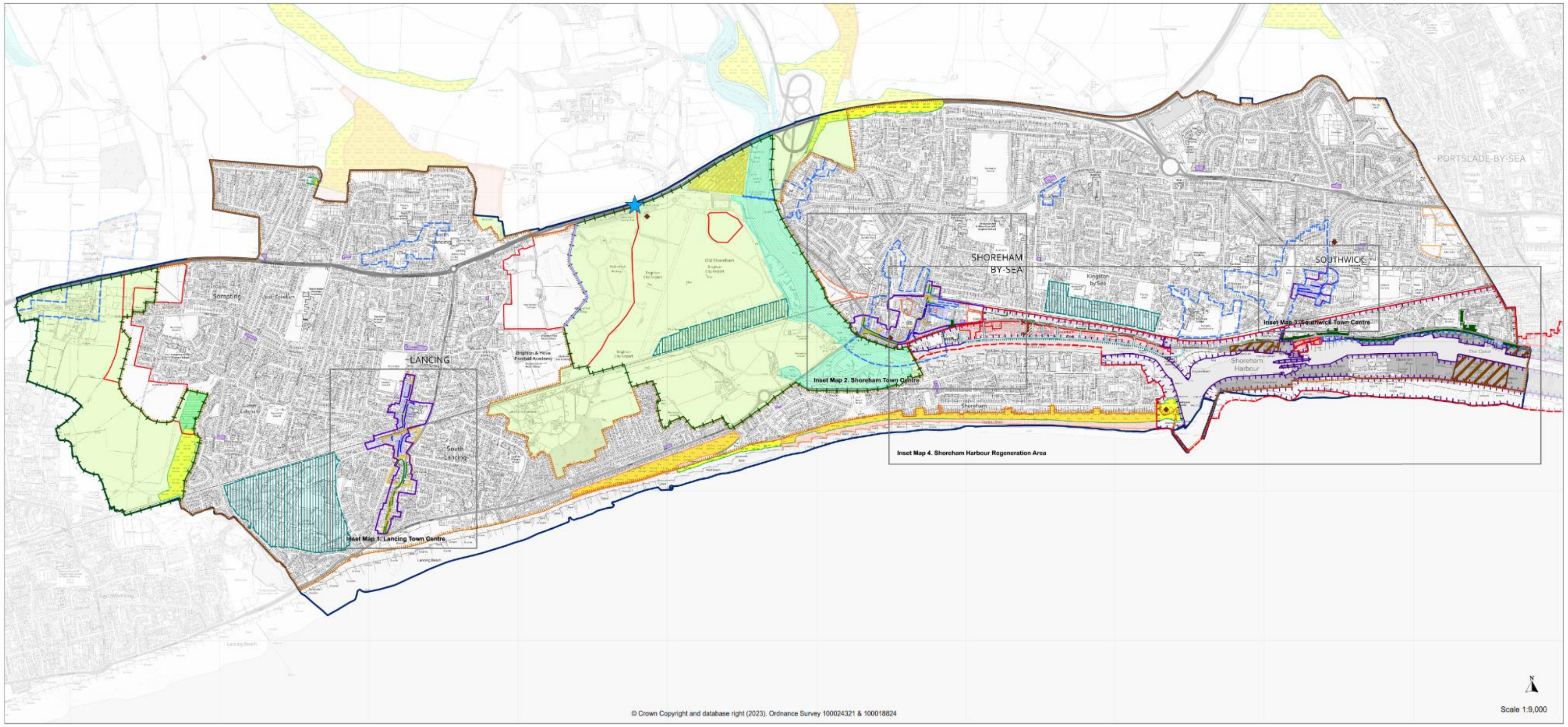
Of NO_X, it is NO_2 that is associated with health impacts. Exposure to NO_2 can bring about reversible effects on lung function and airway responsiveness. It may also increase reactivity to natural allergens, and exposure to NO_2 puts children at increased risk of respiratory infection and may lead to poorer lung function in later life.

In the UK, emissions of NO_X have decreased by 62% between 1990 and 2010. For 2010, NO_X (as NO_2) emissions were estimated to be 1,106kt. The transport sector remained the largest source of NO_X emissions with road transport contribution 34% to NO_X emissions in 2010.

Appendix C - Adur Local Plan Area

BUREAU VERITAS

Adur Policies Map 2023 - Adur Local Plan and Shoreham Harbour Joint Area Action Plan



Legend

- Adur Local Plan (ALP) Area
- Built Up Area (BUA) - ALP Policy 2
- Indicative Built Up Area Boundary
- Strategic Site Allocations - ALP Policies 5, 6, 7
- Potential Development Sites (in or on edge of Shoreham Town Centre) - ALP Policy 11
- Protected Employment Sites - ALP Policy 25
- Eastbrook Development Opportunities - ALP Policy 12
- Shoreham Harbour Regeneration Area (Broad Location) - ALP Policy 8
- Site of Special Scientific Interest (SSSI) - ALP Policy 31
- Local Wildlife Site (LWS) - ALP Policy 31
- Local Nature Reserve (LNR) - ALP Policy 31
- Proposed Extension to LWS - ALP Policy 6
- Local Green Gap - ALP Policy 14
- Countryside - ALP Policy 13
- Ricardo Boundary - ALP Policies 4, 13
- Safeguarded Wharves - WSMP Policy M10
- Temporary Safeguarded Wharves - WSMP Policy M10
- Conservation Areas - ALP Policies 16, 17
- Town Centre Boundaries - ALP Policy 27
- Primary Shopping Area - ALP Policy 27
- Primary Retail Frontages - ALP Policies 9, 11, 12, 27
- Secondary Retail Frontages - ALP Policies 9, 11, 27
- Local Shopping Parades - ALP Policy 27
- Proposed Roundabout (Indicative) - ALP Policies 5, 7
- Town Centre Blocks (Numbered) - ALP Policies 9, 11
- Scheduled Ancient Monuments
- Waterfront Pedestrian and Cycle Route - JAAP Policies SH5, SH8, CA7
- New / Upgraded Flood Defences - JAAP Policies SH6, CA7
- New / Upgraded Port Access Road - JAAP Policy CA5
- Site Allocations (Shoreham Harbour) (Numbered) - JAAP Policies SH3, SH4, CA5, CA7
- Character Areas (Shoreham Harbour) (Numbered) - ALP Policy 8, JAAP Policies CA1, CA4, CA5, CA6, CA7
- Green Corridor - JAAP Policies SH7, SH8, CA5
- Port (Operational) - JAAP Policies SH2, CA1, CA5, CA6

ALP - Adur Local Plan 2017
JAAP - Shoreham Harbour Joint Area Action Plan 2019
WSMP - West Sussex Joint Minerals Local Plan 2018

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