Partnership for Urban South Hampshire: Air Quality Impact Assessment

Report for East Hampshire District Council, Eastleigh Borough Council, Fareham Borough Council, Gosport Borough Council, Havant Borough Council, Portsmouth City Council, Southampton City Council, Test Valley Borough Council, and Winchester City Council

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Executive Summary

The Partnership for Urban South Hampshire (PUSH) comprises a voluntary partnership of eleven authorities located on the south coast of England. The local authorities included in the study area include Portsmouth City Council, Southampton City Council, Isle of Wight Council, Eastleigh Borough Council, East Hampshire District Council (part), Fareham Borough Council, Gosport Borough Council, Havant Borough Council, New Forest District Council (part), Test Valley Borough Council (part) and Winchester City Council (part).

The PUSH Spatial Position Statement 2016 envisages the provision of an additional 104,350 homes by 2034. Local authorities within the PUSH sub-region are currently preparing supporting local plans, with timelines varying by authority and looking to either 2034 or 2036. The greatest population growth is likely to be seen in Portsmouth and Southampton as part of the 'cities first' approach. The proposed development may have the potential for significant effects on the environment both within the PUSH region and in surrounding areas. At the same time, the impact of development planned in neighbouring authorities adjoining the PUSH sub-region will potentially have effects on people and the natural environment within the PUSH area. This report considers air quality impacts from increased vehicle emissions associated with proposed development in the PUSH region.

Air quality is an ongoing issue of concern for many local authorities within the PUSH region. In the context of human health and the UK's national air quality objectives, the main pollutant emissions arising from increased road traffic are nitrogen dioxide (NO2) and particulate matter (both PM10 and PM2.5). The national Air Quality Objective for nitrogen dioxide continues to be exceeded at a number of locations. There are currently 21 Air Quality Management Areas (AQMAs) in the PUSH area, located within Portsmouth, Fareham, Southampton and Eastleigh.

Air quality impacts are also a concern for natural habitats. The area of South Hampshire includes many natural habitat sites and species of international importance. There are many roads in the PUSH region which pass through or nearby designated sites. These sites may be adversely affected by increases in air concentrations of pollutants, particularly oxides of nitrogen and ammonia, and the deposition of these pollutants within the habitats.

This report contains the results of an assessment of air quality impacts to support the PUSH local planning authorities in carrying out their reviews of the spatial strategy for the area. A sub-regional air dispersion model (RapidAir) was used to model predicted air quality impacts at all locations within the PUSH study area at a resolution of 3m x 3m. This method of spatially detailed compliance modelling was used to assess air quality impacts in terms of both potential effects on human health and on protected nature conservation sites.

Traffic growth within the study area was provided by Solent Transport's Sub-Regional Transport Model (SRTM). In total, four traffic scenarios were modelled: 2014 Reference Case, 2034 Baseline Scenario, 2034 Do Minimum (2034 DM) Scenario and 2034 Do Something (2034 DS) Scenario. Both 2034 DM and DS scenarios included development and growth within the PUSH region, equating to approximately 100,000 additional dwellings compared to the 2034 Baseline scenario. 2034 DS includes additional transport interventions which are aimed at helping to mitigate the impact of the proposed developments on the transport network.

Air quality impacts on human health were assessed based on predicted annual average airborne concentrations of nitrogen dioxide (NO2) and particulate matter (PM10 and PM2.5) for all four traffic model scenarios. The air quality impacts were evaluated within existing AQMAs, as well as any other locations within the study area predicted to have pollutant concentrations exceeding the Air Quality Objectives.

The air quality modelling study indicates that, because of general improvements in air quality over the period up to 2034, ambient concentrations of NO2, PM10 and PM2.5 within the majority of AQMAs in

the PUSH study area are forecast to improve, and at almost all locations within the AQMAs, concentrations will meet the applicable air quality objectives under the future development scenarios. The modelling indicates that the maximum concentrations are predicted to exceed the objectives in some limited areas under the 2034 development scenarios. However, in all cases, these exceedances are not forecast to occur at locations of relevant exposure (e.g. residences, schools, hospitals etc.). While there is no specific requirement for further mitigation to achieve air quality objectives in 2034, further mitigation measures could be considered to address the higher concentrations within these AQMAs, and are discussed in subsequent chapters of this report. Work is also under way under separate initiatives to ensure that air quality objectives are achieved at all relevant locations as quickly as possible.

Air quality impacts on designated sites were assessed based on predicted annual average airborne concentrations of oxides of nitrogen (NOx) and ammonia (NH3), as well as annual deposition of nutrient nitrogen and acid. The assessment of impacts on designated was carried out in a stepwise process, designed to comply with Natural England's emerging requirements and good practice for evaluation of the impacts of air pollution on nature conservation sites. The requirements from Natural England were developed primarily for the assessment of designated sites with European (or equivalent international) designation, namely Ramsar sites, Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). We have also included nationally designated Sites of Special Scientific Interest (SSSIs) that do not form components of European sites in this study.

This assessment indicates that the proposed future PUSH development scenarios have the potential to result in air quality impacts for several European-designated sites, for which likely significant effects from air quality impacts cannot be ruled out based on the existing evidence base. In most cases, predicted areas of possible air quality impacts occur in close proximity to existing motorways and A-roads. It is recommended that Councils should consider whether further surveys could be useful to confirm the existence of protected habitats and species within the relevant designated sites. In the event that such surveys confirm that the protected habitats and species are not present in these zones, no further action would be needed to mitigate impacts. Where impacts cannot be ruled out in this way, for European-designated sites, an HRA Stage 2 appropriate assessment will be required to inform the respective local plans, and mitigation of any significant impacts may potentially be needed.

This study shows that overall the PUSH region will experience an improvement in air quality over the assessment period, resulting from changes to the road fleet during this time. However, it is also important that the Councils seek further opportunities to avoid or reduce the impacts of vehicle emissions on air quality, through the implementation of well-designed policies and plans that incorporate effective air quality and transport related measures, such as those discussed in this report. The PUSH partnership offers a unique opportunity for the development of a regional strategy that incorporates these principles.

Table of contents

Abbreviations

Abbreviation	Explanation
AADT	Annual Average Daily Traffic
APIS	Air Pollution Information System
AQMA	Air Quality Management Area
ASR	Annual Status Report
AURN	Automatic Urban and Rural Network
BEIS	UK Department for Business, Energy & Industrial Strategy
CAZ	Clean Air Zone
CL	Critical Limit/Level
DM	Do Minimum (a future-year model scenario)
DS	Do Something (a future-year model scenario)
EBC	Eastleigh Borough Council
EEA	European Environment Agency
EFT	Emissions Factor Toolkit
EV	Electric Vehicle
FBC	Fareham Borough Council
GBC	Gosport Borough Council
GDM	Gateway Demand Model
GIS	Geographic Information System
HBC	Havant Borough Council
HGV	Heavy Goods Vehicle
HRA	Habitats Regulations Assessment
IAQM	Institute of Air Quality Management
ITN	Integrated Transport Network
LAQM	Local Air Quality Management
LEIM	Local Economic Impact Model
LES	Low Emission Strategy
LGV	Light Goods Vehicle
MDM	Main Demand Model
NAEI	National Atmospheric Emissions Inventory
NH_3	Ammonia
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides ($NO + NO_2$)
NTEM	National Trip End Model
NTS	National Travel Survey
PCC	Portsmouth City Council
PHI	Priority Habitat Inventory
PM_{10}	Particulate matter 10 micrometres or less in diameter
$PM_{2.5}$	Particulate matter 2.5 micrometres or less in diameter
PTM	Public Transport Model

Abbreviation	Explanation
PUSH	Partnership for Urban South Hampshire
RMSE	Root Mean Square Error
RTM	Road Traffic Model
SAC	Special Area of Conservation
SCC	Southampton City Council
SHMA	Strategic Housing Market Assessment
SPA	Special Protection Area
SRTM	Sub-Regional Transport Model
SSSI	Site of Special Scientific Interest
TVBC	Test Valley Borough Council
ULEV	Ultra-Low Emission Vehicle
WCC	Winchester City Council
WTP	Workplace Travel Plan

1 Introduction

The Partnership for Urban South Hampshire (PUSH) comprises a voluntary partnership of eleven authorities[1] located on the south coast of England. PUSH authorities generally recognise the benefits of working together to support the sustainable economic growth of the sub-region and to facilitate the strategic planning functions necessary to support that growth.

The PUSH sub-region covers an area of 590 km^2 and currently has a population of approximately 1.2 million people. The PUSH Spatial Position Statement 2016[2] envisages the provision of an additional 104,350 homes by 2034. Local authorities within the PUSH sub-region are currently preparing supporting local plans, with timelines varying by authority and looking to either 2034 or 2036. The greatest population growth is likely to be seen in Portsmouth and Southampton as part of the 'cities first' approach. This represents a significant increase in population across the PUSH region, which may have the potential for significant effects on the environment both within the PUSH region and in surrounding areas. At the same time, the impact of development planned in neighbouring authorities adjoining the PUSH sub-region will potentially have effects on people and the natural environment within the PUSH area. This report considers air quality impacts from increased vehicle emissions associated with proposed development in the PUSH region.

Air quality is an ongoing issue of concern for many local authorities within the PUSH region. In the context of human health and the UK's national air quality objectives (see Section 4.1), the main pollutant emissions arising from increased road traffic are nitrogen dioxide (NO_2) and particulate matter (both PM_{10} and $PM_{2.5}$). The national air quality objective for NO_2 continues to be exceeded at a number of locations. There are currently 21 Air Quality Management Areas (AQMAs) in the PUSH area, located within Portsmouth, Fareham, Southampton and Eastleigh. Southampton was identified in the UK's 2015 Air Quality Plan, and Southampton is one of the first five cities outside of London directed to consider the implementation of a Clean Air Zone (CAZ) in order to address exceedances of the NO_2 air quality objective.[3] Southampton City Council and New Forest District Council are carrying out a consultation process on proposals for a Clean Air Zone in September 2018. Additionally, in the UK's revised 2017 Air Quality Plan,[4] Fareham Borough Council was highlighted as one of the authorities that must produce a targeted local air quality action plan to address exceedances of the NO_2 air quality objective along a portion of the A27. The precise details of the Southampton CAZ and the air quality measures developed by Fareham Borough Council as part of its targeted local plan have not yet been finalised, nor explicitly modelled in this study; however, these measures are expected to result in improvements to air quality in the near future.

The potential air quality impacts on natural habitats are also a concern. The area of South Hampshire includes many natural habitat areas and species of international importance. There are many roads in the PUSH region which pass through or nearby designated sites. These sites may be adversely affected by increases in air concentrations of pollutants, particularly oxides of nitrogen and ammonia, and the deposition of these pollutants within the habitats.

In this study, a sub-regional air dispersion model (RapidAir) is used to model predicted air quality impacts at all locations within the PUSH study area at a resolution of 3m x 3m. The PUSH study area

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[1] Portsmouth City Council, Southampton City Council, Isle of Wight Council, Eastleigh Borough Council, East Hampshire District Council (part), Fareham Borough Council, Gosport Borough Council, Havant Borough Council, New Forest District Council (part), Test Valley Borough Council (part) and Winchester City Council (part).

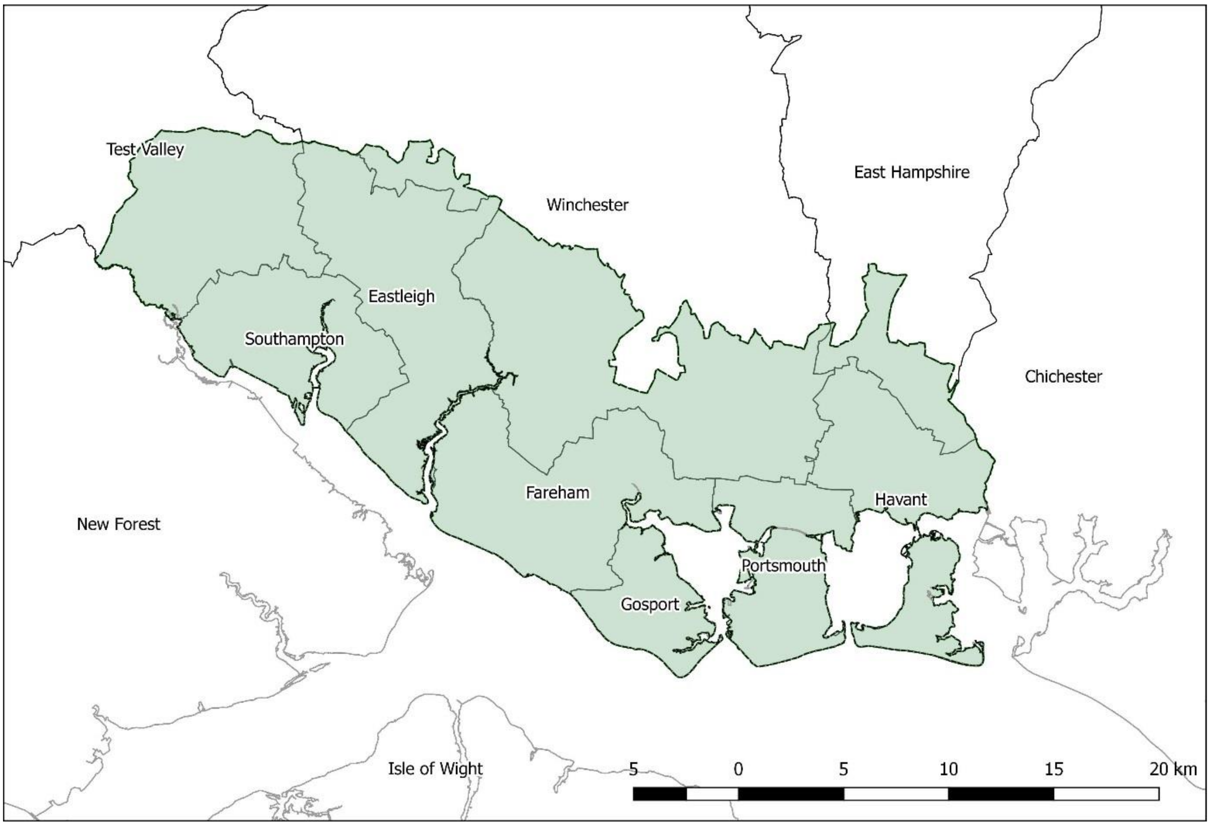
[2] Partnership for Urban South Hampshire, "PUSH Spatial Position Statement", June 2016, https://www.push.gov.uk/wp-content/uploads/2018/05/PUSH-Spatial-Position-Statement-2016.pdf, accessed 20/06/2018.

[3] UK Department for Environment, Food & Rural Affairs, "Air quality in the UK: plan to reduce nitrogen dioxide emissions (2015)", https://www.gov.uk/government/publications/air-quality-in-the-uk-plan-to-reduce-nitrogen-dioxide-emissions, accessed 22/02/2018.

[4] UK Department for Environment, Food & Rural Affairs, "Air quality plan for nitrogen dioxide (NO2) in UK (2017)", https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017, accessed 20/06/2018.

(Figure 1-1) includes the City of Portsmouth, City of Southampton, Eastleigh Borough, East Hampshire District (part), Fareham Borough, Gosport Borough, Havant Borough, Test Valley Borough (part), and Winchester City (part). The traffic models used in this assessment include traffic data accounting for future proposed development and housing in the PUSH sub-region, which is a larger area encompassing the study area as well as the Isle of Wight and part of New Forest District. Air quality impacts within the study area therefore account for in-combination effects from increased traffic across the larger PUSH sub-region, however the air quality impacts in New Forest District and the Isle of Wight are being addressed in separate studies.

Figure 1-1 PUSH study area



Traffic growth within the study area was provided by Solent Transport's Sub-Regional Transport Model (SRTM). In total, four traffic scenarios were modelled:

- 2014 Reference Case: This model was designed to replicate 2014 traffic conditions within the PUSH sub-region. It is used to verify the performance of the air dispersion model and investigate baseline air quality conditions within the study area.
- 2034 Baseline Scenario: This model was designed to represent a future scenario without the proposed PUSH development, and it has all land use growth inputs removed from the PUSH sub-region from 2014 onwards. The scale and location of development are assumed to be unchanged from 2014 conditions within the PUSH sub-region. For the remaining model areas outside of the PUSH sub-region, it is assumed that development and growth would continue as expected for 2034, and in accordance with TEMPRO v7.2 growth projections.
- 2034 Do Minimum (2034 DM) Scenario: This model scenario includes development and growth within the PUSH region, equating to approximately 100,000 additional dwellings compared to the 2034 Baseline scenario. It includes transport schemes that are already committed as well as several supporting schemes that are vital to committed development sites even though the schemes themselves may not yet be committed.

- 2034 Do Something (2034 DS) Scenario: This model scenario includes development and growth within the PUSH region, equating to approximately 100,000 additional dwellings compared to the 2034 Baseline scenario. This model scenario includes additional transport interventions, specified by the Solent Transport and PUSH authorities, which are aimed at helping to mitigate the impact of the proposed developments on the transport network.

Air quality impacts on human health are assessed based on predicted annual average airborne concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) for all four traffic model scenarios. The air quality impacts are evaluated within existing AQMAs, as well as any other locations within the study area predicted to have pollutant concentrations exceeding the Air Quality Objectives.

Air quality impacts on designated sites are assessed based on predicted annual average airborne concentrations of oxides of nitrogen (NOx) and ammonia (NH_3), as well as annual deposition of nutrient nitrogen and acid. This updates work carried out by AEA Technology in 2010[5] which assessed the impact of the housing growth on European Sites within the PUSH area for a period from 2006 to 2026.

For more detailed information about air pollutants, their sources and health impacts, please refer to the "Overview of air pollutants" information provided by the National Atmospheric Emissions Inventory (NAEI) website.[6]

[5] AEA Technology, "Road transport emissions impacts on Nature Conservation Sites", July 2010.

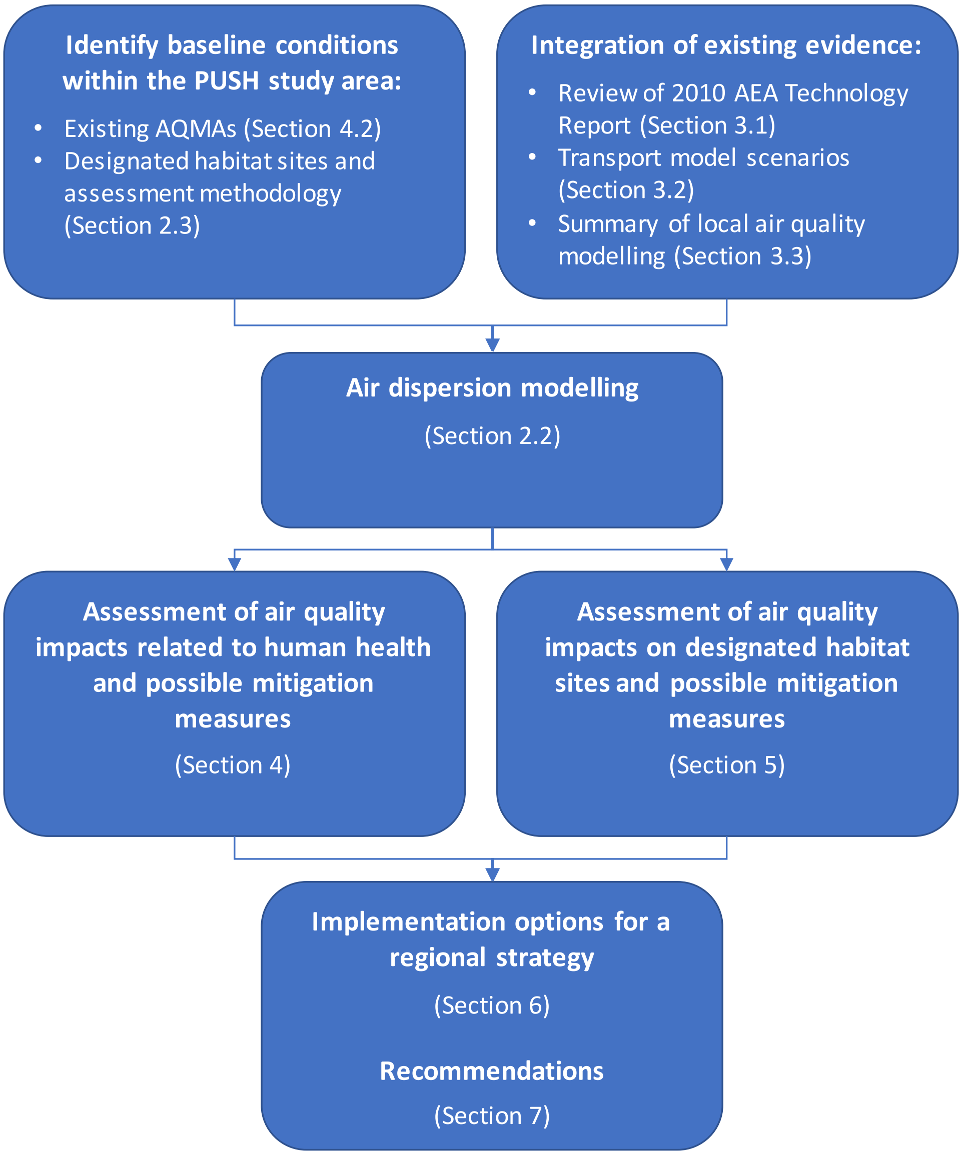
[6] National Atmospheric Emissions Inventory, "Overview of air pollutants", http://naei.beis.gov.uk/overview/ap-overview, accessed 20/06/2018.

2 Method Statement

2.1 Study Overview

An overview of the study methodology is provided below. Sections in this report are organized to facilitate reading the sections sequentially, however the flow chart below provides a summary of the location of different pieces of information.

Figure 2-1 Study overview



2.2 Air dispersion modelling methodology

2.2.1 Air quality modelling system

The RapidAir Urban Air Quality Modelling Platform was used to predict air pollutant concentrations for this study. This is Ricardo Energy & Environment's proprietary modelling system developed for urban air pollution assessment, and the model that was used previously in Southampton for the Low Emission Strategy (LES) and Clean Air Zone (CAZ) studies, as well as for an assessment of the Royal Borough of Windsor and Maidenhead local plan completed in March 2018.

RapidAir has been developed to provide graphic and numerical outputs which are comparable with other models used widely in the United Kingdom. The model approach is based on loose-coupling of three elements:

- Road traffic emissions model conducted using fleet specific COPERT 5 (via the Defra EfT) algorithms to prepare grams/kilometre/second (g km^{-1} s^{-1}) emission rates of air pollutants originating from traffic sources.
- Convolution of an emissions grid with dispersion kernels derived from the USEPA AERMOD[7] model, at resolutions ranging from 1 m to 20 m. AERMOD provides the algorithms which govern the dispersion of the emissions and is an accepted international model for road traffic studies.
- The kernel based RapidAir model running in GIS software to prepare dispersion fields of concentration for further analysis with a set of decision support tools coded by us in Python/arcpy.

RapidAir includes an automated meteorological processor based on AERMET which obtains and processes meteorological data of a format suitable for use in AERMOD. Surface meteorological data is obtained from the NOAA online repository[8] and upper air data is downloaded from the NOAA Radiosonde database[9].

The model produces high resolution concentration fields at the city scale (down to a 1m scale) so is ideal for spatially detailed compliance modelling. The combination of an internationally recognised model code and careful parameterisation matching international best practice makes RapidAir ideal for this study. A validation study has been conducted in London using the same datasets as the 2011 Defra inter-comparison study[10]. Using the LAEI 2008 data and the measurements for the same time period the model performance is consistent (and across some metrics performs better) than other modelling solutions currently in use in the UK. A paper is currently being finalised for publication with our partners at Strathclyde University in the journal *Environmental Modelling and Software*.

2.2.2 Model domain

Dispersion modelling was carried out to forecast levels of air pollutants at a 3m x 3m grid resolution across the entire PUSH study area, including all the Air Quality Management Areas (AQMAs) and designated sites located within that boundary. A grid height of 1.5 m was modelled to represent human exposure at ground level. Dispersion modelling was carried out for the years 2014 (as a reference year for dispersion model verification) as well as the three future 2034 scenarios (Baseline Scenario, Do Minimum Scenario and Do Something Scenario).

Data were then extracted from the 3m x 3m grid results to provide a detailed evaluation of air quality impacts at locations within the relevant AQMAs and designated sites.

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[7] https://www3.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod

[8] ftp://ftp.ncdc.noaa.gov/pub/data/noaa

[9] https://www.esrl.noaa.gov/roabs/

[10] https://uk-air.defra.gov.uk/research/air-quality-modelling?view=intercomparison

2.2.3 Traffic activity data

Annual average daily traffic (AADT) vehicle numbers and average vehicle speeds were extracted from the SRTM datasets provided by Systra for the four scenarios (2014 Reference Case, 2034 Baseline, 2034 Do Minimum, and 2034 Do Something). Further detailed information about the SRTM and the four transport model scenarios can be found in Section 3.2.

The SRTM model classifies road links into several categories: A road, B road, motorway, slip road, shopping, buffer and other. The SRTM also provides a fleet composition breakdown into cars, light goods vehicles (LGVs), heavy goods vehicles (HGVs) and buses. NAEI fleet split information can be used to further split cars into petrol and diesel categories, and HGVs into rigid HGV and articulated HGV categories, based on national average fleet composition information and depending on whether the road link is categorized as rural, urban or motorway. For this study, SRTM AADT numbers for cars and HGVs were further categorized based on mapping the SRTM road types onto the NAEI road types as shown in Table 2-1 and Table 2-2. Non-motorway SRTM road types (i.e., A road, B road, shopping, buffer and other) were categorized as either rural or urban based on their location as compared to the 2011 Area Classifications for Output Areas (2011 OAC).[11]

Table 2-1 Matching SRTM fleet composition to EFT vehicle types for 2014 Reference Case

SRTM Road Type	NAEI Road Type	Petrol Car	Diesel Car	Electric Car	Rigid HGV	Articulated HGV
A road, B road, shopping, buffer, other	Rural	54.54%	45.46%	-	52.49%	47.51%
	Urban (not London)	58.81%	41.15%	0.04%	80.13%	19.87%
Motorway, slip road	Motorway	44.69%	55.31%	-	29.99%	70.01%

Table 2-2 Matching SRTM fleet composition to EFT vehicle types for 2034 model scenarios

SRTM Road Type	NAEI Road Type	Petrol Car	Diesel Car	Electric Car	Rigid HGV	Articulated HGV
A road, B road, shopping, buffer, other	Rural	56.59%	43.41%	-	47.85%	52.15%
	Urban (not London)	59.50%	35.91%	4.58%	75.93%	24.07%
Motorway, slip road	Motorway	48.78%	51.22%	-	28.86%	71.14%

The fleet compositions in Table 2-1 and Table 2-2 were calculated using the most recent set of NAEI fleet projection information available (base year 2016, published February 2017).[12] Since the publication of the 2016 NAEI dataset, the UK government has published a UK Air Quality Plan in 2017[4] and a draft UK Clean Air Strategy in 2018.[13] Both of these publications reaffirm the UK government's intention for the sale of new conventional petrol and diesel cars and vans to end by 2040, and for almost every car and van on the road to be a zero emission vehicle by 2050.[14] If the UK government is to achieve these

[11] The National Archives, "2011 Area Classifications", http://www.ons.gov.uk/ons/guide-method/geography/products/area-classifications/ns-area-classifications/ns-2011-area-classifications/index.html, accessed 12/12/2017.

[12] National Atmospheric Emissions Inventory, "Emission factors for transport", http://naei.beis.gov.uk/data/ef-transport, accessed 28/06/2018.

[13] Department for Environment, Food & Rural Affairs, "Clean Air Strategy 2018", https://consult.defra.gov.uk/environmental-quality/clean-air-strategy-consultation/, accessed 20/07/2018.

[14] Ultra low emission vehicles: evidence review of uptake in the UK (2015), https://www.gov.uk/government/publications/ultra-low-emission-vehicles-evidence-review-of-uptake-in-the-uk

objectives, by 2034 the proportion of full plug-in electric vehicles in the national fleet would be greater than the current fleet projection data indicates. Hence if the government is successful in its strategy, and the proportion of electric vehicles in the national fleet is greater in 2034 than indicated in Table 2-2, the transport pollutant emissions and resulting pollutant concentrations modelled in this study for the 2034 scenario are likely to be overpredicted to some extent.

2.2.4 Emission factors

Vehicle emission factors for oxides of nitrogen (NOx) and particulate matter (PM_{10} and $PM_{2.5}$) were obtained from COPERT v5 emission functions.[12] Vehicle emission factors for ammonia (NH_3) were obtained from the EMEP/EEA air pollutant emission inventory guidebook.[15] Link specific emission factors were calculated with our in-house emission calculation tool RapidEms, which links directly to our RapidAir dispersion modelling system.

The input for RapidEms consists of a basic fleet split based on vehicle categories (diesel cars, petrol cars, LGVs, articulated HGVs, rigid HGVs, and buses) according to the traffic activity information specified in Section 2.2.3. RapidEms is used to provide a more detailed parameterization of vehicle fleets in 2015 and 2034, including all vehicles up to and including Euro 6/VI.

2.2.5 Meteorological data

RapidAir includes an automated meteorological processor based on AERMET which obtains and processes meteorological data of a format suitable for use in AERMOD. Surface meteorological data is obtained from the NOAA online repository[16] and upper air data is downloaded from the NOAA Radiosonde database[17].

For this study, 2014 surface meteorological data was obtained from three stations (Southampton, Wittering and Thorney Island) and upper air meteorological data was obtained from two stations (Larkhill and Herstomonceux). RapidMet was used to carry out data filling where necessary according to the methodology provided by the USEPA in their "Meteorological Monitoring Guidance for Regulatory Modelling Applications" guidance document[18]. Data gaps from the primary meteorological stations (Southampton and Larkhill) are first filled using data from the other nearby stations (Wittering and Thorney Island for surface stations, and Herstomonceux for the upper air station). Remaining data gaps were filled based on the persistence method, where a missing value is replaced by the use of data from the previous hour(s), for data gaps up to and including three hours.

2.2.6 Reference year modelling and model verification

This section provides a summary of the model verification process and the derivation of linear adjustment factors to improve model performance. A more detailed description of the model verification process is presented in Appendix 1.

2.2.6.1 Oxides of nitrogen (NOx) and nitrogen dioxide (NO_2) model verification and adjustment

A combination of automatic monitoring and diffusion tube NO_2 measurements was used for model verification. NO_2 measurements were obtained from Defra's Automatic Urban and Rural Network (AURN) as well as the Annual Status Reports (ASRs) of East Hampshire DC, Eastleigh BC, Fareham BC, Gosport BC, Havant BC, Portsmouth CC, Southampton CC, Test Valley BC and Winchester BC.

Some monitoring sites were excluded from the model verification for the following reasons:

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15 European Environment Agency, "EMEP/EEA air pollution emission inventory guidebook 2016", https://www.eea.europa.eu/publications/emep-eea-guidebook-2016, accessed 12/12/2017.

16 ftp://ftp.ncdc.noaa.gov/pub/data/noaa

17 https://www.esrl.noaa.gov/roabs/

18 United States Environmental Protection Agency, "Meteorological Monitoring Guidance for Regulatory Modelling Applications" available via https://www3.epa.gov/scram001/guidance/met/mmgrma.pdf, accessed June 2017.

- The monitoring station is located outside the boundaries of the PUSH study area.
- No measurement was reported for that monitoring site in 2014.
- Data capture for the monitoring station was less than 75% in 2014.

After exclusion of some monitoring sites for the above reasons, a total of 173 NO_2 measurements were carried forward into the model verification step.

RapidAir was used to generate a map of NOx concentrations arising from road traffic sources across the entire PUSH study area at a 3m x 3m resolution, based on SRTM traffic activity data from the 2014 Reference Case and 2014 meteorological data. Background NOx values for 2014 were obtained from the 2013 reference year background maps available on the LAQM website.[19] NOx contributions arising from major roads were removed from the background map values to avoid double-counting, and the background values were then added to the RapidAir road NOx results to compare the modelled vs measured concentrations at each of the monitoring locations. This initial comparison indicated that the model was under-predicting the NOx arising from road emissions at most locations. Refinements were subsequently made to the model inputs to improve model performance where possible, and a linear adjustment factor of 1.3089 was calculated for the road emissions component of the NOx model (see Appendix 1).

Total NOx was calculated as the sum of the adjusted NOx road contribution from RapidAir and the Defra 2014 background maps (with main road sources removed from the background map). Total NO_2 concentrations were derived using the following equation (see Appendix 1 for further details):

$$(NO_2 \text{ in } \mu g/m^3) = -0.0020(NOx \text{ in } \mu g/m^3)^2 + 0.7157(NOx \text{ in } \mu g/m^3)$$

To evaluate model performance and uncertainty, the Root Mean Square Error (RMSE) for the observed vs predicted NO_2 annual mean concentrations was calculated, as detailed in Technical Guidance LAQM.TG(16). This guidance indicates that an RMSE of up to 4 $\mu g/m^3$ is ideal, and an RMSE of up to 10 $\mu g/m^3$ is acceptable. In this case the RMSE was calculated at 8.4 $\mu g/m^3$, which is acceptable, and reasonable for a modelling study over this large a geographical region.

2.2.6.2 Particulate matter (PM_{10} and $PM_{2.5}$) model verification and adjustment

Automatic particulate matter (PM_{10}) monitoring measurements were used for model verification. A total of 6 PM_{10} measurements were obtained from the Annual Status Reports (ASRs) of Gosport BC, Portsmouth BC and Southampton CC.

RapidAir was used to generate a map of PM_{10} concentrations arising from road traffic sources across the entire PUSH study area at a 3m x 3m resolution, based on SRTM traffic activity data from the 2014 Reference Case and 2014 meteorological data. Background PM_{10} values for 2014 were obtained from the 2013 reference year background maps available on the LAQM website. PM_{10} contributions arising from major roads were removed from the background map values to avoid double-counting, and the background values were then added to the RapidAir road PM_{10} results to compare the modelled vs measured concentrations at each of the monitoring locations. This initial comparison indicated that the model was under-predicting the PM_{10} arising from road emissions at most locations. Refinements were subsequently made to the model inputs to improve model performance where possible, and a linear adjustment factor of 3.8962 was calculated for the road emissions component of the PM_{10} model (see Appendix 1). Total PM_{10} was calculated as the sum of the adjusted PM_{10} road contribution from RapidAir and the Defra 2014 background maps (with main road sources removed from the background map).

To evaluate model performance and uncertainty, the Root Mean Square Error (RMSE) for the observed vs predicted PM_{10} annual mean concentrations was calculated, as detailed in Technical Guidance

[19] Department for Environment, Food & Rural Affairs, Background maps, https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html, accessed 20/06/2018.

LAQM.TG(16). In this case the RMSE was calculated at 6.5 µg/m^3, which is acceptable, and reasonable for a modelling study over this large of a geographical region.

There were only two monitoring sites with $PM_{2.5}$ measurements within the PUSH study area in 2014: the AURN monitoring sites located at Gatcombe Park Primary School (Portsmouth) and Brintons Road (Southampton Centre). Due to the limited availability of $PM_{2.5}$ monitoring data, the linear adjustment factor derived for the PM_{10} model (3.8962) was also used to adjust the road emission results from the RapidAir $PM_{2.5}$ model. Total $PM_{2.5}$ was calculated as the sum of the adjusted $PM_{2.5}$ road contribution from RapidAir and the Defra 2014 background maps (with main road sources removed from the background map).

2.2.6.3 Ammonia (NH_3) model verification and adjustment

There are no monitoring locations for NH_3 located within the PUSH study area, and therefore it was impossible to compare measured vs modelled concentrations for NH_3. We have adopted an approach based on Section 7.527 of the Technical Guidance LAQM.TG(16) which suggests that, in the absence of measured data for model verification of a traffic pollutant, it may be appropriate to apply the adjustment factor derived from another traffic pollutant to the pollutant that does not have any monitoring data available. Of the two linear bias adjustment factors derived above, the adjustment calculated for PM_{10} (3.8962) is larger and therefore more conservative. RapidAir was used to generate a map of NH_3 concentrations arising from road traffic sources across the entire PUSH study area at a 3m x 3m resolution, and these values were subsequently multiplied by 3.8962 to obtain an adjusted NH_3 road contribution values.

There are no background maps available for NH_3 concentrations, and therefore total NH_3 concentrations could not be modelled. This does not affect the analysis of air quality impacts at designated sites, as it is the development contribution to traffic emissions that is of interest in this study, rather than the total concentration of NH_3.

2.2.7 Future scenario modelling

2.2.7.1 Airborne pollutant concentrations

For the three future scenarios (2034 Baseline, 2034 Do Minimum and 2034 Do Something), RapidAir was used to generate pollutant concentration map across the entire PUSH study area at a 3m x 3m resolution. These maps were generated using SRTM traffic activity data from the appropriate future scenario, emission factors calculated using RapidEms, and 2014 meteorological data.

Pollutant concentration maps for road-only contributions (NOx, NO_2, PM_{10}, $PM_{2.5}$ and NH_3) were calculated using the adjustment factors described in Section 2.2.6. Maps for total pollutant concentrations (NOx, NO_2, PM_{10}, and $PM_{2.5}$) were calculated by adding the road-only concentration maps to the appropriate pollutant background map from the LAQM website. Background maps for the year 2030 were selected, as this is the farthest year into the future for which background maps are available. Note that 2013 base year maps were selected for consistency with the 2014 (base year 2013) map used in the model verification step.

2.2.7.2 Pollutant deposition

Dry deposition rates of nutrient nitrogen and acid were calculated by multiplying the ground level air concentration of the appropriate pollutants (road contribution only) by the appropriate deposition velocity, followed by multiplication with a conversion factor.

Deposition velocities and conversion factors were obtained from Environment Agency guidance,[20] and are provided in Table 2-3 and Table 2-4 respectively.

[20] Environment Agency, "AQTAG06: Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air," March 2014

Table 2-3 Deposition velocities for NO_2 and NH_3

Pollutant	Vegetation type	Deposition velocity (m/s)
NO_2	Grassland (sites with short vegetation)	0.0015
	Woodland (sites with tall vegetation)	0.003
NH_3	Grassland (sites with short vegetation)	0.02
	Woodland (sites with tall vegetation)	0.03

Table 2-4 Dry deposition conversion factors

Pollutant	Conversion factor for nitrogen deposition (from µg/m^2-s to kgN/ha-year)	Conversion factor for acid deposition (from µg/m^2-s to kEq/ha-year)
NO_2	95.9	6.84
NH_3	260	18.5

2.2.8 Model years and considerations

This study assesses air pollution concentrations across the PUSH sub-region for 2014 (as a historical reference year) and for three future development scenarios in 2034. These years were selected based on the availability of existing SRTM modelling results. The 2034 scenarios correspond to the end of the development period described in the 2016 PUSH Spatial Position Statement.[2] A comprehensive analysis of the air quality impacts of the PUSH development is therefore constrained to the 2034 development scenarios modelled in this study.

Comprehensive air quality impact assessments on proposed development for intervening years, up to 2034, would require further SRTM modelling followed by further air dispersion modelling. While it would be possible to interpolate the SRTM results to give approximate changes in road traffic flows between the years 2014 and 2034, and to run air dispersion modelling on these interpolated SRTM outputs, the results of this process would be indicative only. A simple linear interpolation process would not accurately account for the timing of individual developments or transport measures, and may consequently overlook critical decision-making points and constraints in the years between 2014 and 2034.

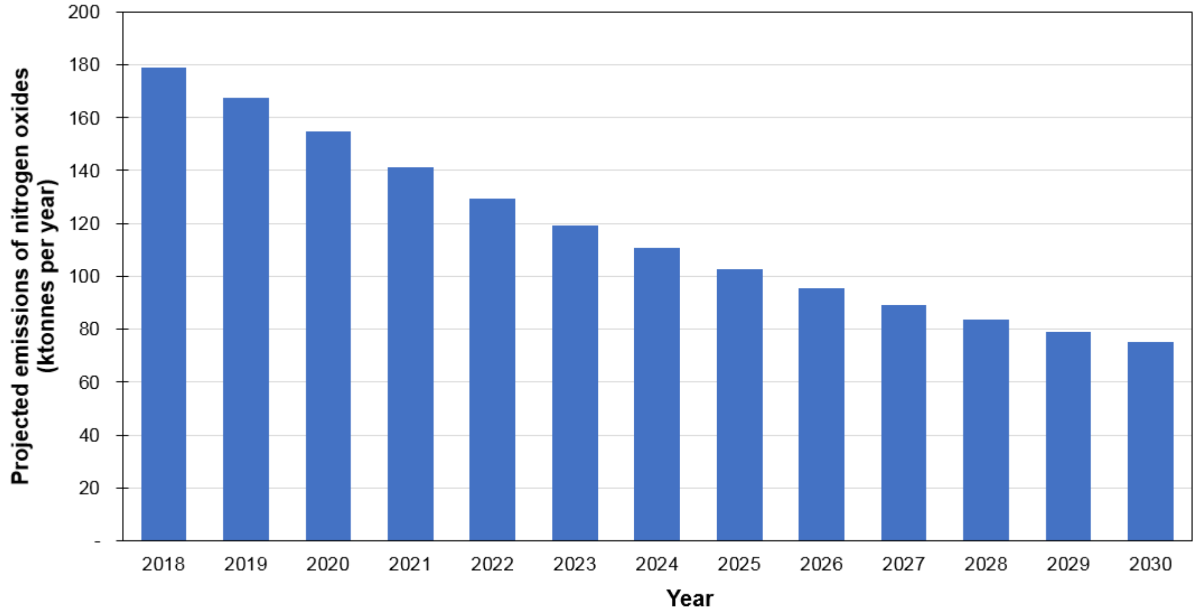
Although the current study is based on air dispersion modelling of a total of four scenarios in two specific years (2014 and 2034), and does not use linear interpolation, the results can nonetheless provide some indicative information about air quality in the years leading up to 2034. The results of the 2014 reference year represent a recent model scenario, and the pollutant contour plots will assist in identifying areas of current concern for air quality issues. The areas which were predicted to exceed the annual air quality objectives for the 2014 scenario are also the areas most likely to experience persistent air quality issues going forward, unless mitigation measures are introduced to target pollutant emissions affecting those areas.

Some local authorities in the PUSH sub-region have expressed concerns that air pollution in the region may get worse before it gets better, for example, if a substantial portion of the allocated development occurs in the near future and the improvements to vehicle emission standards for new vehicles do not live up to expectations. Figure 2-2 presents projected road emissions of nitrogen dioxides for approximately 9,000 major UK roads from 2018 to 2030. The emissions in this figure are extracted from the Streamlined Pollution Climate Mapping model (SL-PCM)[21] for the baseline projection scenario,

[21] 2017 NO2 projections data (2015 reference year), https://uk-air.defra.gov.uk/library/no2ten/2017-no2-projections-from-2015-data, accessed 20/09/2018.

which assumes no further action beyond the air quality measures that were committed by 2015. Although the emissions correspond to a subset of the UK's road network, the decrease in annual NOx emissions is indicative of the expected trend in NOx road emissions going forward, and this decrease reflects anticipated improvements in Euro emissions standards.

Figure 2-2 Projected road emissions of nitrogen oxides (NOx) in ktonnes per year for major UK roads



In order to avoid a situation where air pollution in the PUSH sub-region worsens before improving, it will be important to ensure that development is phased appropriately, and that national and local air quality mitigation measures and transport measures are implemented in a timescale that keeps pace with development. Achieving appropriate phasing may require further modelling analysis by individual developers, and/or by local authorities, potentially to support the development of supplementary guidance.

2.2.9 Sources of model uncertainty

There are a number of sources of model uncertainty inherent in this type of study, as discussed below:

- A monitoring site used to derive the linear adjustment factor might be located next to a large car park, bus stop, petrol station, or taxi rank that has not been explicitly modelled due to unknown activity data. This would have the effect of artificially inflating the calculated adjustment factor, resulting in an over-prediction of impacts.
- A monitoring site used to derive the linear adjustment factor might be located in an area where not all of the road sources contributing to pollutant concentrations have been modelled, i.e. at a junction. This would have the effect of artificially inflating the calculated adjustment factor, resulting in an over-prediction of impacts.
- Uncertainties in the amount and distribution of development accounted for in the SRTM modelling. Household projections are revised from time to time and may vary from the values included in the SRTM model (see Section 3.2.3). It should also be noted that the SRTM accounts for development growth and associated increases in background traffic within the core, marginal and buffer regions of the model (see Section 3.2.1 and Figure 3-1). However, there will also be future development in the 'external' region that has not been modelled explicitly by the SRTM. Furthermore, the amount and distribution of development described in the 2016 PUSH Spatial Position Statement[2] will be subject to refinement as individual local plans are developed in further detail.

- Uncertainties in the traffic model outputs on modelled road links, with regards to number of vehicles, type of vehicles and vehicle speed. The number of low emission vehicles in the future development scenarios may be underestimated if the UK government is successful in ending the sale of all conventional diesel and petrol cars and vans by 2040,[4] which could result in a systematic over-estimation of future air quality impacts.
- Uncertainties in the real-world emissions from Euro 6/VI vehicles. Early real-world emission test results of Euro 6 vehicles indicate mixed results, ranging from vehicles which met the Euro 6 standards under real-world driving emissions to vehicles which displayed NOx emissions up to 12 times higher than the Euro 6 standard.[22,23] However, the increasing use of real-world emissions tests is likely to intensify pressure on vehicle manufacturers to comply with more stringent Euro standards. If real-world emissions do not decrease as anticipated, the PUSH group of local authorities may wish to review the current study in the context of updated emission parameters at some point in the future.
- Uncertainties in the background maps used to develop model adjustment factors and predict total modelled concentrations, with regards to other sources of pollution, such as industrial sources, domestic heating, port activity and forest fires.
- Background maps for the year 2030 were used to calculate total pollutant concentrations in the 2034 scenarios, as that is the farthest year into the future for which background maps are available. Background concentrations in 2030 are not expected to differ significantly from background concentrations in 2034 or 2036, taking into account the uncertainties associated with the interpolation process and forecasting 12-18 years into the future. If anything, the 2030 maps are expected to be slightly conservative (i.e. over-predict) NOx and NO_2 levels in 2034 or 2036. There is no strong reason to anticipate that the 2030 maps for PM_{10} and $PM_{2.5}$ would be over- or under-predictions of the levels expected to occur in 2034 or 2036.
- Some PUSH local authorities are preparing local plans with timelines to 2034, and others are preparing plans with timelines to 2036. As discussed further in 3.2.2, Systra have determined that the transport model land use inputs would be expected to be unchanged from 2034 to 2036. We have used vehicle emission factors corresponding to 2034 in the air dispersion model; as vehicle emission factors tend to decrease overtime, this is expected to be a slightly conservative approach (i.e. the results of the dispersion model are most applicable to 2034, and are expected to slightly over-predict the air quality impacts in 2036).
- The uncertainties introduced by modelling background concentrations over such a wide area at 1km resolution: i.e. the mapped background concentrations change very suddenly at the edges of each 1km background map square. In reality annual average background concentrations would change gradually over an urban area. A possible solution to this issue wold be to interpolate the 1km background maps to a finer resolution e.g. 200m; this would have the effect of smoothing out the sudden changes in background concentrations at the 1km square edges of the background maps.
- Uncertainties resulting from the lack of monitoring data for ammonia (NH_3). We have adopted a conservative approach in our analysis by using the higher of the two model adjustment factors we derived. This is expected to result in an over-prediction of the impacts associated with NH_3, including airborne NH_3 concentrations, nitrogen deposition and acid deposition. The incorporation of monitoring data for NH_3 would result in a more robust model.

[22] The Real Urban Emissions Initiative, https://www.trueinitiative.org/, accessed 20/06/2018.

[23] Emissions Analytics, EQUA Index, https://equaindex.com/equa-air-quality-index/, accessed 20/06/2018.

2.3 Assessment of impacts on designated sites

The assessment of impacts on sites designated for nature conservation was carried out in a stepwise process, designed to comply with Natural England's emerging requirements and good practice for evaluation of the impacts of air pollution on nature conservation sites. The requirements from Natural England were developed primarily for the assessment of designated sites with European (or equivalent international) designation, namely Ramsar sites, Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). We have also included Sites of Special Scientific Interest (SSSIs) that do not form components of European sites (i.e., standalone SSSIs) in this study.

2.3.1 Consideration of whether the proposed development could give rise to emissions which are likely to reach a designated site

Established guidance from Natural England and Highways England indicates that protected sites falling within 200 metres of the edge of a road affected by a plan or project need to be considered further.

This assessment avoids the need for relying on the assumption of a 200 metre zone of influence by including dispersion modelling of emissions from all roads with modelled traffic flows within the PUSH study area, whether or not they are located within 200m of a designated site. All potentially relevant designated sites located within 300m of the PUSH study area boundary were included in the subsequent stage. This approach ensured a robust assessment without relying on a distance-based screening criterion, and provided a more detailed and complete assessment for each relevant designated site.

Designated sites located within 300m of the PUSH boundary are presented in Figure 2-3, Figure 2-4 and Figure 2-5. Since all the designated sites with SPA designation also have Ramsar designation, both designations are presented together in Figure 2-3.

2.3.2 Consideration of whether the qualifying features of the designated site are sensitive to air pollution impacts

Consideration was given to whether the designated site contains qualifying features that are sensitive to the emissions associated with the planned development. For increased road traffic resulting from the proposed development, the associated emissions include nutrient nitrogen deposition, acid deposition, airborne oxides of nitrogen (NOx) and airborne ammonia (NH_3).

Site screening was carried out by searching for information on the UK Air Pollution Information System (APIS, www.apis.co.uk) and identifying potential sensitivity to air pollution impacts. At this stage, the spatial distribution of qualifying features within each designated site was not considered. If a potentially sensitive feature was identified at the designated site, as determined by APIS listing a critical load or critical level for at least one pollutant associated with road traffic at that site, it was included in the subsequent stages of the study. Otherwise, the site was screened out of requiring further assessment. The results of this analysis are summarised in Table 2-5 (for European-designated sites and their underlying SSSIs) and Table 2-6 (for standalone SSSIs).

Consideration was also given to whether potential impacts on "functional linked land" should be considered: that is, a zone surrounding the designated site which plays a role in supporting the habitats and/or species for which each site was designated. Natural England advised that, in view of the nature of the specific designated sites under consideration in this study, and their qualifying features, there was no requirement to consider functionally linked land in an assessment of potential air quality impacts of the proposed development in the PUSH study area.

Table 2-5 European-designated sites and underlying SSSIs: Assessment of sensitivity to emissions from road traffic

Site name	Ramsar site code	SPA site code	SAC site code	SSSI grid reference	Does the site contain qualifying features that are sensitive to emissions from road traffic?
Chichester and Langstone Harbours (Ramsar & SPA) [a]	UK11013	UK9011011			Yes – include in study
Chichester Harbour (underlying SSSI) [a]				SU779017	Yes – include in study
Langstone Harbour (underlying SSSI) [a]				SU695025	Yes – include in study
Emer Bog SAC			UK0030147		Yes – include in study
Baddesley Common and Emer Bog (underlying SSSI)				SU395214	Yes – include in study
Portsmouth Harbour (Ramsar & SPA)	UK11055	UK9011051			Yes – include in study
Portsmouth Harbour (underlying SSSI)				SU617034	Yes – include in study
River Itchen SAC			UK0012599		Yes – include in study
River Itchen (underlying SSSI)				SU476240	Yes – include in study
Solent and Southampton Water (Ramsar & SPA) [a]	UK11063	UK9011061			Yes – include in study
Solent and Isle of Wight Lagoons (underlying SAC)			UK0017073		Yes – include in study
Eling and Bury Marshes (underlying SSSI)				SU371126	Yes – include in study
Gilkicker Lagoon (underlying SSSI)				SZ608977	Yes – include in study
Lee-on-the Solent to Itchen Estuary (underlying SSSI) [a]				SU510034	Yes – include in study
Lincegrove and Hackett's Marshes (underlying SSSI) [a]				SU487087	Yes – include in study
Lower Test valley (underlying SSSI)				SU364144	Yes – include in study
River Test (underlying SSSI)				SU378386	Yes – include in study
Titchfield Haven (underlying SSSI)				SU538033	Yes – include in study
Upper Hamble Estuary and Woods (underlying SSSI) [a]				SU500108	Yes – include in study
Solent Maritime SAC			UK0030059		Yes – include in study

[a] These designated sites also overlap with Solent Maritime SAC
Note that other sites are grouped together if they have overlapping boundaries with different designations

Table 2-6 Standalone SSSI sites: Assessment of sensitivity to emissions from road traffic

Site name	SSSI grid reference	Does the site contain notifiable features that are sensitive to emissions from road traffic?
Botley Wood and Everett's and Mushes Copses	SU541101	Yes – include in study
Browndown	SZ578991	Yes – include in study
Catherington Down	SU691143	Yes – include in study
Downend Chalk Pit	SU600065	No qualifying features listed in APIS – exclude from study
Hook Heath Meadows	SU644080	Yes – include in study
Lye Heath Marsh	SU648085	Yes – include in study
Moorgreen Meadows	SU482144	Yes – include in study
Portsdown	SU640065	Yes – include in study
Sinah Common	SZ695979	Yes – include in study
Southampton Common	SU414146	Yes – include in study
The Moors, Bishop's Waltham	SU561169	Yes – include in study
The Wild Grounds	SU580009	Yes – include in study
Trodds Copse	SU418224	Yes – include in study
Waltham Chase Meadows	SU564149	Yes – include in study
Warblington Meadow	SU729052	Yes – include in study

2.3.3 Assessment of air quality impacts of the development against screening thresholds

The next step was to use the dispersion modelling results to predict the air quality impacts associated with changes in traffic flow resulting from the two PUSH development scenarios (2034 Do Minimum and 2034 Do Something). For each set of model results (nutrient nitrogen deposition, acid deposition, airborne NOx and airborne NH_3), the contributions attributable to the PUSH development scenarios were calculated as follows:

- (Contribution of the 2034 Do Minimum Scenario) = (2034 Do Minimum) – (2034 Baseline)
- (Contribution of the 2034 Do Something Scenario) = (2034 Do Something) – (2034 Baseline)

The contributions attributable to each PUSH development scenario were then compared to a screening threshold, where the screening threshold for each pollutant / habitat combination was set to 1% of the applicable Critical Load or Critical Level. This approach is supported by online guidance published by Defra and the Environment Agency,[24] a position statement published by the Institute of Air Quality Management (IAQM),[25] and recent guidance received from Natural England.[26]

According to the position statement published by the IAQM, the 1% threshold *"was originally set at a level that was considered to be so low as to be unequivocally in the 'inconsequential' category. In other words, this can be reasonably taken to mean that an impact of this magnitude will have an insignificant effect. This would be determined as part of the HRA screening stage. Such a conclusion would eliminate*

[24] Department for Environment, Food and Rural Affairs and Environment Agency, "Air emissions risk assessment for your environmental permit", February 2016.

[25] Institute for Air Quality Management, "Position Statement: Effect of Air Quality Impacts on Sensitive Habitats," January 2016

[26] Email communication with Natural England, 12/01/2018.

the requirement to proceed to 'appropriate assessment.'[25] The position statement indicates that the 1% criterion is intended to be a threshold below which the impact should be considered insignificant and screened out; impacts above 1% do not necessarily correspond to the onset of damage to a designated site. Impacts above 1% should be treated as potentially significant and undergo further detailed assessment.

In view of this guidance, a threshold of a contribution of 1% of the applicable Critical Load or Critical Level was used to screen out any areas where the proposed PUSH development would have an insignificant impact on the relevant designated site.

Additionally, where the contribution of airborne NOx was predicted to exceed 1% of the Critical Level (30 $\mu g/m^3$), the total predicted concentration of NOx was determined by adding the NOx contribution from the PUSH development scenario to the predicted background NOx concentration in 2034. Background NOx concentrations for 2034 were obtained from the UK Air website.[27] If the total predicted NOx concentration was determined to be less than 21 $\mu g/m^3$ (i.e. 70% of the NOx long-term Critical Level), the impact was screened out as insignificant, in line with guidance published by Defra and the Environment Agency.[24] This approach was not used for other pollutants (nutrient nitrogen deposition, acid deposition and airborne NH_3) due to the absence of 2034 background maps for these pollutants.

2.3.4 Consideration of in-combination effects

Recent guidance from Natural England, developed following the requirements of the Wealden Judgment, advise that the screening thresholds should be applied with consideration to impacts from individual proposed developments and with consideration to in-combination effects. The SRTM models used in this assessment include traffic data accounting for future proposed development and housing in the PUSH sub-region, which is a larger area than the PUSH study area. As a result, the 2034 Do Minimum and 2034 Do Something scenarios already account for in-combination effects associated with road traffic emissions from the proposed development in East Hampshire, Eastleigh, Fareham, Gosport, Havant, Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley, and Winchester.

The National Infrastructure Planning website[28] was investigated to identify any potentially relevant major industrial developments in the PUSH region. This highlighted two potentially relevant projects:

- Southampton to London Pipeline Project: This pipeline renewal project is unlikely to have any significant air quality impacts.
- Navitus Bay Wind Park: Permission has been refused for this project.

Consequently, the current assessment does not include in-combination effects from industrial plans and projects.

The NOx, PM_{10} and $PM_{2.5}$ pollutant background maps[19] used in the air dispersion model account for existing industrial activity, including large combustion installations, airports and shipping activity. Known industrial sources are modelled explicitly in the baseline year of the background maps, and future-year background maps are derived by incorporating datasets from the UK Department for Business, Energy & Industrial Strategy (BEIS) regarding projected energy and economic activity data for various industrial sectors. The background maps therefore account for future growth in industrial sector emissions, within the limits of current government growth projections.

The current assessment does not explicitly include in-combination effects from new industrial plans and projects, particularly those which are unlikely to be included in the BEIS sector projections which underpin the background pollutant maps. There are no currently proposed major infrastructure projects

[27] Department for Environment, Food and Rural Affairs, UK Air website, "Background mapping data for local authorities", https://uk-air.defra.gov.uk/data/laqm-background-home

[28] https://infrastructure.planninginspectorate.gov.uk/

which require consideration. Other new industrial plans and projects seeking planning permission will need to carry out their own in-combination assessment of effects, where applicable, as part of the HRA process.

2.3.5 Consideration of whether the qualifying features of the designated site will be exposed to emissions exceeding the screening thresholds

The results of the present study are intended to inform Habitats Regulations Assessments (HRAs) for individual local authorities within the PUSH study area.

This step involves a spatial analysis of the distribution of qualifying features and broad habitats within the designated site, assisted with GIS software and the Priority Habitat Inventory (PHI) GIS shapefile available from Natural England.[29] Where it is determined that sensitive qualifying features are not present within the area affected by emissions exceeding the 1% screening threshold, it can be ascertained that the development plan does not pose a credible air quality risk to the designated site's qualifying features. Sites in this category can be excluded from further assessment (e.g. HRA Stage 2 – appropriate assessment).

For designated sites where it is determined that there are qualifying features and/or sensitive broad habitats within the area affected by emissions exceeding the screening threshold, the affected areas have been mapped using GIS software. Guidance from Natural England with respect to the HRAs indicates that European-designated sites (Ramsar sites, SPAs and SACs) within this category must be subject to an appropriate assessment (HRA Stage 2). SSSIs in this category are not subject to HRA, but may be subject to further assessment with respect to air quality impacts.

For designated sites where an appropriate assessment is required, in-combination effects should be re-evaluated at the time of the appropriate assessment. This should include possible in-combination effects from other local plans, as well as allocations and/or committed development for industrial activity which may affect the designated site, including but not limited to digesters, combustion / incineration processes, and energy plants.

[29] Natural England Open Data, "Priority Habitat Inventory (South) (England)", https://naturalengland-defra.opendata.arcgis.com/datasets/priority-habitat-inventory-south-england, accessed 12/12/2017.

Figure 2-3 Ramsar sites and SPAs located within 300m of PUSH study area

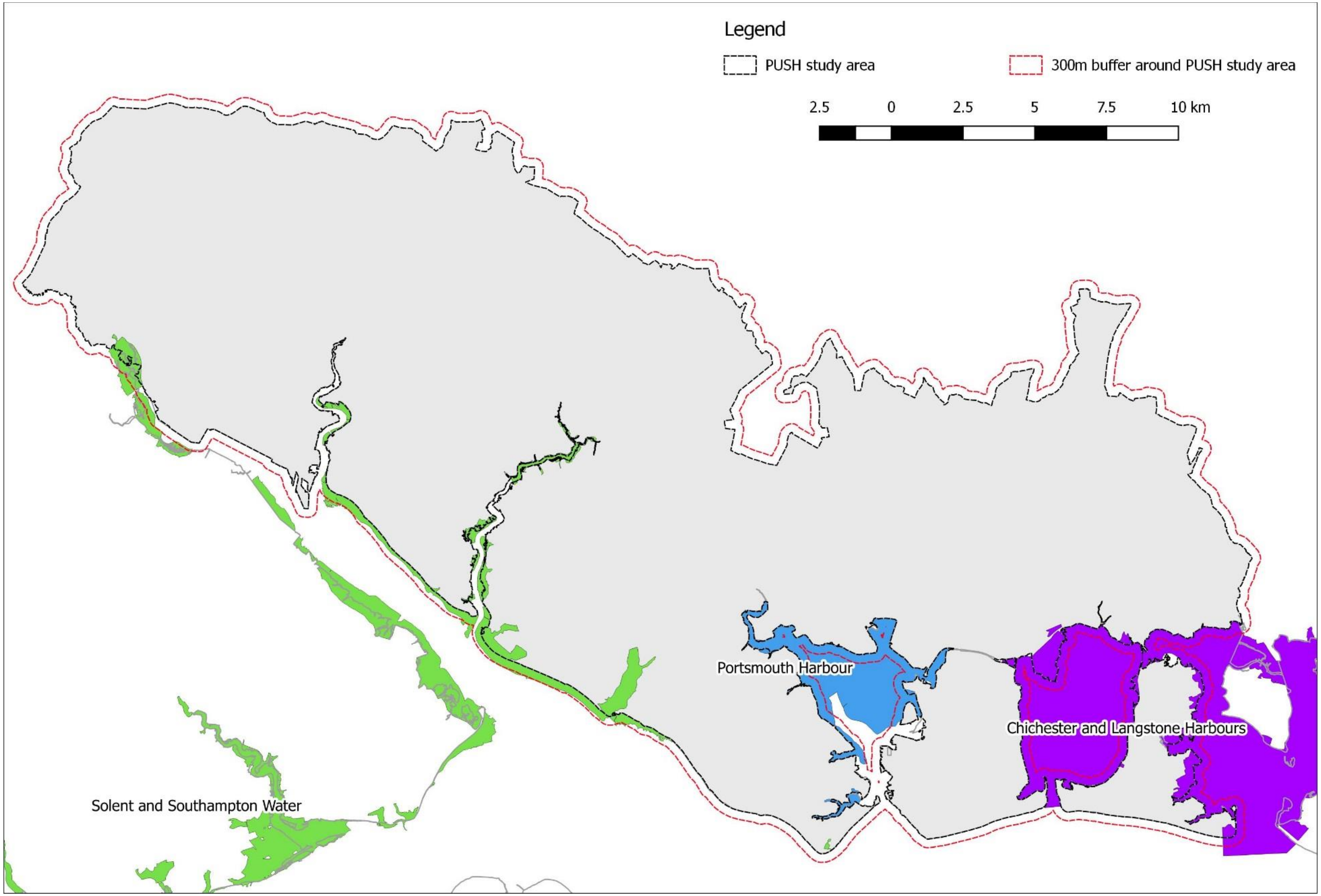


Figure 2-4 SACs located within 300m of the PUSH study area

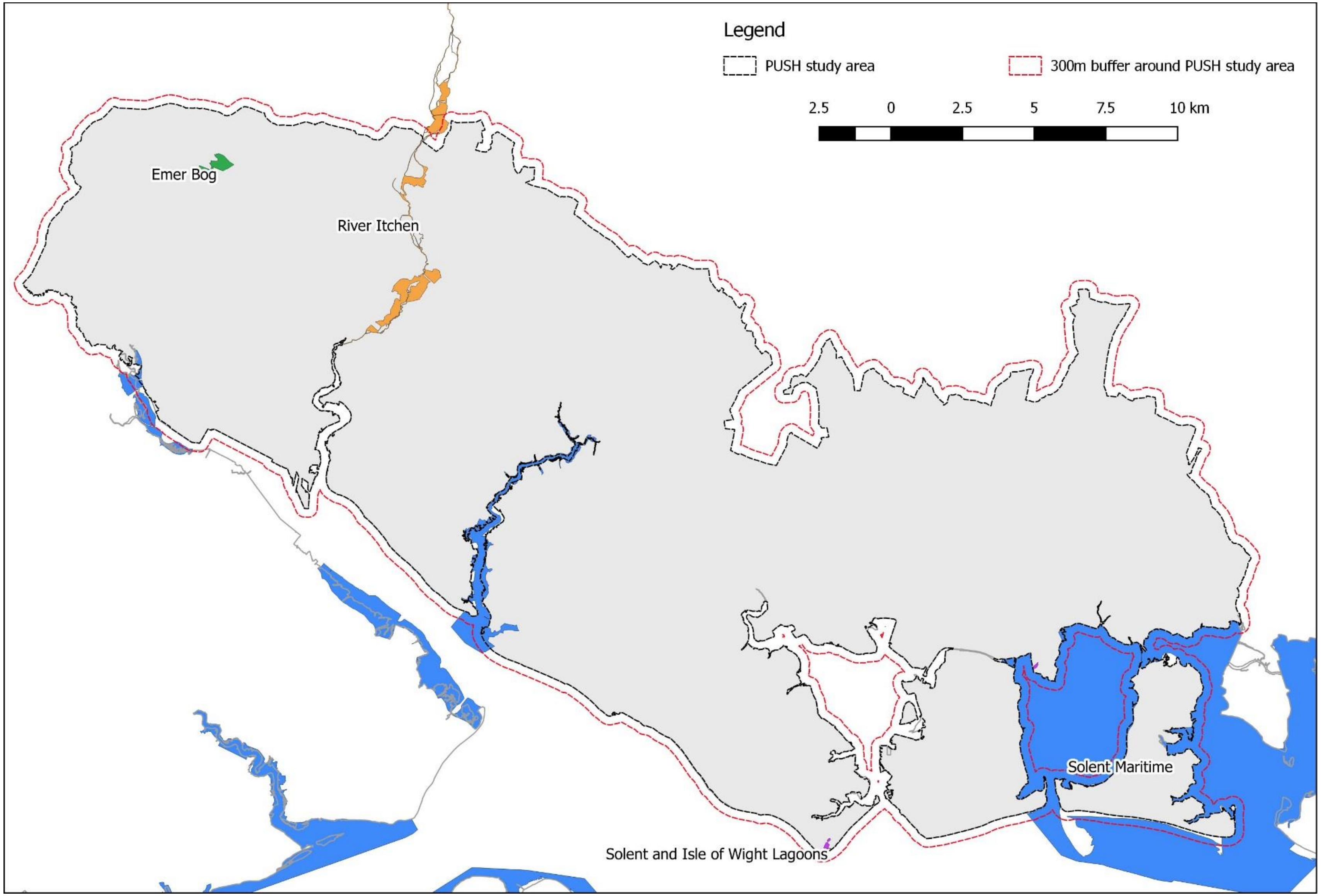
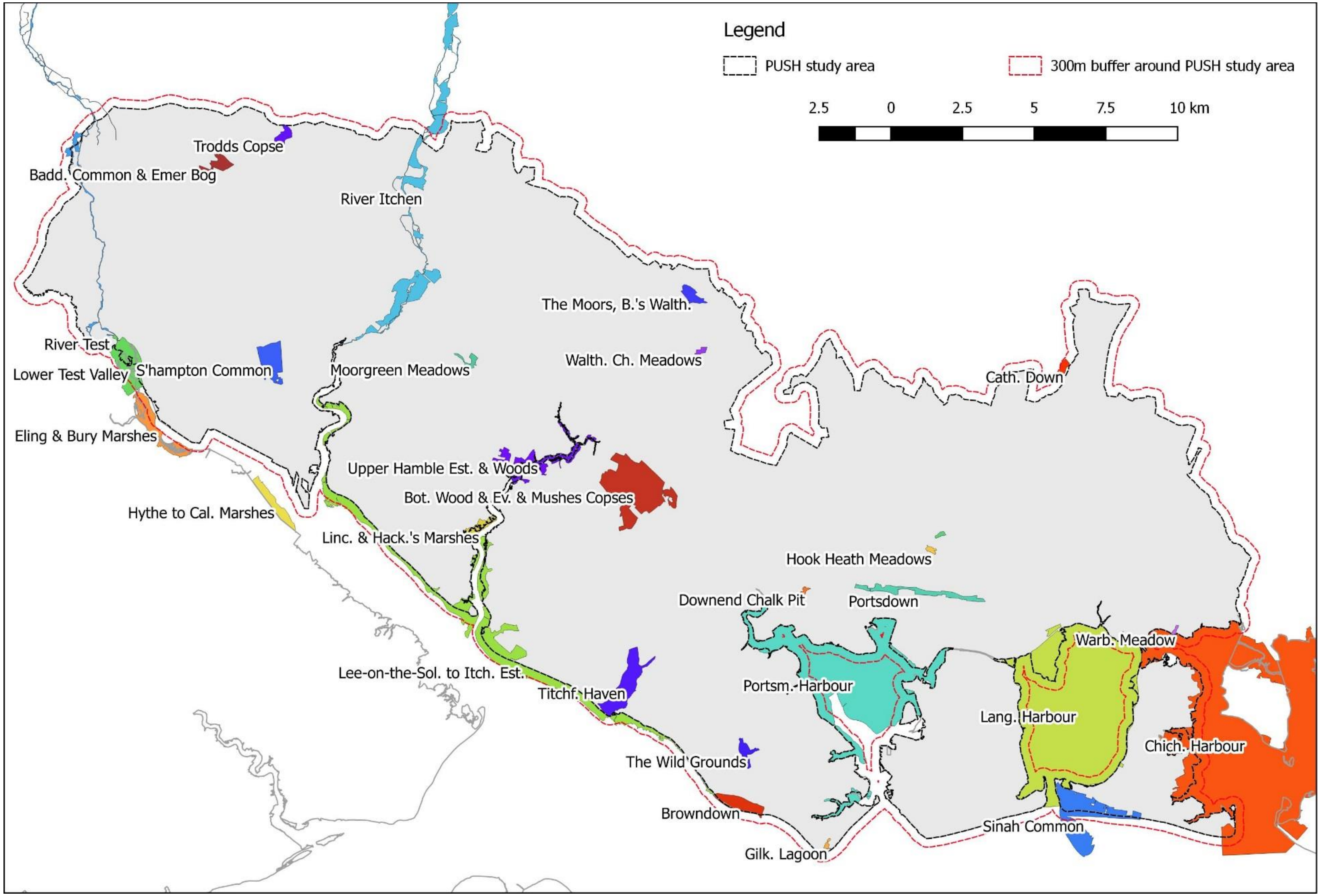


Figure 2-5 SSSIs located within 300m of the PUSH study area



3 Integration of existing evidence

3.1 Review of 2010 AEA Technology report

AEA Technology (predecessor business to Ricardo Energy and Environment) carried out a study for PUSH entitled "Road transport emissions impacts on Nature Conservation Sites" in July 2010.[30] One of the objectives of the present project is to review and update the 2010 AEA Technology report. The 2010 study will be reviewed in this section, and the impacts of PUSH development scenarios on designated sites will be assessed in Section 5.

The 2010 study had access to tools and information to enable air quality impacts at designated sites to be assessed in detail. The focus of the study was defined in terms of the following questions:

- Are the critical levels for oxides of nitrogen and ammonia and critical loads for nutrient nitrogen and acid deposition currently exceeded at the sites?
- Are concentrations and rates of deposition predicted to increase or decrease from 2007 to 2026 with the additional growth from PUSH?
- What part of the habitat area will experience increases in concentrations or rates of deposition corresponding to a fraction of the critical level or critical load as the result of the additional traffic generated by PUSH in 2026?
- What part of the habitat area will experience increases in concentrations or rates of deposition corresponding to a higher fraction of the critical level or critical load as the result of the additional traffic generated by PUSH in 2026?

The remit of the 2010 study did not include assessment of impacts on air quality in relation to human exposure, for example by evaluating potential impacts in Air Quality Management Areas (AQMAs).

While the 2020 study assessed impacts on designated sites in Hampshire in some detail, the study predated the current guidance for systematic assessment of the impacts of air pollutants at designated sites. Guidance from the Environment Agency, together with emerging guidance from Natural England, sets out a staged assessment methodology which enables attention to be focused on key issues. A screening process is used to eliminate sites from requiring more detailed evaluation, based on aspects such as excluding areas where the forecast impact of a development either alone or in combination with other plans or projects is below 1% of the applicable critical load or critical level.

In the absence of the current guidance, the 2010 study went into considerable detail to evaluate air quality impacts within both nationally designated sites (Sites of Special Scientific Interest (SSSIs)) and European sites (Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites). In particular, the 2010 study looked at SSSIs which are not part of European sites, which would not normally be required as part of an assessment under Section 21 of the Conservation of Habitats and Species Regulations (2010 No. 490). Additionally, the 2010 study investigated the impact of air emissions resulting from the PUSH authorities' housing development plans on components of each designated site, broken down by broad habitat type. Under the current procedures, much of this analysis would have been screened out by use of the "1% screening criterion." Furthermore, an assessment of impacts by habitat type in this way, if required, would typically follow at a later stage in the assessment. The 2010 study recommended some designated sites would "*further benefit from on-the-ground assessments of site conditions related to air, water and soil quality and any potential impacts on plant communities and faunal groups.*" Under current procedures, the assessment of broad habitat areas within European sites would be carried out alongside ecological assessment of site conditions.

[30] AEA Technology, "Road Transport Emissions Impacts on Nature Conservation Sites", Reference number ED45347, 04/08/2010.

As well as the emergence of structured guidance for carrying out habitats regulations assessments, the published tools and data to support habitats risk assessment have been updated since 2010. In particular, critical loads for individual designated sites have been updated. Site-relevant critical loads are available for nitrogen deposition, which supersede the broad habitat values used in the 2010 study (Table 2 in the 2010 report). The site-relevant critical loads for acid deposition used in the 2010 study have also been updated. Furthermore, guidance has been published which confirms that, in locations where background deposition exceeds the critical level for acid deposition (this applies to almost all sensitive sites in the UK), impacts should be assessed against the “minCLmaxN” value.[31]

In addition to the above updates to the published datasets and guidance pertaining to the way in which designated sites are assessed, significant changes have also been made to the way in which traffic emissions are predicted and modelled since 2010. Defra has published and updated its recommended dataset for road traffic modelling, referred to as the “Emissions Factor Toolkit,” which supersedes the emission factors derived from the National Atmospheric Emissions Inventory used in the 2010 study. The 2010 study included dispersion modelling of road emissions for segments of road classified as either motorways or A-roads and located within 200m of a designated site. The model used in the 2010 study provided a resolution of up to 10m x 10m at receptors located close to the modelled road links, with a coarser resolution at receptor points located farther away. In contrast, the current study undertakes dispersion modelling of road emissions for all road segments included in the SRTM model provided by Systra (see Section 3.2), at a resolution of 3m x 3m, across the entire PUSH study area.

Additionally, the PUSH authorities’ plans for housing development in Hampshire have progressed since the 2010 study was carried out, and new traffic forecasts have been developed by the PUSH traffic consultants following publication of the South Hampshire Strategic Housing Market Assessment (SHMA). The SHMA looks beyond the 2026 horizon used in the 2010 AEA Technology report to either 2034 or 2036, depending on each local authority’s timeline.

3.2 Integration of sub-regional transport model

3.2.1 Transport model development

MVA Consultancy was commissioned to develop a Sub-Regional Transport Model (SRTM) that covered the South Hampshire sub-region, including the areas of Southampton and Portsmouth. The SRTM was developed to support a wide-ranging set of interventions across the sub-region, and was specifically required to be capable of the following:[32]

- Forecasting changes in travel demand, road traffic, public transport patronage and active mode (walking and cycling) use over time as a result of changing economic conditions, land-use policies and development, and transport improvements and interventions;
- Testing the impacts of land-use and transport policies; and
- Testing the impacts of individual transport interventions in the detail necessary for preparing submissions for inclusions in funding programmes.

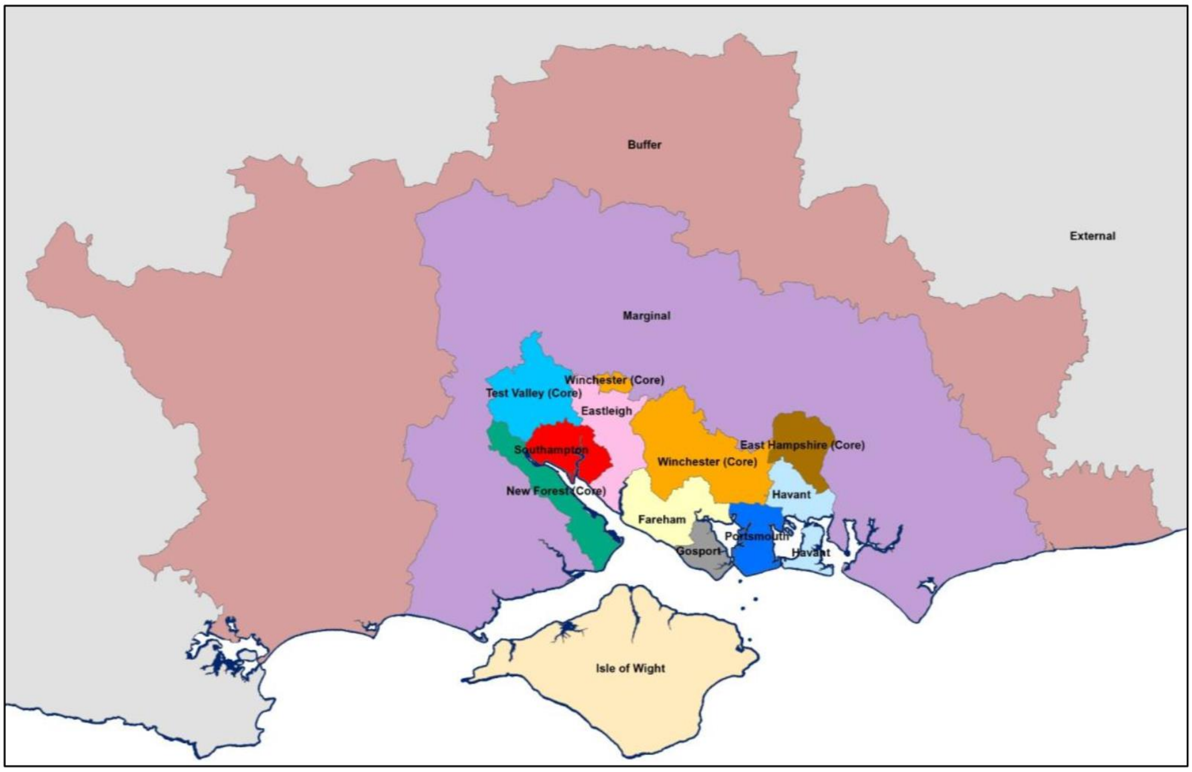
The SRTM includes four main model regions (core, marginal, buffer and external; Figure 3-1), which have been modelled to varying levels of detail. The core region includes Test Valley (in part), New Forest (in part), Southampton, Eastleigh, Winchester (in part), Fareham, Gosport, Portsmouth, Havant, East Hampshire (in part) and Isle of Wight. Each of the four main model regions is further broken down into model zones. The zones within the core and marginal model regions are mainly based on groups of Census Output Areas (COAs) and Census Wards (CWs), respectively. Zones are based on Districts

[31] http://www.apis.ac.uk/clf-guidance

[32] MVA Consultancy, “Transport for South Hampshire Evidence Base Model Development Report: Report 2”, MVA Project Number C39344, August 2011.

immediately outside the marginal model area, and on Counties in the model areas farther away. Key transport model parameters such as land use are specified by zone, and consequently the core model region has been modelled at the highest resolution and with the greatest level of detail; model resolution and detail decrease in zones farther away from the model core.

Figure 3-1 SRTM geographical coverage[33]

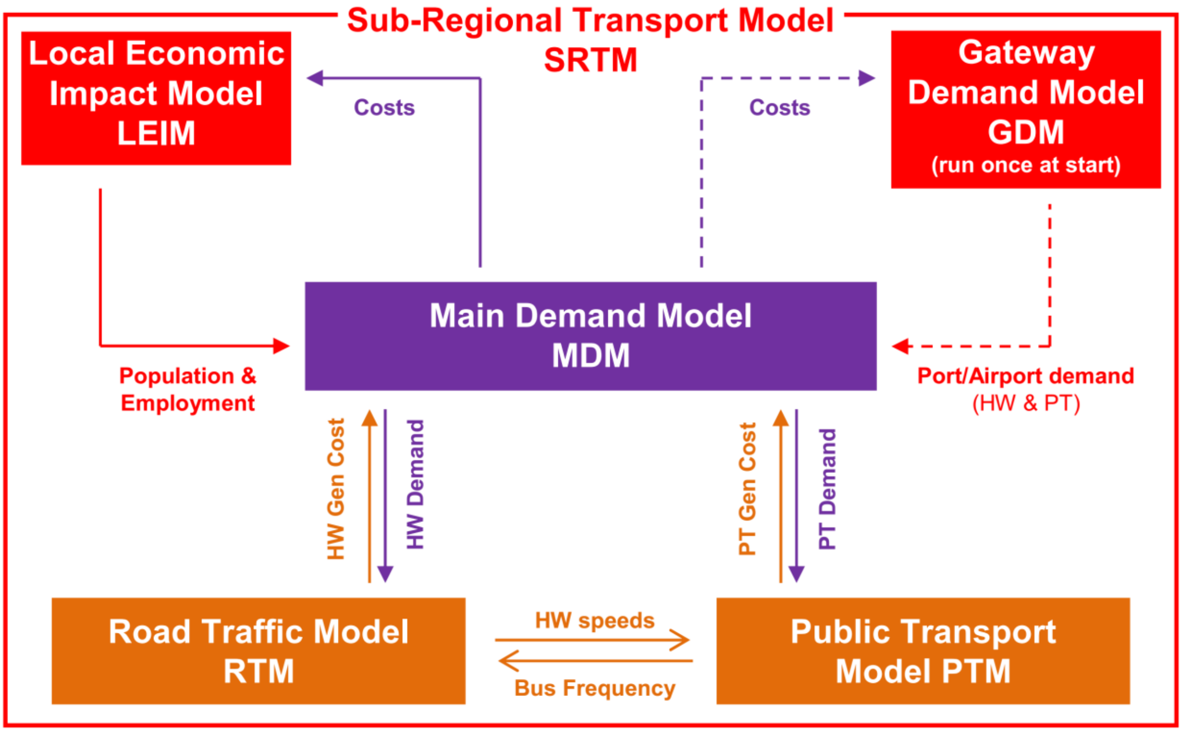


The SRTM is a suite of linked models comprised of the following components:

- Main Demand Model (MDM) which predicts when (frequency and time of day), where (destination choice) and how (choice of mode) journeys are made. Mode choices include car, public transportation, park & ride (a combination of car and public transportation), and active modes (walking and cycling).
- Gateway Demand Model (GDM) which predicts demand for travel from ports and airports.
- Road Traffic Model (RTM) which determines the routes taken by vehicles through the road network and journey times, accounting for congestion.
- Public Transport Model (PTM) which determines routes and services chosen by public transport passengers.
- Local Economic Impact Model (LEIM) which uses inputs including transport costs to forecast quantities and locations of households, populations and jobs.

The model components interact as demonstrated in Figure 3-2.

Figure 3-2 Interaction of models included in the SRTM[32]



The SRTM is an evidence-based Land-Use and Transport Interaction model. The SRTM was originally developed, calibrated and validated against 2010 data and conditions, and included five forecast years: 2014, 2019, 2026, 2031, and 2036. Data sources included:

- Roadside interview survey data
- Rail Travel Survey
- Public transport origin destination data
- Ticket data for buses
- On board counts
- Manual and automatic traffic counts
- Journey time data
- Census Journey to Work Data
- National Travel Survey (NTS) Data
- National Trip End Model (NTEM) Data
- Population and Employment Data

3.2.2 Transport model update for PUSH

Systra was recently commissioned by PUSH to apply Solent Transport's Sub Regional Transport Model (SRTM) to examine the impacts of the latest growth projections and transport interventions for the PUSH sub-region through to 2034. In total, four scenarios were modelled using the SRTM for this study:

- 2014 Reference Case: The starting point for the model land use was the original 2014 SRTM model, which was amended in 2015 to reflect lower growth than was originally forecast in 2010. The model was also updated to include completed developments for 2014 to 2015.

- 2034 Baseline Scenario: The starting point for this model, as well as the other 2034 scenarios, was the original 2036 SRTM model. Systra determined that, for the purposes of running the model, the land use inputs for 2035 and 2036 were identical to those for 2034.[33] The 2034 Baseline scenario has all land use growth inputs removed from the PUSH area from 2014 onwards. In essence, the scale and location of development is assumed to be unchanged from 2014 conditions within the PUSH area, which equates to a difference of approximately 100,000 dwellings in the PUSH area compared to the 2034 Do Minimum and 2034 Do Something models. For the remaining model areas in the 2034 Baseline scenario, it is assumed that development and growth can continue as expected for 2034 (i.e. these are not supressed outside of the PUSH region); the increase in development beyond the PUSH area is the main difference between the 2034 Baseline and the 2014 Reference scenarios. There is an approximate 10% growth in highway volume between the 2034 Baseline and 2034 Do Something scenarios, which is comparable to the person demand response in the Main Demand Model. It is also consistent with a growth of 100,000 dwellings on approximately 1.15 million underlying dwellings within the model. This scenario includes the transport schemes detailed in Table 3-1.
- 2034 Do Minimum (2034 DM) Scenario: This model scenario includes development and growth within the PUSH region, equating to approximately 100,000 additional dwellings compared to the 2034 Baseline scenario. It includes transport schemes that are already committed as well as several supporting schemes that are vital to committed development sites even though the schemes themselves may not yet be committed. Transport schemes included in this scenario are detailed in Table 3-1 and Table 3-2.
- 2034 Do Something (2034 DS) Scenario: This model scenario includes development and growth within the PUSH region, equating to approximately 100,000 additional dwellings compared to the 2034 Baseline scenario. This model scenario includes additional transport interventions, specified by the Solent Transport and PUSH authorities, which are aimed at helping to mitigate the impact of the proposed developments on the transport network. Transport schemes included in this scenario are detailed in Table 3-1, Table 3-2 and Table 3-3.

Table 3-1 Transport schemes included in the 2034 Baseline, 2034 Do Minimum and 2034 Do Something scenarios

Name of scheme	Description
Highways England schemes:	
M27 J3 Improvements (recently constructed)	M27 westbound exit slip-road widening to three lanes (from two) and M271 northbound and southbound approaches widening to three lanes (from two).
M27 J5 Improvements (recently constructed)	Provision of a free flow left turn lane from M27 westbound to A335 Stoneham Way; provision of a free flow left turn lane from A335 Wide Lane southbound onto M27 eastbound on-slip; widening from two to three lanes on M27 eastbound off-slip; widening of Stoneham Way southbound arm of the junction from one lane to two; and widening of some parts of the circulatory part of the roundabout plus signalisation of additional arms of the junction.
M27 J9 Improvements	Committed scheme to improve junction 9 and the Rookery Avenue/Whiteley Way/Parkway roundabout to facilitate access to the North Whiteley development. For additional information: https://www.hants.gov.uk/transport/transportschemes/m27junction9

[33] Systra, "Technical Report: Push Development & Transport Interventions, 2036 PUSH Do Something Versus 2014 Base", Reference number 102827, 03/06/2016.

Name of scheme	Description
Local authority schemes	
Southampton Platform Road Improvements	Completed scheme: conversion of gyratory system to two-way, four lane road; and improved, direct access to Dock Gate 4 from the west.
Fareham Newgate Lane North	Completed scheme; a major improvement scheme for the northern section of Newgate Lane between Palmerston Drive and Tanners Lane in Fareham, that was completed in Autumn 2015. Key outputs included additional lanes, reconstruction of a roundabout to improve capacity, provision of a new roundabout bypass lane, and creation of a new signalised junction to provide access to HMS Collingwood. For additional information: https://www.hants.gov.uk/transport/transportschemes/newgatelanenorth
Fareham A27 Western Way and Western Road Improvements	Completed scheme to widen road to provide additional westbound traffic lane, plus “shortcut” for westbound buses leaving Fareham bus station, avoiding a roundabout.
Fareham Peel Common Roundabout	Completed scheme to improve capacity; installation of traffic lights on the Rowner Road, Broom Way and Newgate Lane entries to the roundabout, and additional lanes on the roundabout from Newgate Lane towards Rowner Road, and on the Rowner Road approach to the roundabout, to increase capacity for peak hour traffic. For additional information: http://www.fareham.gov.uk/parking_and_traffic/peelcommon.aspx
Fareham A27 St Margaret’s Roundabout	Completed scheme; signalisation of the A27 Southampton Road, Cartwright Drive and Warsash Road approaches to the roundabout; extra traffic lanes on the A27 Southampton Road approaches to the roundabout; widened traffic lanes on the Cartwright Drive approach; and various other alterations to layout to improve capacity and capability. Complimentary to the A27 Segensworth to Titchfield scheme. For additional information: http://www.fareham.gov.uk/latest_news/stmargarets.aspx
Havant Dunsbury Hill Farm Link Road and Access Junction	Committed scheme; creation of a new link road from the A3(M) junction 3, via Dunsbury Park commercial/ industrial development, to north west corner of Leigh Park.
Havant Asda Roundabout	Completed scheme; reconstruction of roundabout, including enlargement, signalisation and additional lanes.

Table 3-2 Transport schemes included in the 2034 Do Minimum and 2034 Do Something scenarios

Name of scheme	Description
Highways England schemes:	
M27 Southampton Junctions (M271 / Redbridge roundabout plus M27 J8 Eastern Access to Southampton)	Proposed scheme in Highways England RIS1 programme. Currently under development, however primary outputs proposed to be: • Improvements at M27 J8 to include part signalisation, additional lanes on some slip roads; • Improvements to Windhover Roundabout to include additional lanes on some parts of junction and additional traffic signals; • A3024 Bitterne Road to include improvements to 31 junctions between Windhover and the city centre. Measures vary by junction but generally include widening, signalisation, and removal of bus lanes; • Replacement of two existing rail bridges with wider bridges. For additional information: http://roads.highways.gov.uk/projects/m27-southampton-junctions/

Name of scheme	Description
M3 J9 to J14 Smart Motorway	Committed RIS1 scheme. Implementation of Smart Motorway scheme incorporating hard shoulder running to increase capacity at busy times and variable speed limits indicated on overhead gantries (speed limits vary depending on traffic volume and incidents). For additional information: http://roads.highways.gov.uk/projects/m3-junctions-9-to-14-smart-motorway/
M27 J4 to J11 Smart Motorway	Committed RIS1 scheme. Implementation of Smart Motorway scheme incorporating hard shoulder running to increase capacity at busy times and variable speed limits indicated on overhead gantries (speed limits vary depending on traffic volume and incidents). For additional information: http://roads.highways.gov.uk/projects/m27-junctions-4-to-11-smart-motorway/
M27 J10 Improvements (all movement junction)	Committed scheme; reconstruction of M3 junction 10 to create an all-moves junction and enable direct access to the Welborne development. For additional information: http://www.welbornegardenvillage.co.uk/pdf/WelborneJ10-PositionStatement.pdf
M3 J9 Improvements (A34 free-flow)	Committed RIS1 scheme; major reconstruction of this junction to enable free flow access from M3 northbound to A34 northbound, and from A34 southbound to M3 southbound. For additional information: http://roads.highways.gov.uk/projects/m3-junction-9-improvements/
Local authority schemes	
Eastleigh scenario "DM2" Improvements	Scenario from Eastleigh Strategic Transport study (ESTS) incorporating land use and highway infrastructure changes as follows: • Do Minimum 1 (DM1): Development sites with planning permission and all others whose transport mitigations were identified in the pre-Submission 2011-2029 Local Plan; and • Do Minimum 2 (DM2): Development sites from the DM1 scenario plus potential additional development for housing required as part of the 2011-36 draft Local Plan. For additional information: https://www.eastleigh.gov.uk/media/1713/eastleigh-strategic-transport-study-document.pdf
Eastleigh Leigh Road Junction Improvements	Completed scheme: improvements to Leigh Road/ Passfield Avenue/ Woodside Avenue junction, including changes to layout and additional /extended lanes on some arms.
Winchester Whiteley Way extension	Committed scheme: continuation of Whiteley Way via North Whiteley development to the A3051.
Fareham Newgate Lane South	Completed scheme to create a new alignment for southern part of Newgate Lane, with a new single carriageway road constructed on a smoother alignment to the east of the existing road and Woodcote Lane. There will be fewer interruptions to traffic flow caused by turning traffic. Complimentary to Newgate Lane North and Peel Common roundabout schemes. For additional information: https://www.hants.gov.uk/transport/transportschemes/newgatelanesouth
Fareham A27 Segensworth to Titchfield Improvements	Completed scheme; primary output of the scheme is reconstruction of this section of the A27 to upgrade from single carriageway to dual carriageway. There are also some associated additional junction improvements as part of the scheme. For additional information: https://www.hants.gov.uk/transport/transportschemes/a27segensworthtotitchfield

Name of scheme	Description
Fareham A27 Station Roundabout	Completed scheme; improvements to Fareham station roundabout including improved Eclipse BRT stops and priority measures, and enhanced pedestrian access to rail station. Improvements to the A27 west of the station roundabout, with additional lane between roundabout and Gudge Heath Lane junction to increase capacity. Various other enhancements. For additional information: https://www.hants.gov.uk/transport/transportschemes/a27bishopsfieldroadtostationroundabout
Havant London Road / Park Lane Junction	Park lane widening from one lane to two lanes.
Havant A3(M) J3 partial signalisation	Proposed scheme, to include part signalisation of this junction.

Table 3-3 Transport schemes included in the 2034 Do Something Scenario

Name of scheme	Description
Highway schemes:	
M271 J1 LIDL distribution centre changes	Committed scheme; part of wider development of Adanac Park, including new roundabout at Brownhill Way, a development spine road, and a new access south of the additional roundabout to serve the LIDL site.
Abbotswood development Improvements	Conversion of A3090 Winchester Hill / Briashfield Road junction to signal control, and widening of right turn on Halterworth Lane at junction with A3090 Winchester Rd.
A3057 / A3090 Plaza Junction Improvements	Conversion of mini-roundabout to signal controlled junction.
Relocation of Red Funnel Dock Gate	Committed scheme; relocation of Red Funnel car ferry terminal from Town Quay / Royal Pier, to Trafalgar dry dock site accessed via new Dock Gate off Platform Road. For additional information: http://www.investinsouthampton.co.uk/developments/developmentdetails.aspx?id=166
Eastleigh "DS2a" schemes	Scenario from Eastleigh Strategic Transport study (ESTS) incorporating land use and highway infrastructure changes. This scenario includes development sites from the DM2 scenario with all the transport interventions from the DS1 scenario plus the additional major transport interventions presented in Chapters 4 and 5 of the report. These interventions are very extensive and are mostly uncommitted/ unfunded or only partially funded. The improvements included in this scenario are as follows: • New link road to the north of Bishopstoke between the B3354 Winchester Road and the B3335 Highbridge Road, including improvements to Highbridge Road, known as the North Bishopstoke Bypass; • A new link road between the B3335 Allbrook Hill/Highbridge Road and the A335 Allbrook Way, known as the Allbrook Hill Relief Road. This link would form an integral part of the North Bishopstoke Bypass. • A new link road to the south of Bishopstoke between Allington Lane and Chickenhall Lane or the B3037 Bishopstoke Road, known as the South Bishopstoke Bypass; • Junction improvements along the B3037 Bishopstoke Road corridor, including at the A335 Twyford Road/Romsey Road roundabout, the Chickenhall Lane roundabout, and the Riverside priority junction; • Improvements to the Wide Lane bridge over the railway, located to the south of Southampton Airport Parkway rail station (see "A335 and Wide Lane Improvements")

Name of scheme	Description
	• Junction and link improvements at various locations along the A3025 Hamble Lane, including at the Tesco access roundabout, the Jurd Way roundabout and the Portsmouth Road junction. • A new link road to the north of Botley between Woodhouse Lane and the A334 Station Hill/Mill Hill, including widening of Woodhouse Lane, known as the Botley Bypass. • A new link road between the A335 Wide Lane (adjacent to Southampton Airport Parkway rail station) and Chickenhall Lane, known as the Chickenhall Lane Link Road (see "Chickenhall Lane Link Road") For additional information: https://www.eastleigh.gov.uk/media/1713/eastleigh-strategic-transport-study-document.pdf
A335 and Wide Lane Improvements	Proposed improvements on this corridor including new bridge on Wide Lane over railway to resolve existing tight bend and pinch point.
Chickenhall Lane Link Road	Unfunded proposal; proposal to build a link road from Wide Lane (south of Eastleigh) across northern boundary of airport and across the Botley rail line to Chickenhall Lane (south west of Bishopstoke).
North Whiteley scheme including improvements to southern end of Whiteley Way	Committed scheme; continuation of Whiteley Way and Bluebell Way to the A3051 (separate junctions). Also improvements to R1a (signalisation), R1 (signalisation of roundabout), and R2 (additional entry lanes on Whiteley Way arms) to provide additional capacity.
Stubbington Bypass	Committed scheme; scheme to divert traffic around the outskirts of Stubbington and reduce journey time and peak hour congestion onto and off the Gosport peninsula, and remove transport barriers to growth and encourage investment and regeneration, including at the Solent Enterprise Zone at Daedalus. The Bypass proposals comprise: • Construction of a new single carriageway road between the B3354 Titchfield Road and Gosport Road, passing to the north and east of Stubbington • On-line widening of Titchfield Road between by Bypass and the A27 Improvements to the A27 Titchfield Gyratory and further improvements to the Peel Common Roundabout (Gosport Road arm) • Traffic management measures in Stubbington village For additional information: https://www.hants.gov.uk/transport/transportschemes/stubbingtonbypass
Portsmouth City Centre Roads Scheme	Proposed scheme; major reconfiguration of the road network north of Portsmouth city centre to improve traffic flows passing through city centre between southern end of M275 and Gunwharf/ areas south and west of city centre. For additional information: https://www.portsmouth.gov.uk/ext/development-and-planning/regeneration/city-centre-road
Portsmouth MOVA junction improvements	Implementation of MOVA traffic signal co-ordination/control system to improve efficiency of traffic movements.
New A27 junction between Havant and Emsworth	Proposed new all-moves grade separated junction to enable access to Havant Local Plan development allocation located between Havant and Emsworth.
A3(M) J2 signalisation	Proposed part signalisation of this junction.
A326 Ringwood Road signalisation	Proposed signalisation scheme at A326/ Ringwood Rd junction.
Fletchwood Road signalisation	Proposed signalisation scheme at A326/ Fletchwood Rd junction.

Name of scheme	Description
High Street access to Coppins Bridge removed	Proposed junction improvements in central Newport, Isle of Wight.
Signalisation of Honeycross / Medina Way junction	Proposed junction improvements in central Newport, Isle of Wight.
St Mary's Roundabout	Proposed junction improvements in central Newport, Isle of Wight.
River Way Junction	Proposed junction improvements in central Newport, Isle of Wight.
Public transport schemes	
Tipner Park and Ride	Proposed Park and Ride site located in Portsmouth.
Southampton Park and Ride sites	Proposed Park and Ride sites at Adanac M271, M27 J5 and M27 J8.
Southampton bus priority	Proposed scheme to reduce journey times on key corridors, including along the A3025, A3024, A33, A3057 and A326. For additional information, see Appendix A in the Technical Report produced by Systra.[33]
South Hampshire BRT including	Proposed bus rapid transit (BRT) network, including Fareham to Gosport, Fareham to QAH/Portsmouth/Southampton, Clanfield/Waterlooville to Portsmouth/Southsea, Havant to Portsmouth/Southsea, Fareham to Whiteley and Havant to Waterlooville. For additional information, see Appendix B in the Technical Report produced by Systra.[33]
Solent Metro (tram-train) services	Proposed tram-train routes, including Southampton-Eastleigh-Fareham (circular), Southampton to Portsmouth, and Southampton-Eastleigh-Romsey (circular). For additional information, see Appendix C in the Technical Report produced by Systra.[33]
New fast ferry service	Proposed fast ferry service, linking Fawley, Warsash, Hythe, Royal Pier and Marchwood.
Isle of Wight bus priority	Proposed scheme to reduce journey times between East Cowes, Newport and Ryde.
Island Line journey time improvements	Proposed improvements to the Island Line railway line on the Isle of Wight.

3.2.3 Factors which influence trip generation and road link speeds

Trip generation is determined at a zonal level and is a function of demographics and socio-economic characteristics. It is sensitive to changes in land use rather than changes in travel cost.[32] The SRTM accounts for 10 land use categories: residential, retail, office, industrial, warehousing, primary & secondary education, adult education, hotel & other accommodation, healthcare and leisure. A summary of land use by local authority area is provided in Table 3-4.[33] The values presented in Table 3-4 correspond to those used in the SRTM model runs which underpin the current study, and serve as an indication of projected housing growth in the PUSH sub-region. Household projections are updated periodically on the UK government website[34] and will show some variance to the values included here.

Cruise speeds between junctions in the core SRTM area were derived from GPS-based TrafficMaster data. Each modelled road link was allocated a link category, based on factors such as road type, number

[34] https://www.gov.uk/government/statistical-data-sets/live-tables-on-household-projections#based-live-tables

of lanes, speed limit, presence of buses, etc. For each link category, average speeds were calculated from all TrafficMaster data for that category. The averages were calculated such that links with high standard deviations for speeds received a lower weighting, and consequently had less influence on the average, than links with low standard deviations for average speed. In addition, major roads (dual and motorways) were coded with speed flow relationships which vary speeds on these links.

The average speeds on modelled road links, as determined by the SRTM, depend on the cruise speeds, the specified link capacity, and the occurrence of saturation conditions. Saturated conditions constrain traffic volumes at downstream locations, and queues with reduced journey speeds result at junctions which are over capacity.

Table 3-4 Total households 2014 and 2034

Local Authority	2014	2036	Increase
East Hampshire*	8,476	10,321	1,845
Eastleigh	50,188	65,239	15,051
Fareham	46,746	56,564	9,818
Gosport	34,506	37,500	2,994
Havant	49,638	57,768	8,130
New Forest*	28,506	33,155	4,649
Test Valley*	17,131	21,307	4,177
Winchester*	16,039	24,774	8,736
Portsmouth	88,651	102,541	13,890
Southampton	100,783	118,767	17,984
Isle of Wight	62,613	76,609	13,996
Total*	503,275	604,546	101,271

* The SRTM model updates account for land use growth only in the core areas of the model

3.2.4 Adaptation of transport model outputs for use in air dispersion modelling

Systra provided traffic activity data for the four modelled scenarios (2014 Reference, 2034 Baseline, 2034 Do Minimum and 2034 Do Something). The modelled road network used for all four scenarios was represented by approximately 10,000 road links spanning the PUSH region, saved in a shapefile format and viewable using geographic information system (GIS) software.

For the purposes of transport modelling, including applications such as identifying areas with traffic delays and capacity problems, the modelled road links do not need to exactly match the physical location of the roads. Some of the road links in the Systra shapefile were geographically accurate and matched the physical road layout, while other road links were represented as simple straight lines between two points. For the purposes of air dispersion modelling, however, it is important that the modelled road links are spatially accurate in order to accurately predict pollution concentrations over a geographic area; otherwise the modelled location of pollution hotspots will not be accurate. Therefore, the first step in adapting the transport model for use in air dispersion modelling was to manually “snap” the road links from the Systra shapefile to spatially accurate road centreline locations based on the Ordnance Survey ITN Roads GIS dataset.

Figure 3-3 provides an example of the GIS file output before and after manual snapping for an area in the Eastleigh Borough. After snapping, the spatial accuracy of several roads has been improved, including sections of the M27 motorway and road segments passing in close proximity to an Air Quality

Management Area (AQMA). This figure also includes the entire road network, shown in grey, which emphasizes that the SRTM transport model only accounts for traffic flows on roads that are busy and/or considered important from a transportation perspective. As such, while the SRTM model includes many motorways, A-Roads, B-Roads and a substantial number of minor roads, and will therefore capture the main road emission sources, not every road affecting an AQMA or a designated site is included.

Figure 3-3 Example of SRTM network GIS file before and after manual snapping

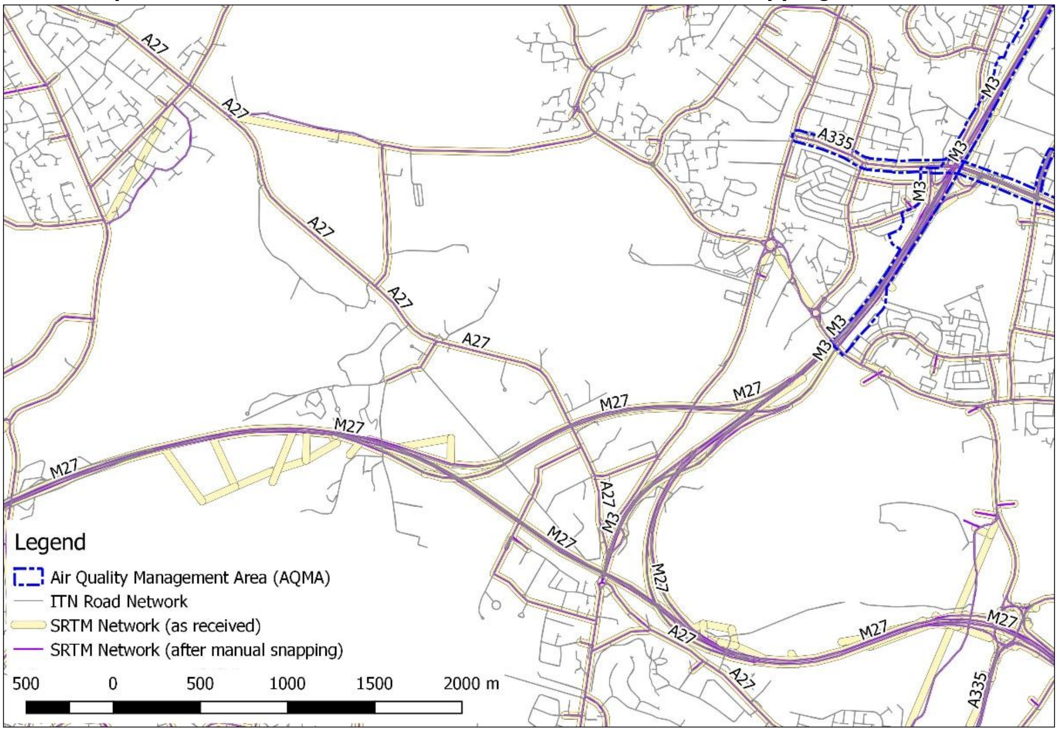


Figure 3-4 through to Figure 3-7 combine the spatially corrected (after 'snapping') shapefile with annual average daily traffic (AADT) flows from the SRTM models to provide a high-level overview of traffic activity in the four scenarios. These figures show total AADT for all modelled vehicle types on all modelled road links, and demonstrate that a significant increase in traffic is predicted in the PUSH study area from 2014 to 2034. The maximum AADT travelling in one direction on any road link is approximately 74,000 in the 2014 Reference Case; 102,000 in the 2034 Baseline Scenario; 107,000 in the 2034 Do Minimum Scenario; and 103,000 in the 2034 Do Something Scenario.

Figure 3-4 Total annual average daily traffic (AADT) flow for 2014 Reference Case

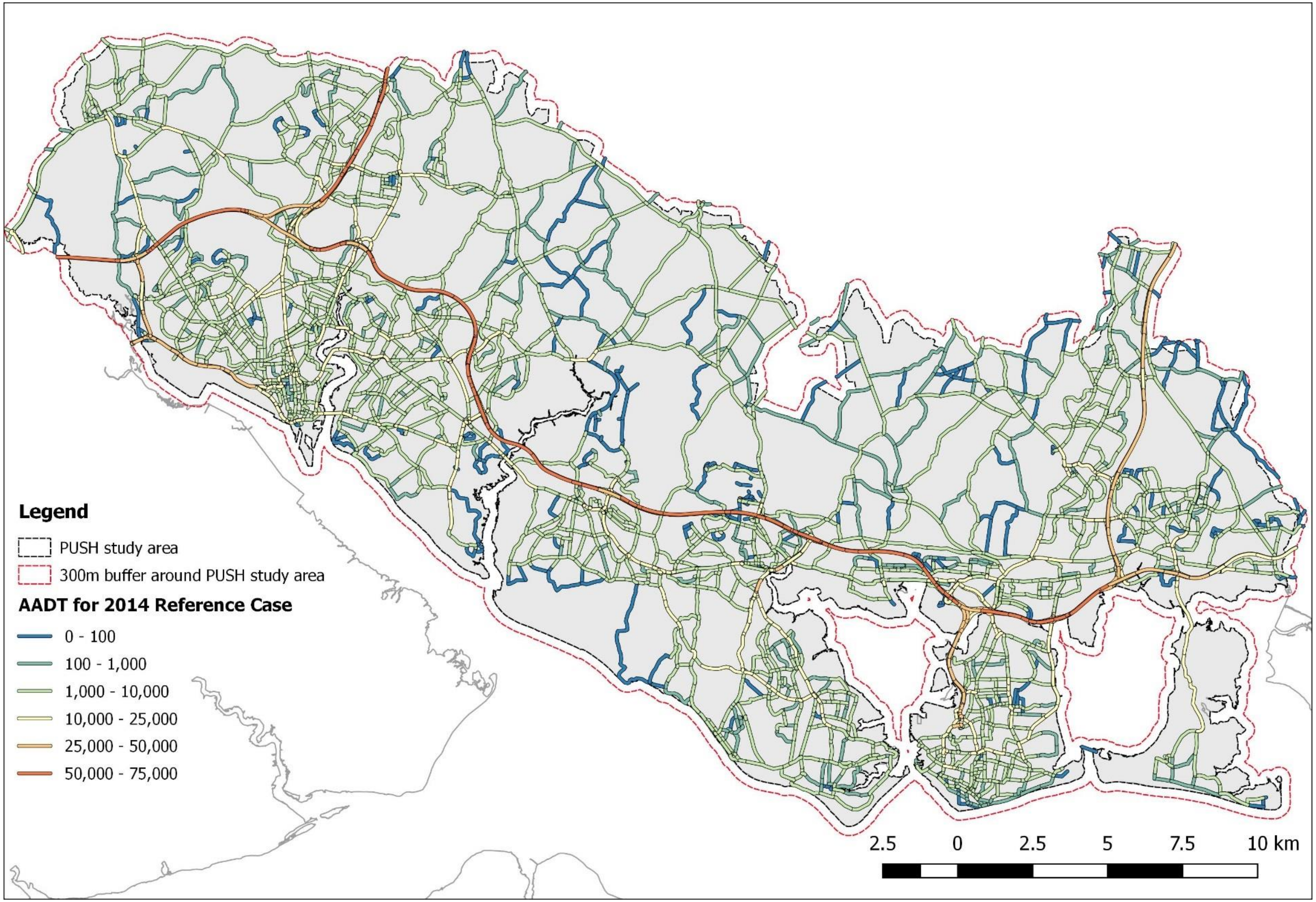


Figure 3-5 Total annual average daily traffic (AADT) flow for 2034 Baseline Scenario

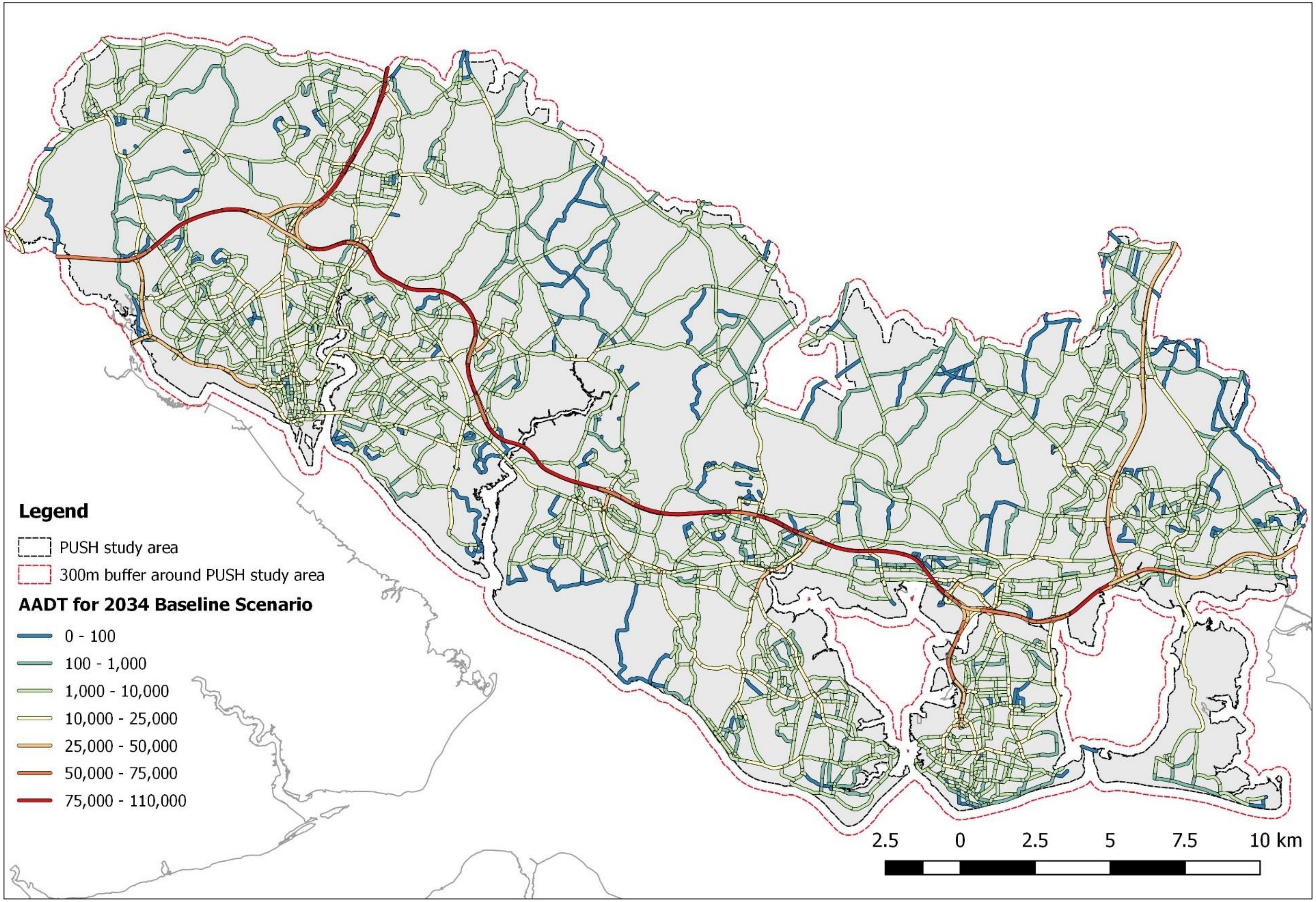


Figure 3-6 Total annual average daily traffic (AADT) flow for 2034 Do Minimum Scenario

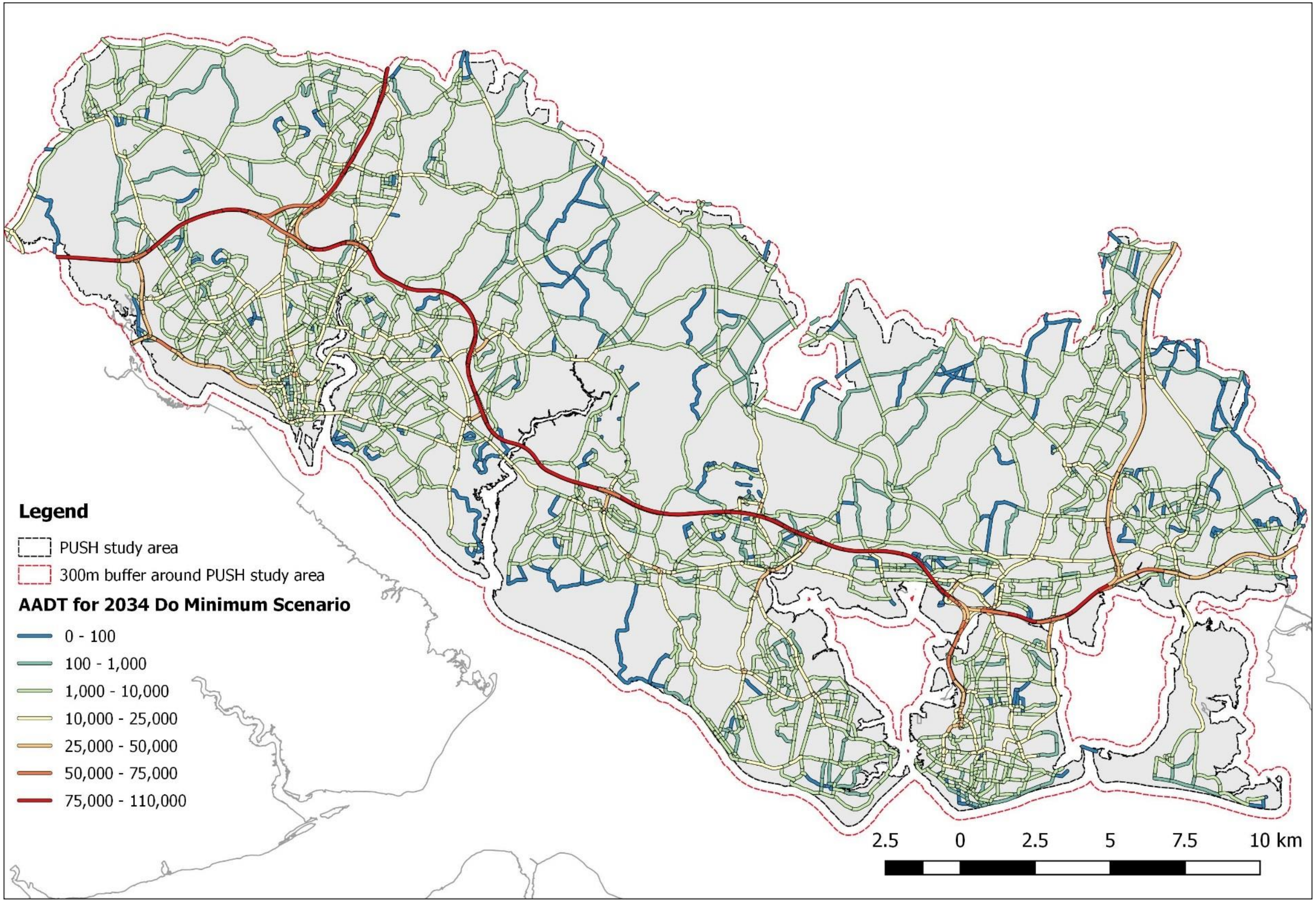
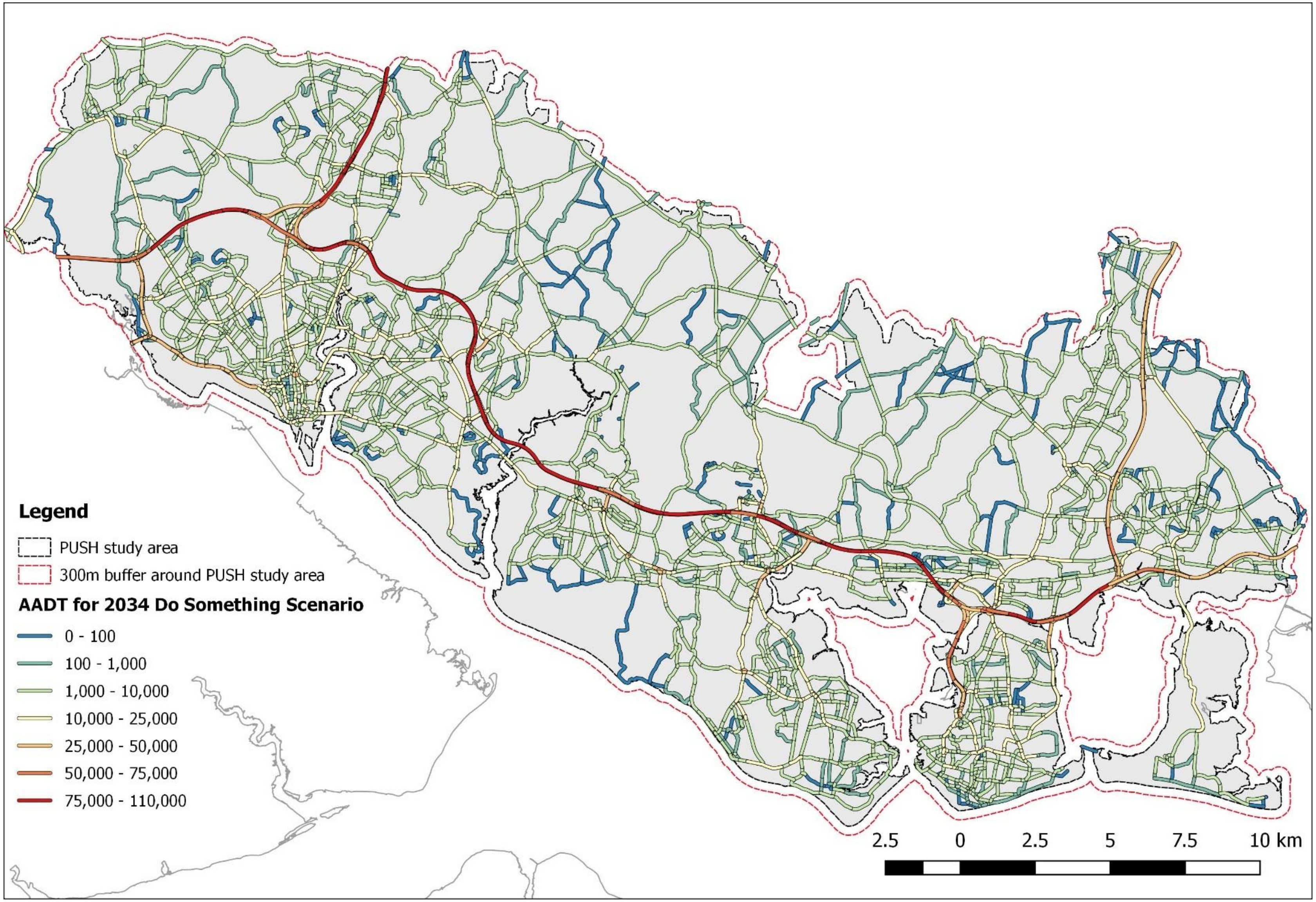


Figure 3-7 Total annual average daily traffic (AADT) flow for 2034 Do Something Scenario



3.3 Compilation of local air quality modelling data

Recent local air quality modelling studies are a potentially useful source of information in order to understand existing conditions within the PUSH study area. Table 3-5 summarizes the publicly available information relating to air quality modelling within the PUSH sub-region.[35]

Table 3-5 Summary of local air quality modelling data

Local authority	Total Number of monitors in 2014
East Hampshire	No modelled data available
Eastleigh	No modelled data available
Fareham	Detailed Assessment of the air quality in an area between two existing AQMAs included as an Appendix in the 2016 Annual Status Report (ASR).[36]
Gosport	No modelled data available
Havant	No modelled data available
Portsmouth	Source apportionment study publised based on 2015 data, and summarised in the 2016 (ASR).[37]
Southampton	Developing a Clean Air Zone (CAZ) feasibility study, however no data published as of yet
Test Valley	No modelled data available
Winchester	No recent modelled data available
Isle of Wight	No modelled data available
New Forest	Part of Southampton CAZ study, however no data published as of yet

Fareham's 2016 ASR includes a Detailed Assessment carried out by Bureau Veritas using an ADMS dispersion model. The model results suggested that the NO_2 annual mean air quality objective was exceeded at a total of 26 receptor locations, 19 of which were located outside of the existing AQMAs. Based on the model results, the Detailed Assessment suggested an extension of the boundaries of the existing AQMAs. The model results are shown in Figure 3-8.

Portsmouth's 2016 ASR summarised the results of a source apportionment study carried out by the consultancy AECOM and covering NO_2, PM_{10} and $PM_{2.5}$. The study was based on 2015 monitoring data and used the AAQuIRE detailed dispersion model. The study predicted that NO_2 concentrations exceeding the Air Quality Objectives at sensitive receptors were confined to locations within existing AQMAs. It was estimated that all areas of Portsmouth would achieve compliance with the annual NO_2 air quality objective by 2022. The modelling also indicated that the air quality objectives for PM_{10} and $PM_{2.5}$ have been achieved in Portsmouth and exceedances are unlikely to occur anywhere within the city.

Southampton is one of the five cities in the United Kingdom which has been directed to consider the implementation of a Clean Air Zone (CAZ), and a CAZ feasibility study encompassing Southampton and New Forest is currently under development.

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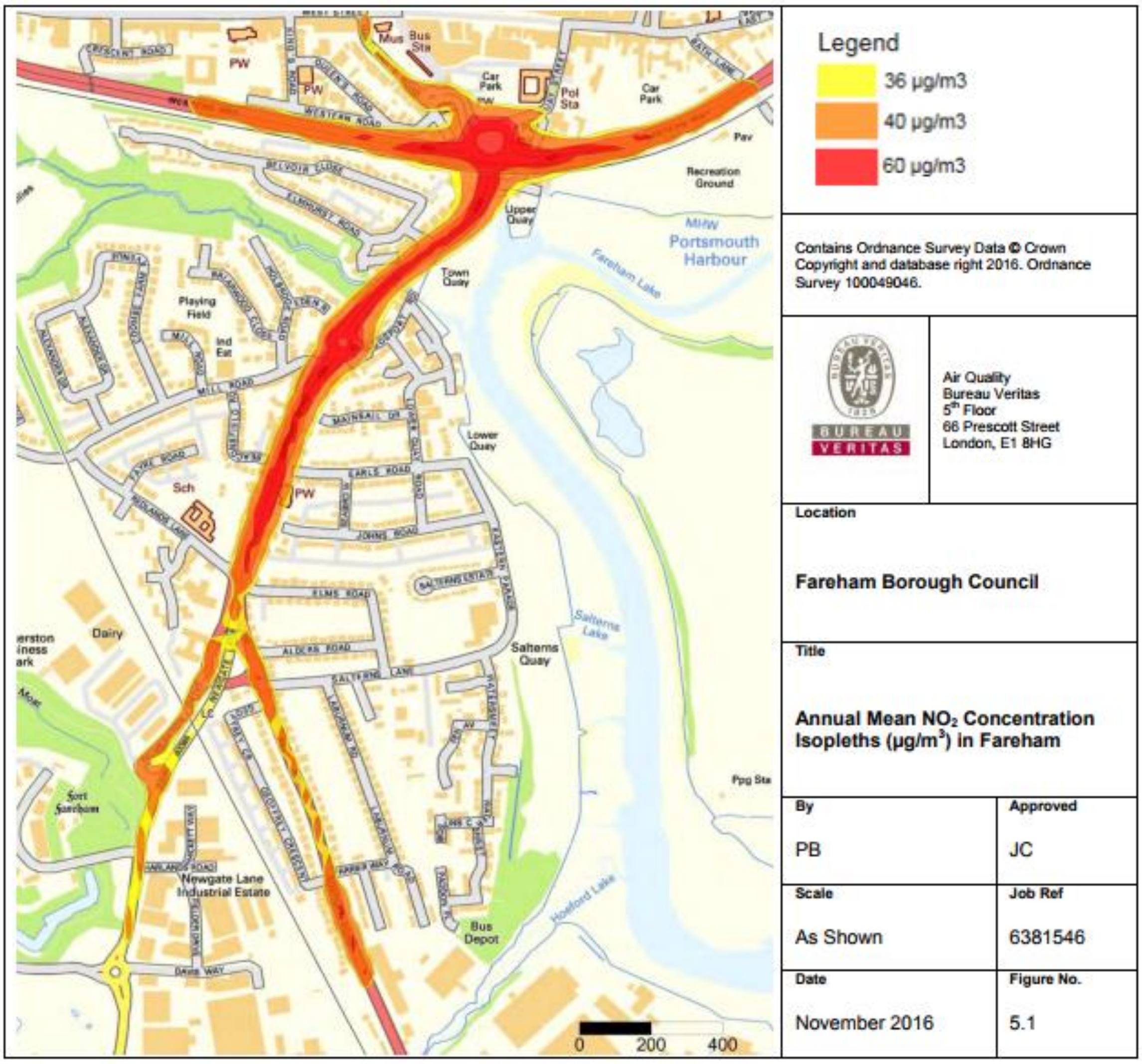
[35] Council websites were accessed 29/01/2018

[36] Fareham and Gosport Environmental Health Partnership, "Annual Status Report 2016", January 2017, http://www.fareham.gov.uk/PDF/licencing_and_inspections/HCU-170130_FarehamAndGosport16.pdf, accessed 29/01/2018.

[37] Portsmouth City Council, "2016 Air Quality Annual Status Report (ASR)", September 2017, https://www.portsmouth.gov.uk/ext/documents-external/env-air-quality-2016-annual-status-report.pdf, accessed 29/01/2018.

Figure 3-8 Annual mean NO_2 concentration isopleths ($\mu g/m^3$) in Fareham as determined by a Detailed Assessment



4 Assessment of air quality related to human health

This section describes the impact of the PUSH development scenarios on air quality related to human health within existing AQMAs and within each Local Authority.

4.1 Overview of air quality standards for human health

Table 4-1 summarises the air quality objectives relevant in this study. For Local Air Quality Management purposes, and for the assessment of air quality against the annual objective concentrations, personal exposure is also important. Therefore, predicted concentrations greater than the values listed in Table 4-1 at a given location do not necessarily indicate an exceedance of the Air Quality Objective. Rather, the predicted concentrations should be considered in the context of personal exposure, with consideration given to the types of locations where the Air Quality Objectives should apply (Table 4-2).

Table 4-1 Air Quality Objectives in England

Pollutant	Air Quality Objective	Measured as
Nitrogen dioxide	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Particulate Matter ($PM_{2.5}$); to be achieved by 2020 and maintained thereafter	25 µg/m^3	Annual mean

Table 4-2 Examples of where the Air Quality Objectives should apply[38]

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

[38] Department for Environment Food and Rural Affairs, "Local Air Quality Management: Technical Guidance (TG16)", April 2016.

There are no current legal requirements for the $PM_{2.5}$ air quality objective, however local authorities are expected to make efforts to reduce emissions and/or concentrations of the pollutant through the application of measures, as described in their Annual Status Report.

4.2 Identification of Air Quality Management Areas (AQMAs) within the PUSH sub-region

Each local authority in England has a responsibility under the Environment Act 1995 to assess and monitor, as required, nitrogen dioxide concentrations within its council area. If nitrogen dioxide (NO_2) concentrations either exceed the annual objective concentration of 40 µg/m^3 or there are more than 18 exceedances of the 1-hour objective of 200 µg/m^3 in a year, the local authority is required to declare an Air Quality Management Area (AQMA) and develop an Air Quality Action Plan to prevent further exceedances. Similarly, local authorities are also required to declare an AQMA and develop an Air Quality Action Plan if particulate matter (PM_{10}) concentrations exceed the objectives set out in Table 4-1.

As of January 2018, a total of 21 AQMAs have been declared in the PUSH area. These are listed in Table 4-3 and displayed in Figure 4-1. All were declared on the basis of exceedance of the annual mean objective for nitrogen dioxide. The AQMAs are located within four local authority boundaries: Eastleigh Borough Council (4), Fareham Borough Council (2), Portsmouth City Council (5) and Southampton City Council (10).

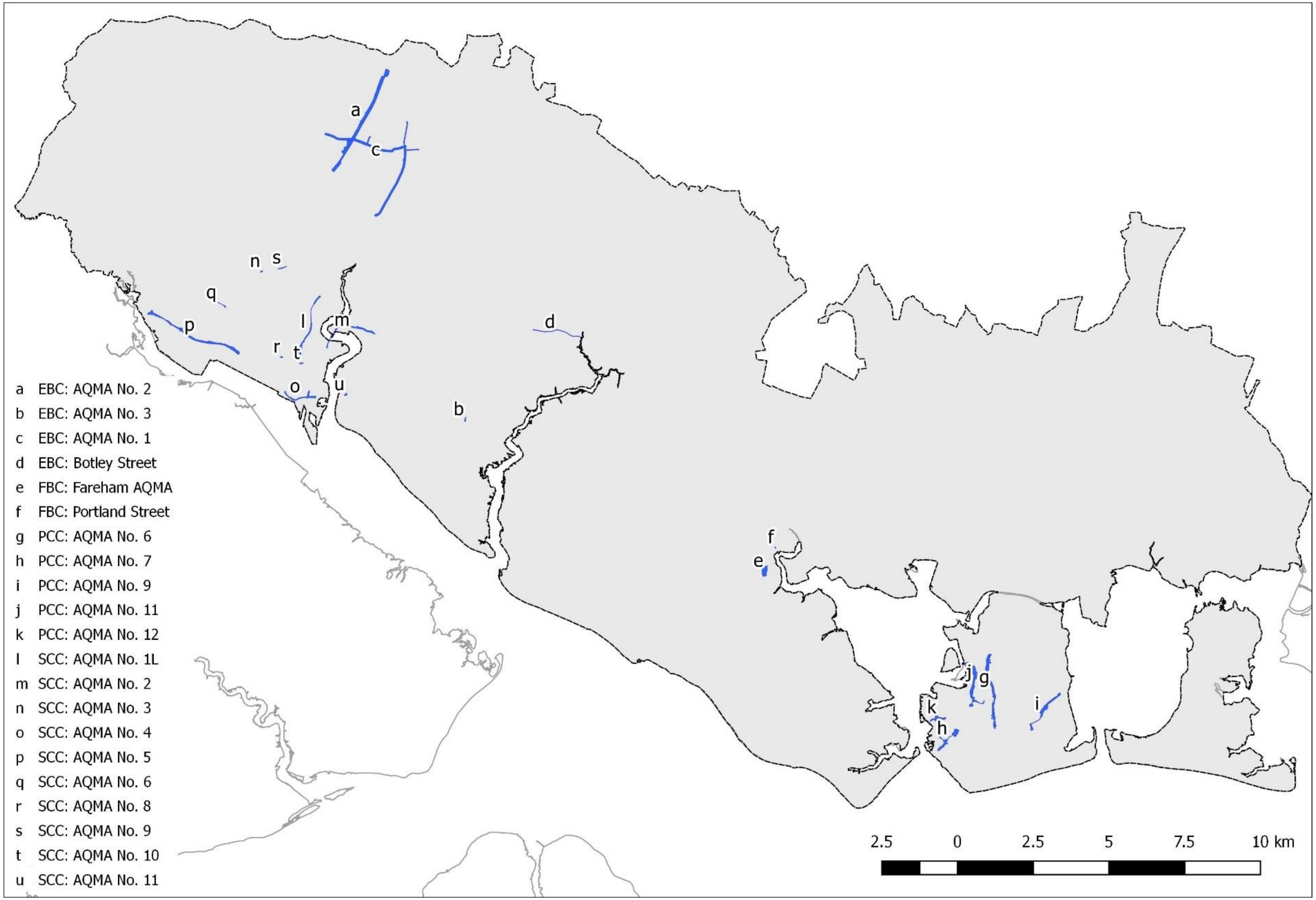
Table 4-3 Location of Air Quality Management Areas with the PUSH region (as of January 2018)

Local Authority	AQMA ref	Title	Description	Area, Hectares
Eastleigh Borough Council (EBC)	453	Eastleigh AQMA No.2 (M3)	An area extending either side of the M3 motorway between junctions 12 to 14.	39.5
	454	Eastleigh AQMA No.3	An area encompassing a number of properties along Hamble Lane, Bursledon between the junctions with Jurd Way and Portsmouth Road.	0.5
	1660	Eastleigh AQMA No.1 (A335)	A corridor of land 30m either side of the road from the Wide Lane roundabout at Southampton Airport Parkway Station northwards up Wide Lane, Southampton Road and Station Hill (A335) to the Station Hill, Romsey Road, Twyford Road, Coles Close and Bishopstoke Road roundabout and then west along Romsey Road and Leigh Road (A335) under the M3 to the junction of Leigh Road and Bournemouth Road (B3043).	41.9
	TBC	Eastleigh High Street Botley	The designated area incorporates the A334 from the Borough boundary east of the junction with the B3354, Winchester Street, to its junction with Woodhouse Lane incorporating Broad Oak and a 5m corridor either side of it	2.7
Fareham Borough Council (FBC)	438	Fareham AQMA (Gosport Road AQMA)	An area encompassing the junction of Gosport Road, Redlands Lane and Newgate Lane, and the surrounding area.	4.7

Local Authority	AQMA ref	Title	Description	Area, Hectares
	523	Portland Street AQMA	An area encompassing residential properties and the Sacred Heart Catholic Church on Portland Street.	0.2
Portsmouth City Council (PCC)	334	Portsmouth AQMA No.6	An area incorporating a section of road stretching from Fratton Road to London Road.	18.1
	335	Portsmouth AQMA No.7	An area incorporating a network of roads in central Portsmouth including High Street, St Georges Road, Cambridge Road, St Michael Road, King Richard Road, Montgomery Way, and Hampshire Terrace.	7.4
	337	Portsmouth AQMA No.9	An area incorporating a section of road stretching from Milton Road to Eastern Road, Milton.	9.4
	339	Portsmouth AQMA No.11	An area incorporating a network of roads stretching from Marketway to Lake Road to the M275.	16.0
	340	Portsmouth AQMA No.12	An area incorporating a section of road stretching from The Hard to Queen Street, Portsea.	4.4
Southampton City Council (SCC)	368	AQMA No.1 (Bevois Valley)	An area along Onslow road from Bevois Hill down to (and encompassing) the Charlotte Place Roundabout.	8.5
	369	AQMA No.2 (Bitterne Road West)	An area along Bitterne Road West from the junction with Hawkeswood Road/Quayside Road to the junction with Maybray King Way and Little Lance`s Hill.	7.9
	370	AQMA No.3 (Winchester Road)	An area along Winchester Road, from the roundabout where Winchester Road, Hill Lane and Burgess Road meet, extending along Winchester Road and ceasing before the junction with Ashwood Gardens.	0.3
	371	AQMA No.4 (Town Quay)	An area along the A33 Town Quay between West Quay Road Roundabout and Terminus Terrace/entrance to Ocean Village in Canute Road, along Platform Road	5.6
	372	AQMA No.5 (Redbridge Road & Millbrook Road)	An area encompassing the Redbridge Road Flyover and Roundabout and sections of the approaching roads.	19.6
	373	AQMA No.6 (Romsey Road)	An area encompassing part of Romsey Road and its junction with Winchester Road/Teboura Way.	1.2
	555	AQMA No.8 (Commercial Road)	An area encompassing properties and land along Commercial Road, from the junction with Havelock Road extending West along Commercial Road to the junction with Water Lane.	0.3

Local Authority	AQMA ref	Title	Description	Area, Hectares
	7302	AQMA No. 9 (Burgess Road)	Burgess Road	0.6
	7303	AQMA No. 10 (New Road)	New Road	0.5
	7304	AQMA No. 11 (Victoria Road)	Victoria Road	0.5

Figure 4-1 Location of Air Quality Management Areas with the PUSH area



4.3 Model results within Air Quality Management Areas (AQMAs)

4.3.1 NO_2 model results at AQMAs

Table 4-4 provides the results of the modelled nitrogen dioxide (NO_2) concentrations at the existing AQMAs within each Local Authority.

The modelled concentrations for the 2014 Reference Year were predicted to exceed the long-term objectives for NO_2 (of 40 µg/m^3) within parts of all AQMAs, with the exception of the Fareham Borough Council Portland Street AQMA and the Portsmouth City Council AQMA No. 12. These results demonstrate the uncertainty inherent in transport and air dispersion modelling, particularly in areas where there are street canyon effects, as there were measured exceedances within the Portland Street AQMA in 2014. The term street canyon refers to a relatively narrow street where the road is flanked by buildings on both sides. Relatively high pollution levels may be observed in urban street canyons owing to the increased traffic emissions and reduced natural ventilation.

For all three 2034 scenarios, the minimum and average modelled NO_2 concentrations were forecast to be below 40 µg/m^3 at all AQMAs. The maximum NO_2 concentrations were forecast to be below the long-term objective under the 2034 Baseline and the 2034 Do Something scenarios at all AQMAs with the exception of the following four AQMAs:

- No. 2 (M3) and No.1 (A335), Eastleigh Borough Council
- No.11, Portsmouth City Council
- No. 4 (Town Quay), Southampton City Council

In addition to the four AQMAs listed above, the model results also predict concentrations above the long-term objective under the 2034 Do Minimum scenario at the following three AQMAs:

- No. 8 (Commercial Road), No. 1 (Bevois Valley), and No. 5 (Redbridge Road & Millbrook Road), Southampton City Council

The largest exceedance of the NO_2 objective predicted for any of the 2034 scenarios occurs in Southampton AQMA No. 4 (Town Quay) in the 2034 Do Minimum scenario. In all three future scenarios, the NO_2 exceedances occur adjacent to busy roads, and do not necessarily reflect concentrations at points of exposure. Model results for all three future scenarios at potential exposure locations complied with the nitrogen dioxide objective. For NO_2, the modelled concentrations in the future 2034 scenarios are consistently lower than the modelled concentrations in the 2014 Reference Year scenario, indicating that NO_2 levels are generally predicted to improve between 2014 and 2034.

4.3.2 PM_{10} model results at AQMAs

Table 4-5 provides the results of the modelled particulate matter (PM_{10}) concentrations at the existing AQMAs within each Local Authority.

The minimum and average modelled concentrations were forecast to be below the long-term objective for PM_{10} at all AQMAs and for all modelled scenarios. The maximum PM_{10} concentrations were forecast to be below the long-term objective under all four modelled scenarios at all AQMAs with the exception of the following four AQMAs:

- No. 2 (M3) & No.1 (A335), Eastleigh Borough Council
- No.11, Portsmouth City Council
- No.5 (Redbridge Road & Millbrook Road), Southampton City Council

For all three of the 2034 scenarios, the largest exceedances of the PM_{10} objective are forecast to occur within Eastleigh AQMAs No. 2 and No. 1. Unlike the NO_2 model results, which predict a general improvement in NO_2 levels between the 2014 Reference Year and 2034 future scenarios, the PM_{10} model results predict PM_{10} levels will increase at some locations by 2034. This can be mitigated to some extent by the transport measures included in the 2034 Do Something scenario. The Do Something scenario, compared against the Do Minimum scenario, significantly reduces the maximum modelled PM_{10} concentrations at the four AQMAs listed above - with a decrease of up to 10.5 µg/m^3 at Eastleigh AQMAs No. 2 and No. 1; a decrease of up to 11.6 µg/m^3 at Portsmouth AQMA No. 11; and a decrease of up to 5.2 µg/m^3 at Southampton AQMA No. 5. Further measures for the mitigation of emissions of particulate matter are considered in Section 0.

Model results for all three future scenarios at potential exposure locations complied with the PM_{10} objective.

4.3.3 $PM_{2.5}$ model results at AQMAs

Table 4-6 provides the results of the modelled particulate matter ($PM_{2.5}$) concentrations at the existing AQMAs within each Local Authority.

The minimum and average modelled concentrations were forecast to be below the long-term objective for $PM_{2.5}$ at all AQMAs, with the exception of the average value under the 2014 Baseline at No.2 (M3) AQMA, Eastleigh Borough Council. The maximum modelled $PM_{2.5}$ concentrations were forecast to be below the long-term objective under the three 2034 scenarios at all AQMAs with the exception of the following four AQMAs:

- No. 2 (M3) & No.1 (A335), Eastleigh Borough Council
- No.11, Portsmouth City Council
- No.5 (Redbridge Road & Millbrook Road), Southampton City Council

As was the case for PM_{10}, the largest exceedances of the $PM_{2.5}$ objective for all of the 2034 scenarios are forecast to occur within Eastleigh AQMAs No. 2 and No. 1. For $PM_{2.5}$, the modelled concentrations in the future 2034 scenarios are consistently lower than the modelled concentrations in the 2014 Reference Year scenario, indicating that $PM_{2.5}$ levels are generally predicted to improve between 2014 and 2034.

Model results for all three future scenarios at potential exposure locations complied with the $PM_{2.5}$ objective.

Table 4-4 Modelled NO_2 concentrations (road contribution + background concentration, µg/m³) at all AQMAs within the PUSH study area*

Local Authority	AQMA	2014 Reference Year			2034 Baseline			2034 Do Minimum			2034 Do Something		
		Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Eastleigh Borough Council	No.2 (M3)	26.1	64.0	47.2	13.4	46.8	23.4	13.7	50.4	24.3	13.4	47.8	23.4
	No.3	22.8	44.8	32.3	14.1	22.1	17.4	14.5	24.1	18.4	14.2	23.0	17.7
	No.1 (A335)	15.1	64.0	27.5	9.9	46.8	14.2	9.9	50.4	14.7	9.9	47.8	13.4
	High Street Botley	18.4	41.6	28.2	11.3	17.6	13.6	11.6	19.5	14.0	10.2	19.0	11.3
Fareham Borough Council	Fareham AQMA (Gosport Road AQMA)	21.5	56.3	34.9	13.1	26.5	17.4	13.5	30.7	18.6	13.1	26.8	17.5
	Portland Street AQMA	23.4	30.2	25.4	13.2	15.0	13.7	13.8	15.9	14.4	13.4	15.4	14.0
Portsmouth City Council	No.6	22.7	53.2	28.4	15.8	28.2	17.5	16.0	39.8	18.2	15.8	27.8	17.7
	No.7	24.5	51.1	32.6	18.8	26.9	21.3	19.2	29.0	21.9	19.2	28.7	21.7
	No.9	18.2	52.3	27.7	11.9	24.2	15.2	12.0	28.1	15.9	12.0	25.7	15.6
	No.11	25.1	63.8	44.8	17.0	45.0	25.0	17.2	48.8	26.1	16.7	41.2	24.5
	No.12	24.0	38.9	27.4	20.0	22.5	20.8	20.2	22.7	20.9	20.0	22.4	20.8
Southampton City Council	No.4 (Town Quay)	37.6	62.0	47.3	30.4	45.8	34.2	30.7	50.7	35.1	30.6	44.9	34.4
	No.8 (Commercial Road)	38.6	56.6	43.3	28.6	35.9	30.4	29.7	40.1	32.2	28.9	37.1	30.9
	No.3 (Winchester Road)	32.3	56.1	41.8	16.6	25.5	19.9	17.3	27.7	21.0	16.7	25.9	20.0
	No. 9 (Burgess Road)	29.2	51.4	36.4	15.3	22.8	17.4	16.3	25.7	19.0	15.6	23.6	17.9
	No.5 (Redbridge Road & Millbrook Road)	27.2	63.5	47.8	16.2	38.9	27.6	16.6	40.4	29.1	16.4	39.6	28.2
	No. 10 (New Road)	36.8	41.7	38.8	27.8	28.7	28.2	28.4	29.5	28.8	28.0	29.0	28.4
	No. 11 (Victoria Road)	35.4	40.8	37.3	28.7	30.8	29.4	28.8	31.1	29.6	28.8	31.0	29.6
	No.1 (Bevois Valley)	25.0	63.7	38.0	16.2	39.4	25.0	16.4	42.7	25.5	16.3	40.0	25.0
	No.6 (Romsey Road)	28.4	48.4	35.1	16.6	22.5	18.4	17.1	24.5	19.2	17.0	23.8	19.0
	No.2 (Bitterne Road West)	26.9	59.0	39.5	16.8	30.5	22.1	17.3	33.2	23.2	16.9	30.9	22.4

* Modelled concentration values equal to or greater than the annual air quality objective (40 µg/m³) are highlighted in yellow

Table 4-5 Modelled PM_{10} concentrations (road contribution + background concentration, µg/m³) at all AQMAs within the PUSH study area*

Local Authority	AQMA	2014 Reference Year			2034 Baseline			2034 Do Minimum			2034 Do Something		
		Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Eastleigh Borough Council	No.2 (M3)	21.7	65.9	33.5	20.4	67.4	32.2	21.5	78.5	36.2	20.4	68.0	32.3
	No.3	19.1	30.3	23.4	17.6	27.2	21.4	18.0	29.2	22.4	17.7	27.5	21.6
	No.1 (A335)	17.1	65.9	21.7	15.4	67.4	19.7	15.6	78.5	20.4	14.2	68.0	18.5
	High Street Botley	17.3	28.8	21.6	15.8	25.0	18.9	16.2	28.6	19.6	10.2	19.0	11.3
Fareham Borough Council	Fareham AQMA (Gosport Road AQMA)	18.2	35.7	24.0	16.9	32.8	22.1	17.2	35.8	23.4	16.9	33.0	22.2
	Portland Street AQMA	19.1	21.8	19.9	17.8	20.0	18.5	18.6	21.0	19.3	18.0	20.1	18.6
Portsmouth City Council	No.6	17.9	28.9	20.0	16.6	25.5	18.4	16.9	28.3	19.1	16.7	26.6	18.7
	No.7	15.6	30.0	19.9	14.3	27.4	18.2	14.4	30.2	19.0	14.4	29.2	18.7
	No.9	16.8	31.2	20.9	15.5	27.5	19.2	15.8	29.5	19.9	15.7	29.1	19.7
	No.11	18.6	49.5	28.1	17.1	45.4	25.3	17.5	51.7	27.6	16.9	40.1	24.9
	No.12	16.6	22.5	17.6	15.3	20.3	16.1	15.3	20.9	16.2	15.3	20.2	16.1
Southampton City Council	No.4 (Town Quay)	20.1	39.0	25.1	18.3	31.5	21.6	18.6	35.1	22.5	18.7	33.3	22.5
	No.8 (Commercial Road)	20.7	29.8	22.6	18.9	26.6	20.5	19.5	29.1	21.6	19.1	27.4	20.8
	No.3 (Winchester Road)	22.8	38.0	28.4	20.7	33.6	25.5	21.6	37.0	27.1	20.8	34.2	25.7
	No. 9 (Burgess Road)	20.7	31.1	23.9	18.8	27.4	21.5	19.8	30.2	23.1	19.0	28.1	21.9
	No.5 (Redbridge Road & Millbrook Road)	19.8	43.2	29.7	18.4	41.6	27.9	19.4	48.6	31.1	18.7	43.4	28.7
	No. 10 (New Road)	20.1	21.5	20.6	18.5	19.7	18.9	19.0	20.6	19.6	18.6	20.0	19.1
	No. 11 (Victoria Road)	19.4	22.0	20.4	17.8	20.0	18.6	18.0	20.5	19.0	18.0	20.4	18.9
	No.1 (Bevois Valley)	18.1	39.2	22.7	16.5	35.4	20.7	16.7	39.5	21.5	16.6	36.3	20.8
	No.6 (Romsey Road)	18.7	28.8	21.6	16.9	25.2	19.2	17.2	27.4	20.0	17.2	26.7	19.8
	No.2 (Bitterne Road West)	19.0	34.8	25.0	17.7	32.0	23.5	18.5	37.0	25.9	18.0	33.7	24.1

* Modelled concentration values equal to or greater than the annual air quality objective (40 µg/m³) are highlighted in yellow

Table 4-6 Modelled $PM_{2.5}$ concentrations (road contribution + background concentration, µg/m³) at all AQMAs within the PUSH study area*

Local Authority	AQMA	2014 Reference Year			2034 Baseline			2034 Do Minimum			2034 Do Something		
		Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Eastleigh Borough Council	No.2 (M3)	16.1	53.7	26.9	13.8	43.8	21.5	14.1	46.4	22.7	13.8	44.2	21.5
	No.3	14.1	23.9	17.9	12.1	18.5	14.6	12.1	18.5	14.6	12.1	18.7	14.7
	No.1 (A335)	12.2	53.7	16.4	10.7	43.8	13.4	10.7	46.4	13.5	9.9	44.2	12.7
	High Street Botley	12.7	22.5	16.3	17.2	11.0	13.1	11.1	18.5	13.2	9.97	18.6	10.9
Fareham Borough Council	Fareham AQMA (Gosport Road AQMA)	13.3	28.8	18.4	11.6	22.5	15.2	11.7	22.9	15.4	11.6	22.6	15.3
	Portland Street AQMA	14.1	16.5	14.8	12.3	13.8	12.8	12.6	14.1	13.0	12.4	13.9	12.8
Portsmouth City Council	No.6	12.8	22.5	14.7	11.3	17.1	12.6	11.4	17.8	12.8	11.4	17.6	12.8
	No.7	11.2	23.5	14.8	9.9	18.5	12.4	9.9	19.2	12.6	9.9	19.7	12.7
	No.9	12.2	25.0	15.7	10.7	18.9	13.1	10.8	19.0	13.2	10.8	19.9	13.4
	No.11	13.6	39.8	22.0	11.7	29.8	17.0	11.8	31.2	17.6	11.6	26.6	16.7
	No.12	11.8	16.2	12.5	10.5	13.5	10.9	10.5	13.6	11.0	10.5	13.4	10.9
Southampton City Council	No.4 (Town Quay)	15.0	31.4	19.4	12.9	21.5	15.0	13.0	22.5	15.2	13.1	22.6	15.6
	No.8 (Commercial Road)	15.6	23.9	17.4	13.2	18.4	14.3	13.3	18.9	14.5	13.3	18.9	14.5
	No.3 (Winchester Road)	17.5	30.8	22.4	14.2	22.6	17.3	14.3	23.3	17.5	14.2	23.0	17.4
	No. 9 (Burgess Road)	15.7	24.9	18.5	13.0	18.7	14.8	13.3	19.3	15.2	13.2	19.1	15.0
	No.5 (Redbridge Road & Millbrook Road)	15.0	35.3	23.5	12.7	27.4	18.8	12.9	29.9	19.8	12.8	28.5	19.3
	No. 10 (New Road)	14.9	16.1	15.4	12.9	13.6	13.2	13.0	13.9	13.4	13.0	13.8	13.3
	No. 11 (Victoria Road)	14.6	16.9	15.5	12.6	14.0	13.1	12.6	14.0	13.1	12.7	14.2	13.3
	No.1 (Bevois Valley)	13.2	32.1	17.2	11.5	24.2	14.3	11.5	24.9	14.3	11.5	24.8	14.4
	No.6 (Romsey Road)	13.9	22.7	16.4	11.7	17.0	13.2	11.8	17.4	13.2	11.9	18.0	13.5
	No.2 (Bitterne Road West)	13.9	27.5	18.9	12.3	21.8	16.1	12.6	23.4	17.0	12.4	22.6	16.4

* Modelled concentration values equal to or greater than the annual air quality objective (25 µg/m³) are highlighted in yellow

4.4 Results summary by Local Authority

Mapped results for this section are in Appendix 2.

4.4.1 East Hampshire District Council

Table 4-7 NO_2 model results in East Hampshire District Council

Model Scenario	NO_2 model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m^3 along the A3, however the annual mean concentration is predicted to be below 40 µg/m^3 in all areas within the PUSH study area where the air quality objectives apply.
2034 Baseline	Annual mean concentration below 40 µg/m^3 throughout the portion of East Hampshire that lies within the PUSH study area.
2034 Do Minimum	
2034 Do Something	

Table 4-8 PM_{10} model results in East Hampshire District Council

Model Scenario	PM_{10} model results
2014 Reference Year	Annual mean concentration below 40 µg/m^3 throughout the portion of East Hampshire that lies within the PUSH study area.
2034 Baseline	
2034 Do Minimum	
2034 Do Something	

Table 4-9 $PM_{2.5}$ model results in East Hampshire District Council

Model Scenario	$PM_{2.5}$ model results
2014 Reference Year	Annual mean concentration exceeds 25 µg/m^3 along the A3, however the annual mean concentration is predicted to be below 25 µg/m^3 in all areas where the air quality objectives apply.
2034 Baseline	Annual mean concentration below 25 µg/m^3 throughout the portion of East Hampshire that lies within the PUSH study area.
2034 Do Minimum	
2034 Do Something	

4.4.2 Eastleigh Borough Council

Table 4-10 NO_2 model results in Eastleigh Borough Council

Model Scenario	NO_2 model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m^3 in the AQMAs discussed in Section 4.3.1 and along busy carriageways (the M3, Leigh Rd, the M27, Charles Watts Way, the A3024 and the B3397 / Hamble Ln). Areas outside of existing AQMAs where the concentration is predicted to exceed 40 µg/m^3 and there is a risk of public exposure: - Residences at the south-eastern edge of AQMA No. 2, extending along Chestnut Ave. - Residences along Upmill Cl, Romill Cl, and Oak Vale, located south of the M27 near Allington Ln. There are a large number of trees planted between the M27 and the residences, which are not accounted for in the dispersion model and which should reduce emissions from the M27.

Model Scenario	NO_2 model results
	- Residences along Quob Farm Cl and Brookside Way, located south of the M27 between Quob Ln and Moorgreen Rd. There are a large number of trees planted between the M27 and the residences, which are not accounted for in the dispersion model and which should reduce emissions from the M27.
2034 Baseline 2034 Do Minimum 2034 Do Something	Annual mean concentration exceeds 40 µg/m³ along the M3 and the M27, however the annual mean concentration is predicted to be below 40 µg/m³ in all areas where the air quality objectives apply.

Table 4-11 PM_{10} model results in Eastleigh Borough Council

Model Scenario	PM_{10} model results
2014 Reference Year 2034 Baseline 2034 Do Minimum 2034 Do Something	Annual mean concentration exceeds 40 µg/m³ along the M3 and M27, however the annual mean concentration is predicted to be below 40 µg/m³ in all areas where the air quality objectives apply.

Table 4-12 $PM_{2.5}$ model results in Eastleigh Borough Council

Model Scenario	$PM_{2.5}$ model results
2014 Reference Year	Annual mean concentration exceeds 25 µg/m³ along the M3 and M27. Areas where the concentration is predicted to exceed 25 µg/m³ and there is a risk of public exposure: - Houses and sensitive receptors within the existing boundary of AQMA No. 2, along the M3. - Houses along Upmill Cl, located south of the M27 near Allington Ln. There are a large number of trees planted between the M27 and the houses, which are not accounted for in the dispersion model and which should reduce emissions from the M27.
2034 Baseline 2034 Do Minimum 2034 Do Something	Annual mean concentration exceeds 25 µg/m³ along the M3 and M27, however the annual mean concentration is predicted to be below 25 µg/m³ in all areas where the air quality objectives apply.

4.4.3 Fareham Borough Council

Table 4-13 NO_2 model results in Fareham Borough Council

Model Scenario	NO_2 model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m³ in the AQMAs discussed in Section 4.3.1 and along busy carriageways (the M27, the A27 / Southampton Rd / Western Way, and the A32 / Gosport Rd). Areas outside of existing AQMAs where the concentration is predicted to exceed 40 µg/m³ and there is a risk of public exposure: - Residences along Caer Peris View, located south of the M27 near Skew Rd. There are a large number of trees planted between the M27 and the residences, which are not accounted for in the dispersion model and which should reduce emissions from the M27.

Model Scenario	NO_2 model results
	- Residences along Benedict Way, located south of the M27 near the border of Portsmouth City Council. There are a large number of trees planted between the M27 and the residences, which are not accounted for in the dispersion model and which should reduce emissions from the M27. - Along the A32 / Gosport Rd, extending north and south from the existing boundary of the Fareham AQMA (Gosport Road AQMA).
2034 Baseline	Annual mean concentration exceeds 40 µg/m³ along the M27, however the annual mean concentration is predicted to be below 40 µg/m³ in all areas where the air quality objectives apply.
2034 Do Minimum	
2034 Do Something	

Table 4-14 PM_{10} model results in Fareham Borough Council

Model Scenario	PM_{10} model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m³ along the M27, however the annual mean concentration is predicted to be below 40 µg/m³ in all areas where the air quality objectives apply.
2034 Baseline	
2034 Do Minimum	
2034 Do Something	

Table 4-15 $PM_{2.5}$ model results in Fareham Borough Council

Model Scenario	$PM_{2.5}$ model results
2014 Reference Year	Annual mean concentration exceeds 25 µg/m³ along busy roads (the M27, the A27 / Southampton Rd / Western Way and the A32 / Gosport Rd). However, the annual mean concentration is predicted to be below 25 µg/m³ in all areas where the air quality objectives apply.
2034 Baseline	Annual mean concentration exceeds 25 µg/m³ along the M27, however the annual mean concentration is predicted to be below 25 µg/m³ in all areas where the air quality objectives apply.
2034 Do Minimum	
2034 Do Something	

4.4.4 Gosport Borough Council

Table 4-16 NO_2 model results in Gosport Borough Council

Model Scenario	NO_2 model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m³ along the A32 / Farehem Rd / Brockhurst Rd. Areas where the concentration is predicted to exceed 40 µg/m³ and there is a risk of public exposure: - Residences along both sides of Brockhurst Rd, just south of the junction with Elson Rd
2034 Baseline	Annual mean concentration below 40 µg/m³ throughout Gosport Borough Council
2034 Do Minimum	
2034 Do Something	

Table 4-17 PM_{10} model results in Gosport Borough Council

Model Scenario	PM_{10} model results
2014 Reference Year 2034 Baseline 2034 Do Minimum 2034 Do Something	Annual mean concentration below 40 µg/m^3 throughout Gosport Borough Council.

Table 4-18 $PM_{2.5}$ model results in Gosport Borough Council

Model Scenario	$PM_{2.5}$ model results
2014 Reference Year	Annual mean concentration exceeds 25 µg/m^3 along Brockhurst Rd, however the annual mean concentration is predicted to be below 25 µg/m^3 in all areas where the air quality objectives apply.
2034 Baseline 2034 Do Minimum 2034 Do Something	Annual mean concentration below 25 µg/m^3 throughout Gosport Borough Council.

4.4.5 Havant Borough Council

Table 4-19 NO_2 model results in Havant Borough Council

Model Scenario	NO_2 model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m^3 along the A3, the A27, Park Rd N / Park Rd S, Purbrook Way, Hulbert Rd and Hambledon Rd. Areas where the concentration is predicted to exceed 40 µg/m^3 and there is a risk of public exposure: - Residences along Regents Ct and Rectory Rd, located south of the A27 where it meets Langstone Rd.
2034 Baseline 2034 Do Minimum 2034 Do Something	Annual mean concentration below 40 µg/m^3 throughout Havant Borough Council

Table 4-20 PM_{10} model results in Havant Borough Council

Model Scenario	PM_{10} model results
2014 Reference Year 2034 Baseline 2034 Do Minimum 2034 Do Something	Annual mean concentration exceeds 40 µg/m^3 along the A3 and the A27, however the annual mean concentration is predicted to be below 40 µg/m^3 in all areas where the air quality objectives apply.

Table 4-21 $PM_{2.5}$ model results in Havant Borough Council

Model Scenario	$PM_{2.5}$ model results
2014 Reference Year	Annual mean concentration exceeds 25 µg/m^3 along the A3, the A27, Park Rd N, Purbrook Way, and Hulbert Rd. However, the annual mean concentration is predicted to be below 25 µg/m^3 in all areas where the air quality objectives apply.
2034 Baseline 2034 Do Minimum	

Model Scenario	$PM_{2.5}$ model results
2034 Do Something	Annual mean concentration exceeds 25 µg/m^3 along the A3 and the A27, however the annual mean concentration is predicted to be below 25 µg/m^3 in all areas where the air quality objectives apply.

4.4.6 Portsmouth City Council

Table 4-22 NO_2 model results in Portsmouth City Council

Model Scenario	NO_2 model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m^3 in the AQMAs discussed in Section 4.3.1 and along numerous carriageways (the M27 / A27, Southampton Rd, the A3 / London Rd, Norway Rd / Anchorage Rd, the A2030 / Eastern Rd, the M275, the A2047, Copnor Rd, Milton Rd, Hope St, Flathouse Rd, Alfred Rd, Queen St, the B2154 and St George's Rd). Areas outside of existing AQMAs where the concentration is predicted to exceed 40 µg/m^3 and there is a risk of public exposure: - Residences along Osier Cl and Harbour Way, located East of the M275 and south of Tipner Ln. - Residences on and south of Port Way, located south of the M27 near Junction 12. - Residences along Falmouth Rd, Hillsley Rd, Coleridge Rd, and Browning Ave, located on both sides of the M27 between Junction 11 and Junction 12. - Residences along the A2047 / London Rd, located south of the Portsbridge Roundabout. - Residences along Tudor Cres, located north of the M27 and north-east of the Portsbridge Roundabout. - Residences along Highbury Grove and Hawthorn Cres, located north of the A27 / Havant Bypass and west of the A2030. - Residences along Copnor Rd, particularly between New Rd E and Queen's Rd, and between Chichester Rd and Stubbington Ave / Burrfields Rd.
2034 Baseline 2034 Do Minimum 2034 Do Something	Annual mean concentration exceeds 40 µg/m^3 along the M27 / A27 and the M275. However, the annual mean concentration is predicted to be below 40 µg/m^3 in all areas where the air quality objectives apply.

Table 4-23 PM_{10} model results in Portsmouth City Council

Model Scenario	PM_{10} model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m^3 along the M27 / A27 and the M275. However, the annual mean concentration is predicted to be below 40 µg/m^3 in all areas where the air quality objectives apply.
2034 Baseline	Annual mean concentration exceeds 40 µg/m^3 along the M27 / A27. However, the annual mean concentration is predicted to be below 40 µg/m^3 in all areas where the air quality objectives apply.
2034 Do Minimum 2034 Do Something	Annual mean concentration exceeds 40 µg/m^3 along the M27 / A27 and the M275. However, the annual mean concentration is predicted to be below 40 µg/m^3 in all areas where the air quality objectives apply.

Table 4-24 $PM_{2.5}$ model results in Portsmouth City Council

Model Scenario	$PM_{2.5}$ model results
2014 Reference Year	Annual mean concentration exceeds 25 µg/m^3 along busy carriageways (the M27 / A27, Southampton Rd, the A2030 / Victoria Rd N, the A2030 / Eastern Rd, the M275, and the A3 / Afred Rd). Areas where the concentration is predicted to exceed 25 µg/m^3 and there is a risk of public exposure: - Residences along Browning Ave and Falmouth Rd, located south of the M27 between Junction 11 and Junction 12. - Residences along Highbury Grove and Hawthorn Cres, located north of the A27 / Havant Bypass and west of the A2030. - Residences along Old Commercial Rd, located north of the Church Street Roundabout in AQMA no. 11.
2034 Baseline 2034 Do Minimum 2034 Do Something	Annual mean concentration exceeds 25 µg/m^3 along the M27 / A27 and the M275. However, the annual mean concentration is predicted to be below 25 µg/m^3 in all areas where the air quality objectives apply.

4.4.7 Southampton City Council

Table 4-25 NO_2 model results in Southampton City Council

Model Scenario	NO_2 model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m^3 in the AQMAs discussed in Section 4.3.1, along numerous carriageways (the M27, the M271, Redbridge Rd / Millbrook Rd W / Mountbatten Way / W Quay Rd, the A33 / Bassett Ave, the A35 / Burgess Rd, Winchester Rd, the A3057) and a significant portion of the city centre. Areas outside of existing AQMAs where the concentration is predicted to exceed 40 µg/m^3 and there is a risk of public exposure: - Residences outside the current boundary of AQMA no. 5, including along Coniston Rd to the north, Old Redbridge Rd to the south, and Cuckmere Ln to the north. - Residences along Burgess Rd, outside the current boundary of AQMA no. 3. - Residences along the A33 / Bassett Ave, located near Beechmount Rd. - Residences along the A33 / Bassett Ave, located south of the A27 and the Chilworth Roundabout. - Residences along the A33 / The Avenue and the A33 / Dorset St, located between Westwood Rd to the north and AQMA no. 1 to the south. - Residences beyond the current boundary of AQMA no. 1, including along St Mary's Rd to the east, St Andrews Rd to the south, and Old Northam Rd to the south, as well as residences to the east of the A33 / Kingsway. - Residences along the A3057, Mandela Way and Hill Ln, located west of AQMA no. 8. - Residences located beyond the current boundary of AQMA no. 4, including but not limited to those located on Buldge St, French St, High St and Lower Canal Walk.

Model Scenario	NO_2 model results
	- Residences located near busy roads in the city centre, including those near Mountbatten Way, Western Esplanade, and Castle Way. - Residences located beyond the current boundary of AQMA no. 2, including those along both sides of the A3024 / Northam Rd to the south) and along Athelstan Rd. - Residences along Victoria Rd, located north of Weston Grove Rd / Vosper Rd.
2034 Baseline 2034 Do Minimum 2034 Do Something	Annual mean concentration exceeds 40 µg/m³ in the AQMAs discussed in Section 4.3.1, along the M27, and in small areas within the city centre (along Cumberland Pl, along Havelock Rd). However, the annual mean concentration is predicted to be below 40 µg/m³ in all areas where the air quality objectives apply.

Table 4-26 PM_{10} model results in Southampton City Council

Model Scenario	PM_{10} model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m³ along Redbridge Rd / Millbrook Rd W, Bassett Ave and the M27. However, the annual mean concentration is predicted to be below 40 µg/m³ in all areas where the air quality objectives apply.
2034 Baseline 2034 Do Minimum 2034 Do Something	Annual mean concentration exceeds 40 µg/m³ along Redbridge Rd, Bassett Ave and the M27. However, the annual mean concentration is predicted to be below 40 µg/m³ in all areas where the air quality objectives apply.

Table 4-27 $PM_{2.5}$ model results in Southampton City Council

Model Scenario	$PM_{2.5}$ model results
2014 Reference Year	Annual mean concentration exceeds 25 µg/m³ in the AQMAs discussed in Section 4.3.3 and along numerous carriageways (the M27, the M271, Redbridge Rd / Millbrook Rd W / Mountbatten Way / W Quay Rd, the A33 / Bassett Ave, the A35 / Burgess Rd, Winchester Rd, the A3057). Areas where the concentration is predicted to exceed 25 µg/m³ and there is a risk of public exposure: - Residences within the current boundary of AQMA no. 5, located on Redbridge Rd across from Parkside Ave. - Residences within the current boundary of AQMA no. 2.
2034 Baseline 2034 Do Minimum 2034 Do Something	Annual mean concentration exceeds 25 µg/m³ along Redbridge Rd / Millbrook Rd W, Bassett Ave and the M27. However, the annual mean concentration is predicted to be below 25 µg/m³ in all areas where the air quality objectives apply.

4.4.8 Test Valley Borough Council

Table 4-28 NO_2 model results in Test Valley Borough Council

Model Scenario	NO_2 model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m³ along the M27. Areas where the concentration is predicted to exceed 40 µg/m³ and there is a risk of public exposure: - Residences in the Nursling and Rownhams areas, which border the M27.

Model Scenario	NO_2 model results
2034 Baseline	Annual mean concentration exceeds 40 µg/m^3 along the M27. However, the annual mean concentration is predicted to be below 40 µg/m^3 in all areas within the PUSH study area where the air quality objectives apply.
2034 Do Minimum	
2034 Do Something	

Table 4-29 PM_{10} model results in Test Valley Borough Council

Model Scenario	PM_{10} model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m^3 along the M27. However, the annual mean concentration is predicted to be below 40 µg/m^3 in all areas within the PUSH study area where the air quality objectives apply.
2034 Baseline	
2034 Do Minimum	
2034 Do Something	

Table 4-30 $PM_{2.5}$ model results in Test Valley Borough Council

Model Scenario	$PM_{2.5}$ model results
2014 Reference Year	Annual mean concentration exceeds 25 µg/m^3 along the M27. However, the annual mean concentration is predicted to be below 25 µg/m^3 in all areas within the PUSH study area where the air quality objectives apply.
2034 Baseline	
2034 Do Minimum	
2034 Do Something	

4.4.9 Winchester City Council

Table 4-31 NO_2 model results in Winchester City Council

Model Scenario	NO_2 model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m^3 along the M27. However, the annual mean concentration is predicted to be below 40 µg/m^3 in all areas within the PUSH study area where the air quality objectives apply.
2034 Baseline	
2034 Do Minimum	
2034 Do Something	

Table 4-32 PM_{10} model results in Winchester City Council

Model Scenario	PM_{10} model results
2014 Reference Year	Annual mean concentration exceeds 40 µg/m^3 along the M27. However, the annual mean concentration is predicted to be below 40 µg/m^3 in all areas within the PUSH study area where the air quality objectives apply.
2034 Baseline	
2034 Do Minimum	
2034 Do Something	

Table 4-33 $PM_{2.5}$ model results in Winchester City Council

Model Scenario	$PM_{2.5}$ model results
2014 Reference Year	Annual mean concentration exceeds 25 µg/m^3 along the M27. However, the annual mean concentration is predicted to be below 25 µg/m^3 in all areas within the PUSH study area where the air quality objectives apply.
2034 Baseline	
2034 Do Minimum	
2034 Do Something	

4.5 Recommendations for mitigation

The air quality modelling study indicates that, because of general improvements in air quality over the period up to 2034, ambient concentrations of NO_2, PM_{10} and $PM_{2.5}$ within the majority of AQMAs in the PUSH study area are forecast to improve. At almost all locations within the AQMAs, concentrations will meet the applicable air quality objectives under the 2034 Do Something scenario.

The modelling does indicate that the maximum concentrations are predicted to exceed the objectives in several areas under the 2034 scenarios. However, in all cases, these exceedances are not forecast to occur at locations of relevant exposure (e.g. homes, schools, hospitals etc.). While there is no specific requirement for further mitigation to achieve air quality objectives in 2034, further mitigation measures could be considered to address the higher concentrations within these AQMAs.

The AQMAs in which these exceedances occur, and where the Local Plan would result in an increase in air pollution levels compared to the 2034 Baseline situation, are as follows:

a. No. 2 (M3), Eastleigh Borough Council – PM_{10}, $PM_{2.5}$ & NO_2 for both 2034 Do Minimum and 2034 Do Something scenarios

b. No.1 (A335), Eastleigh Borough Council – PM_{10}, $PM_{2.5}$ & NO_2 for both 2034 Do Minimum and 2034 Do Something scenarios

c. No. 11, Portsmouth City Council – PM_{10}, $PM_{2.5}$ & NO_2 for 2034 Do Minimum scenario only

d. No. 4 (Town Quay), Southampton City Council – NO_2 for 2034 Do Minimum scenario only

e. No. 8 (Commercial Road), Southampton City Council – NO_2 for 2034 Do Minimum scenario only

f. No.5 (Redbridge Road & Millbrook Road), Southampton City Council – PM_{10} & $PM_{2.5}$ for both 2034 Do Minimum and 2034 Do Something scenarios; and NO_2 for 2034 Do Minimum

g. No.1 (Bevois Valley), Southampton City Council – NO_2 for 2034 Do Minimum scenario only

While no exceedances of the air quality objectives at relevant locations are forecast to occur at these locations in 2034, it will be important for all Local Authorities in the PUSH region to ensure planned developments are carefully phased. This will help to prevent development construction and/or operation from affecting compliance with air quality standards in areas that currently do not comply with air quality objectives, or causing non-compliance to occur during the period leading up to 2034. It is recommended that guidance be produced to assist developers in complying with this requirement. The effects of construction can be controlled and mitigated by planning condition, normally requiring a Construction Environmental Management Plan to be agreed with the local planning authority prior to construction commencing. Section 6 also provides recommendations for the development of strategic planning documents.

Each of the local authorities for which an exceedance of an air quality objective was projected under the 2034 scenarios, has set out a series of proposed measures to tackle air quality. These measures were proposed either as part of their requirements under Local Air Quality Management, or through the formation of a Clean Air Strategy.

The following table sets out some of the measures currently being enacted or under consideration in the three local authorities. The majority of these measures have been designed to target emissions of oxides of nitrogen, however most will also have a beneficial impact on concentrations of PM_{10} and $PM_{2.5}$. The development of these measures would contribute to improvements in air quality across the region, including within the AQMAs predicted to experience concentrations in exceedance of the air quality objectives.

Table 4-34: Measures proposed by Eastleigh Borough Council, Portsmouth City Council and Southampton Council to improve air quality

Local Authority	Proposed measures to improve air quality
Eastleigh Borough Council *Eastleigh Air Quality Management Area Action Plan – 6 Month Update* [39]	- Development of a public park and ride scheme at Eastleigh FC. - Low emission taxis – Provide taxi operators with financial incentives to purchase low emission vehicles (bid submitted). - Traffic free zones – e.g. Eastleigh Station Forecourt, Market Place and Bishopstoke cycleway. - Delivery and service plans for freight deliveries. - Heavy goods vehicles restrictions. - Opportunities for electric vehicle (EV) public charge points and revision of EBC parking standards to include better provision for EV charging at home. - Anti-idling campaign at bus station/taxi ranks. - Improved bus routes through cooperation with local transport operators. - Bus day ticket for Eastleigh. - Cycle network and infrastructure improvements. - Funding for low emission buses - OLEV funding bid for Euro VI hybrid buses unsuccessful, however potential to work with local operators to encourage improvements.
Portsmouth City Council *2016 Air Quality Annual Status Report* [40]	- Freight quality partnership – Working closely with freight suppliers to ensure the most appropriate routes are undertaken through AQMAs, with particular focus on AQMA 6 and AQMA 11. - Public awareness campaign (AQ information, Sustainable Travel Behaviour Change, etc.) - Anti-idling campaign. - Cycling measures (cycling campaign, improvements to cycle infrastructure, bike hire scheme, family cycling grants, etc.) - Control of replacement of gas-fired boilers and promotion of energy saving measures, leading to reductions in combustion emissions across the city. - Upgrade fleet and improve emission technologies by bus operators. - Bus station travel plans. - Increased parking space availability at the Park and Ride site, allowing for increased usage of the service. - Workplace travel plans (WTPs) - offers a range of benefits including discounts on peak train travel, cycling and electric vehicles for staff. Potential for 40 WTPs in total. - Workplace travel planning – potential for further schemes to be delivered with local businesses in the future. - Review of PCC fleet – prioritising uptake of low emission vehicles.

Southampton City Council
 	
2016 Air Quality Annual Status Report [41]
	- SCC are in the process of establishing a Clean Air Zone, including the introduction of penalty charges in 2019/20 for the most polluting commercial vehicles. This will also be supplemented by a package of associated measures. The following priorities have been identified to tackle air pollution across the city:
	  - Improved transport and freight delivery.
	  - Encourage uptake of low emission technologies and vehicles.
	  - Develop a Clean Air Partnership with key stakeholders in the city and region.

[39] https://meetings.eastleigh.gov.uk/documents/s50016483/AQMA%20Update%20Report.docx

[40] https://www.portsmouth.gov.uk/ext/documents-external/env-air-quality-2016-annual-status-report.pdf

[41] http://southampton.my-air.uk/wp-content/uploads/sites/5/2018/01/2016-Southampton-Annual-Status-Report.pdf

Local Authority	Proposed measures to improve air quality
	- Implement schemes to support taxi operators, other businesses and public services in reducing the emissions. - Incentivise the use of public transport, cycling and walking.

Note: Measures associated with changes to the road network, including junction/signalling improvements, have not been included in this list, but may also result in beneficial changes in ambient air quality.

The types of additional mitigation which could be considered in each of these areas will differ depending on the nature of the surrounding area. Broadly speaking, the AQMAs listed above can be categorised as either City Centre or Key Corridor:

- City Centre: No.1 (Bevois Valley, Southampton City Council), No. 4 (Town Quay, Southampton City Council) & No. 8 (Commercial Road, Southampton City Council)
- Key Corridor: No. 2 (M3, Eastleigh Borough Council), No.1 (A335, Eastleigh Borough Council), No. 11 (Portsmouth City Council) & No.5 (Redbridge Road & Millbrook Road, Southampton City Council)

The following table provides examples of the measures that can prove effective in tackling pollutant emissions in City Centres and along Key Corridors. This list is not exhaustive and many of the measures will result in improvements in emissions and air quality beyond these areas. Mitigation measures can also be incorporated into strategic planning guidance as a consolidated approach with a wider area of impact, as will be discussed in Section 6.

Table 4-35: Example low emission measures applicable to City Centres and Key Corridors

City Centre	Key Corridor
- Differential parking levy (e.g. workplace parking). - Priority parking for low emission vehicles. - Restrictions on bus access to city centre areas to low emission vehicles. - Taxi measures including low emission taxi ranks and licensing to support low emission vehicles. - Low emission car clubs. - Provision of on-street EV charging infrastructure. - Delivery service plan for local businesses designed to minimise the impact of delivery vehicles on air quality through scheduling, routeing, vehicle emissions controls, etc. - Development of a regional freight consolidation centre. - Anti-idling campaigns. - Development of a Clean Air Charter including clear performance improvement targets. - Improvements in public transport provision; Park & Ride schemes. - Improvements in walking/cycling infrastructure.	- Low emission bus provision routes. - Low emission bus partnership, prioritising low emission buses for key corridors. - Incentivise public transport use (e.g. universal transport card). - Park & Ride schemes. - Priority lanes for low emission vehicles/taxis. - Integrated traffic management systems – e.g. see ITRAQ pilot scheme.[42] - Dedicated paths/routes for walkers/bicycles/E-cycles/electric scooters. - Procurement of low emission buses for schools and hospitals using the key corridors.

Successful implementation of air quality mitigation measures will need to consider the local factors contributing to air quality impacts as well as local economic factors, which will necessarily vary from location to location. For this reason, the effectiveness and cost for each of the measures in the above table will vary depending on the local context. In general, air quality in City Centre areas tends to be negatively impacted by factors such as traffic congestion, large numbers of slow-moving vehicles, and street canyon effects (narrow streets flanked by buildings, a situation which interferes with effective

[42] http://www.dmu.ac.uk/research/research-faculties-and-institutes/technology/digits/partnerships-funding-and-projects/itraq.aspx

dispersion of air pollutants). Air quality in Key Corridor areas tends to be negatively impacted by large numbers of fast-moving vehicles, and these areas are also likely to have a greater portion of heavier vehicles (HGVs) with higher emission rates of the key pollutants. Source apportionment studies may be helpful in identifying the key contributors to air pollution concentrations in areas of ongoing concern and will assist in developing targeted mitigation strategies.

There are many traffic management interventions that have the potential to improve air quality including road pricing, parking management, traffic signal timings, variable speed limits and access restrictions. However, the evidence base is weak with scarce evidence on health outcomes, economic and social inequality impacts, and with insufficient evidence on post implementation evaluation, where more research is needed. While traffic management and access control measures (such as vehicle restricted areas, low emission zones/clean air zones and parking management) can be effective in reducing road traffic emissions, they can be expensive to implement and because of their restrictive nature can be unpopular, if not handled sensitively with considerable consultation and engagement.

These interventions are not mutually exclusive: studies show that road transport interventions are often combined in the aim of achieving a greater impact. Indeed, the evidence suggests that greater emission reductions and improvements in air quality may occur when several measures are integrated and packaged together. For example, traffic management and pricing mechanisms can be supported by a package of complementary measures, such as improvements in walking, cycling, bus and train facilities. If designed appropriately, such measures not only reduce air pollutant emissions, but can also provide climate change benefits, as well as wider benefits such as noise reduction, congestion alleviation, neighbourhood cohesion and economic development.

In general, it is most effective to reduce emissions at the source, either through measures targeted at reducing transport emissions directly (as listed in Table 4-35) or measures targeted at reducing the background contribution to NOx, PM_{10} and $PM_{2.5}$ from other emission sources. In the latter category, measures aimed at reducing emissions from domestic heating, particularly wood burning, are potentially beneficial in reducing concentrations of NOx, PM_{10}, and $PM_{2.5}$. Targeted measure could include information campaigns and measures to encourage the use of cleaner stoves and fuels. In practice, the success of measures targeting domestic heating and wood burning can be difficult to quantify and guarantee, as fitting and using a small domestic wood burning stove lies outside the planning processes. Measures to ban the sale of unseasoned wood which does not have the “ready to burn” accreditation are currently being considered by Defra.[43] This may bring some benefits in reducing the impacts of wood-burning stoves. If there are significant sources of industrial activity contributing to air quality concerns, it may be more effective to develop measures targeting reductions in those industrial activities, where planning policy can play a larger role. Examples in this category would include reducing emissions from port activity, such as providing electricity from the mainland to docked ships so that they are not reliant on diesel generators while at port.

Green infrastructure may also be beneficial, but must be implemented with careful consideration of the street geometry in order to provide air quality improvements. This is an ongoing area of research; however, it is expected that low, high-density vegetation such as hedges is more effective at improving air quality than tall trees. Tall vegetation in a narrow urban street may have the unintended effect of hindering dispersion of pollutants and thereby worsening existing air quality issues. Nonetheless, green infrastructure does provide benefits aside from possible improvements to air quality, including enhancing the aesthetics of a city, and contributing to climate change mitigation and adaptation.

[43] Department for Environment, Food & Rural Affairs, “Plans to cut harmful pollution from domestic burning set out”, https://www.gov.uk/government/news/plans-to-cut-harmful-pollution-from-domestic-burning-set-out, published 17/08/2018, accessed 20/08/2018.

5 Assessment of air quality impacts on designated sites

This chapter sets out the study results with respect to potential impacts of the proposed PUSH development on designated site, including Ramsar sites, Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSIs).

5.1 Assessment of air quality impacts against screening thresholds

This section comprises the outcome of the assessment described in Section 2.3.3.

Critical load and critical level values for the designated sites considered in this study are summarized in Table 5-1 and Table 5-2. Critical loads for nutrient nitrogen deposition (kgN/ha-year) and acid deposition (kEq/ha-year) were obtained from the UK Air Pollution Information System (APIS, www.apis.co.uk) by using the "Site Relevant Critical Loads" tool. For each designated site, the critical load used in this assessment corresponds to the lowest (most stringent) critical load provided for any feature of interest within that designated site. The critical level for the airborne concentration of oxides of nitrogen (NOx) is set at 30 µg/m^3 for all designated sites across the UK. The critical levels for airborne concentrations of ammonia (NH_3) were obtained from APIS, except where otherwise noted in the tables below.

For simplicity, Table 5-1 and Table 5-2 indicate the sensitive qualifying feature associated with the lowest (most stringent) CL only, as this is the value that is used to set the screening thresholds. Many of the designated sites included in this study contain other qualifying features that are sensitive to air pollution and have different CL values, which should be considered in later stages of the HRA process.

The magnitude of nitrogen deposition and acid deposition at a designated site is influenced by the structure of the site's vegetation. Sites with short vegetation (i.e. grassland) will experience lower amounts of deposition than sites with tall vegetation (i.e. woodland), due to the difference in deposition velocities applicable to short and tall vegetation. Most habitats in the following tables have been classified as woodland if any of the features of interest listed on APIS for that designated site are woodland features; otherwise, they have been classified as grassland. A different approach was adopted for the following three sites: Chichester and Langstone Harbours (Ramsar & SPA), Solent and Southampton Water (Ramsar & SPA) and Solent Maritime SAC. These three designated sites cover large geographical areas, and overlap with some SSSIs that are classified as woodland and some SSSIs that are classified as grassland. For these three sites, predicted deposition results have been calculated using both woodland and grassland deposition velocities across the entire designated site, for demonstrative purposes.

The tables below present the maximum modelled contribution of road traffic emissions from the proposed PUSH development scenarios and compare these contributions to a screening threshold equal to 1% of the applicable critical load or critical level. The contributions of the two development scenarios are defined as:

- (Contribution of the 2034 Do Minimum Scenario) = (2034 Do Minimum) – (2034 Baseline)
- (Contribution of the 2034 Do Something Scenario) = (2034 Do Something) – (2034 Baseline)

Values highlighted in yellow exceed the 1% screening threshold, and the affected designated sites undergo further analysis in the following section.

Additionally, for airborne NOx, the maximum modelled total concentration is presented, where the maximum total concentration is equal to the modelled road emissions for that scenario plus the 2034

NOx background values obtained from UK Air.[44] As a precautionary approach, these maximum total NOx concentrations correspond to the highest total concentration predicted anywhere within the designated site, and do not necessarily occur at the same geographic location as the maximum modelled NOx contribution from road traffic emissions. Total NOx concentration values highlighted in yellow exceed 21 µg/m3 (i.e. 70% of the NOx long-term Critical Level), and the affected designated sites undergo further analysis in the next section.

[44] Department for Environment, Food and Rural Affairs, UK Air website, “Background mapping data for local authorities”, https://uk-air.defra.gov.uk/data/laqm-background-home

Table 5-1 Minimum Critical Load and Critical Level (CL) values and associated sensitive features for European-designated sites and underlying SSSIs

Site name	Minimum nutrient nitrogen deposition CL (kgN/ha-year)		Minimum acid deposition CL (kEq/ha-year)		Minimum airborne NH_3 CL (µg/m^3)	
	CL	Sensitive feature	CL	Sensitive feature	CL	Sensitive feature
Chichester and Langstone Harbours (Ramsar & SPA) [a]	8	Sterna sandvicensis (Western Europe/Western Africa) - Sandwich tern	1.123	Sterna sandvicensis (Western Europe/Western Africa) - Sandwich tern	3	Sterna sandvicensis (Western Europe/Western Africa) - Sandwich tern
Chichester Harbour (underlying SSSI) [a]	8	Sterna albifrons - Little Tern	1.123	Neutral grassland (Agrostis stolonifera - Alopecurus geniculatus grassland)	3	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)
Langstone Harbour (underlying SSSI) [a]	8	Sterna albifrons - Little Tern	1.380	Sterna albifrons - Little Tern	3	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)
Emer Bog SAC	10	Transition mires and quaking bogs	0.598	Transition mires and quaking bogs	1	Transition mires and quaking bogs
Baddesley Common and Emer Bog (underlying SSSI)	10	Fen, marsh and swamp (Carex echinata - Sphagnum recurvum (fallax) /auriculatum (denticulatum) mire)	0.598	Fen, marsh and swamp (Carex echinata - Sphagnum recurvum (fallax) /auriculatum (denticulatum) mire)	1	Fen, marsh and swamp (Carex echinata - Sphagnum recurvum (fallax) /auriculatum (denticulatum) mire)
Portsmouth Harbour (Ramsar & SPA)	20	Branta bernicla bernicla (Western Siberia/Western Europe) - Dark-bellied brent goose	Not sensitive	All listed features specified as being 'not sensitive' to acid deposition.	3	Branta bernicla bernicla (Western Siberia/Western Europe) - Dark-bellied brent goose
Portsmouth Harbour (underlying SSSI)	15	Calcareous grassland (Festuca ovina - Avenula pratensis lowland calcareous grassland)	4.856	Calcareous grassland (Festuca ovina - Avenula pratensis lowland calcareous grassland)	3	Vascular plant assemblage - Vascular Plant Assemblage
River Itchen SAC	10	Coenagrion mercuriale - Southern damselfly	0.922	Coenagrion mercuriale - Southern damselfly	3	Coenagrion mercuriale - Southern damselfly
River Itchen (underlying SSSI)	10	Broad-leaved, mixed and yew woodland (Alnus glutinosa - Carex paniculata woodland)	0.618	Broad-leaved, mixed and yew woodland (Alnus glutinosa - Carex paniculata woodland)	3	Neutral grassland (Cynosurus cristatus - Caltha palustris grassland)
Solent and Southampton Water (Ramsar & SPA) [a]	8	Sterna sandvicensis (Western Europe/Western Africa) - Sandwich tern	0.626	Sterna sandvicensis (Western Europe/Western Africa) - Sandwich tern	3	Sterna sandvicensis (Western Europe/Western Africa) - Sandwich tern
Solent and Isle of Wight Lagoons (underlying SAC)	20	Coastal lagoons	Not sensitive	All listed features specified as being 'not sensitive' to acid deposition.	3	Not listed on APIS; value indicated by Natural England via email

Site name	Minimum nutrient nitrogen deposition CL (kgN/ha-year)		Minimum acid deposition CL (kEq/ha-year)		Minimum airborne NH_3 CL ($\mu g/m^3$)	
	CL	Sensitive feature	CL	Sensitive feature	CL	Sensitive feature
Eling and Bury Marshes (underlying SSSI)	15	Broad-leaved, mixed and yew woodland (Fraxinus excelsior - Acer campestre - Mercurialis perennis woodland)	1.929	Broad-leaved, mixed and yew woodland (Fraxinus excelsior - Acer campestre - Mercurialis perennis woodland)	3	Anas crecca - Teal
Gilkicker Lagoon (underlying SSSI) [b]	No data	See note b below	Not sensitive	No features specified as being sensitive to acid deposition.	3	Not listed on APIS; value indicated by Natural England via email
Lee-on-the Solent to Itchen Estuary (underlying SSSI) [a]	20	Anas crecca - Teal	No data	All features specified as either being ‘not sensitive’ to acid deposition or having ‘no comparable acidity class’	3	Anas crecca - Teal
Lincegrove and Hackett's Marshes (underlying SSSI) [a]	15	Fen, marsh and swamp (Phragmites australis swamp and reed-beds)	1.348	Neutral grassland (Agrostis stolonifera - Alopecurus geniculatus grassland)	3	Neutral grassland (Agrostis stolonifera - Alopecurus geniculatus grassland)
Lower Test valley (underlying SSSI)	15	Fen, marsh and swamp (Filipendula ulmaria - Angelica sylvestris mire)	1.143	Fen, marsh and swamp (Filipendula ulmaria - Angelica sylvestris mire)	3	Neutral grassland (Agrostis stolonifera - Alopecurus geniculatus grassland)
River Test (underlying SSSI)	10	Broad-leaved, mixed and yew woodland (Alnus glutinosa - Carex paniculata woodland)	0.580	Broad-leaved, mixed and yew woodland (Alnus glutinosa - Carex paniculata woodland)	3	Neutral grassland (Cynosurus cristatus - Caltha palustris grassland)
Titchfield Haven (underlying SSSI)	15	Fen, marsh and swamp (Juncus effusus / acutiflorus - Galium palustre rush pasture)	1.133	Fen, marsh and swamp (Juncus effusus / acutiflorus - Galium palustre rush pasture)	3	Neutral grassland (Agrostis stolonifera - Alopecurus geniculatus grassland)
Upper Hamble Estuary and Woods (underlying SSSI) [a]	10	Broad-leaved, mixed and yew woodland (Alnus glutinosa - Fraxinus excelsior - Lysimachia nemorum woodland)	1.368	Neutral grassland (Agrostis stolonifera - Alopecurus geniculatus grassland)	3	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)
Solent Maritime SAC	8	Perennial vegetation of stony banks	0.626	Perennial vegetation of stony banks	3	Vertigo moulinsiana - Desmoulin`s whorl snail

[a] These designated sites also overlap with Solent Maritime SAC.

Note that other sites are grouped together if they have overlapping boundaries with different designations

[b] APIS does not list a critical load for nitrogen deposition for Gilkicker Lagoon (SSSI). However, Gilkicker Lagoon is fully encompassed within the Solent and Isle of Wight Lagoons SAC, which does not experience a PUSH development nitrogen deposition contribution exceeding 1% of the screening threshold.

Table 5-2 Minimum Critical Load and Critical Level (CL) values and associated sensitive features for standalone SSSIs

Site name	Minimum nutrient nitrogen deposition CL (kgN/ha-year)		Minimum acid deposition CL (kEq/ha-year)		Minimum airborne NH_3 CL ($\mu g/m^3$)	
	CL	Sensitive feature	CL	Sensitive feature	CL	Sensitive feature
Botley Wood and Everett's and Mushes Copses	10	Broad-leaved, mixed and yew woodland (Alnus glutinosa - Carex paniculata woodland)	2.342	Broad-leaved, mixed and yew woodland (Alnus glutinosa - Carex paniculata woodland)	3	Invertebrate assemblage
Browndown	10	Acid grassland (Agrostis curtisii grassland)	1.143	Acid grassland (Agrostis curtisii grassland)	1	Dwarf shrub heath (Calluna vulgaris - Festuca ovina heath)
Catherington Down	15	Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)	4.856	Calcareous grassland (Brachypodium pinnatum lowland calcareous grassland)	3	Not listed on APIS; value indicated by Natural England via email
Hook Heath Meadows	10	Broad-leaved, mixed and yew woodland (Alnus glutinosa - Fraxinus excelsior - Lysimachia nemorum woodland)	1.123	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	3	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)
Lye Heath Marsh	15	Fen, marsh and swamp (Juncus effusus / acutiflorus - Galium palustre rush pasture)	1.123	Fen, marsh and swamp (Juncus effusus / acutiflorus - Galium palustre rush pasture)	3	Fen, marsh and swamp (Juncus effusus / acutiflorus - Galium palustre rush pasture)
Moorgreen Meadows	10	Broad-leaved, mixed and yew woodland (Alnus glutinosa - Fraxinus excelsior - Lysimachia nemorum woodland)	1.368	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	3	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)
Portsdown	15	Calcareous grassland (Brachypodium pinnatum lowland calcareous grassland)	4.856	Calcareous grassland (Brachypodium pinnatum lowland calcareous grassland)	3	Invertebrate assemblage
Sinah Common	8	Supralittoral sediment (Ammophila arenaria - Festuca rubra semi-fixed dune community)	1.338	Acid grassland (Festuca Ovina - Agrostis Capillaris - Rumex Acetosella Grassland)	1	Acid grassland (Festuca Ovina - Agrostis Capillaris - Rumex Acetosella Grassland)
Southampton Common	15	Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)	1.153	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	3	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)

Site name	Minimum nutrient nitrogen deposition CL (kgN/ha-year)		Minimum acid deposition CL (kEq/ha-year)		Minimum airborne NH_3 CL ($\mu g/m^3$)	
	CL	Sensitive feature	CL	Sensitive feature	CL	Sensitive feature
The Moors, Bishop's Waltham	10	Broad-leaved, mixed and yew woodland (Alnus glutinosa - Carex paniculata woodland)	2.180	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	3	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)
The Wild Grounds	10	Broad-leaved, mixed and yew woodland (Alnus glutinosa - Urtica dioica woodland)	1.133	Fen, marsh and swamp (Juncus subnodulosus - Cirsium palustre fen meadow)	3	Fen, marsh and swamp (Juncus effusus / acutiflorus - Galium palustre rush pasture)
Trodds Copse	10	Broad-leaved, mixed and yew woodland (Alnus glutinosa - Carex paniculata woodland)	1.348	Fen, marsh and swamp (Juncus subnodulosus - Cirsium palustre fen meadow)	1	Not listed on APIS; value indicated by Natural England via email
Waltham Chase Meadows	20	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	2.180	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	3	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)
Warblington Meadow	15	Fen, marsh and swamp (Juncus subnodulosus - Cirsium palustre fen meadow)	1.348	Fen, marsh and swamp (Juncus subnodulosus - Cirsium palustre fen meadow)	3	Not listed on APIS; value indicated by Natural England via email

Table 5-3 Study results: maximum modelled contribution from PUSH development scenarios to nitrogen deposition at European-designated sites and underlying SSSIs

Site name	Grassland or woodland	Minimum critical load (kgN/ha-year)	Maximum road contribution from PUSH 2034 Do Minimum		Maximum road contribution from PUSH 2034 Do Something	
			in kgN/ha-year	as % of minimum CL	in kgN/ha-year	as % of minimum CL
Chichester and Langstone Harbours (Ramsar & SPA) [a]	woodland	8	5.6	69%	2.5	31%
	grassland	8	3.6	45%	1.7	21%
Chichester Harbour (underlying SSSI) [a]	woodland	8	1.3	16%	0.00019	0.0024%
Langstone Harbour (underlying SSSI) [a]	grassland	8	3.6	45%	1.7	21%
Emer Bog SAC	woodland	10	0.0036	0.036%	0.0018	0.018%
Baddesley Common and Emer Bog (underlying SSSI)	woodland	10	0.0036	0.036%	0.0018	0.018%
Portsmouth Harbour (Ramsar & SPA)	grassland	20	10.8	54%	4.7	24%
Portsmouth Harbour (underlying SSSI)	grassland	15	10.8	72%	4.7	31%
River Itchen SAC	woodland	10	17.2	172%	1.6	16%
River Itchen (underlying SSSI)	woodland	10	17.2	172%	1.6	16%
Solent and Southampton Water (Ramsar & SPA) [a]	woodland	8	3.0	37%	0.95	12%
	grassland	8	1.9	24%	0.59	7.4%
Solent and Isle of Wight Lagoons (underlying SAC)	grassland	20	0.089	0.44%	0.066	0.33%
Eling and Bury Marshes (underlying SSSI)	woodland	15	0.90	6.0%	0.29	1.9%
Gilkicker Lagoon (underlying SSSI) [b]	grassland	No data	0.0037	No data	0.066	No data
Lee-on-the Solent to Itchen Estuary (underlying SSSI) [a]	grassland	20	1.9	9.6%	0.59	3.0%
Lincegrove and Hackett's Marshes (underlying SSSI) [a]	grassland	15	0.00022	0.0015%	0.0013	0.0089%
Lower Test valley (underlying SSSI)	grassland	15	1.2	7.7%	0.26	1.7%
River Test (underlying SSSI)	woodland	10	13.2	132%	0.81	8.1%
Titchfield Haven (underlying SSSI)	grassland	15	0.009	0.062%	0.0067	0.045%
Upper Hamble Estuary and Woods (underlying SSSI) [a]	woodland	10	0.48	4.8%	0.52	5.2%
Solent Maritime SAC	woodland	8	24.9	312%	7.2	90%
	grassland	8	16.4	205%	4.6	58%

[a] These designated sites also overlap with Solent Maritime SAC.

Note that other sites are grouped together if they have overlapping boundaries with different designations

[b] APIS does not list a critical load for nitrogen deposition for Gilkicker Lagoon (SSSI). However, Gilkicker Lagoon is fully encompassed within the Solent and Isle of Wight Lagoons SAC, which does not experience a PUSH development nitrogen deposition contribution exceeding 1% of the screening threshold.

Table 5-4 Study results: maximum modelled contribution from PUSH development scenarios to nitrogen deposition at standalone SSSIs

Site name	Grassland or woodland	Minimum critical load (kgN/ha-year)	Maximum road contribution from PUSH 2034 Do Minimum		Maximum road contribution from PUSH 2034 Do Something	
			in kgN/ha-year	as % of minimum CL	in kgN/ha-year	as % of minimum CL
Botley Wood and Everett's and Mushes Copses	woodland	10	2.0	20%	1.7	17%
Browndown	grassland	10	0.14	1.4%	0.16	1.6%
Catherington Down	woodland	15	0.050	0.33%	0.089	0.59%
Hook Heath Meadows	woodland	10	0.0086	0.086%	0.023	0.23%
Lye Heath Marsh	grassland	15	0.00018	0.0012%	0.057	0.38%
Moorgreen Meadows	woodland	10	3.6	36%	0.86	8.6%
Portsdown	grassland	15	2.8	18%	1.4	9.6%
Sinah Common	grassland	8	0.00068	0.0085%	0.0017	0.021%
Southampton Common	woodland	15	1.5	10.1%	0.44	2.9%
The Moors, Bishop's Waltham	woodland	10	0.67	6.7%	0.25	2.5%
The Wild Grounds	woodland	10	0.073	0.73%	0.021	0.21%
Trodds Copse	woodland	10	0.0024	0.024%	0.0084	0.084%
Waltham Chase Meadows	grassland	20	0.41	2.0%	0.22	1.1%
Warblington Meadow	grassland	15	0.0075	0.050%	0.0021	0.014%

Table 5-5 Study results: maximum modelled contribution from PUSH development scenarios to acid deposition at European-designated sites and underlying SSSIs

Site name	Grassland or woodland	Minimum critical load (kEq/ha-year)	Maximum road contribution from PUSH 2034 Do Minimum		Maximum road contribution from PUSH 2034 Do Something	
			in kEq/ha-year	as % of minimum CL	in kEq/ha-year	as % of minimum CL
Chichester and Langstone Harbours (Ramsar & SPA) [a]	woodland	1.123	0.4	35.6%	0.18	16.0%
	grassland	1.123	0.26	23.2%	0.12	10.7%
Chichester Harbour (underlying SSSI) [a]	woodland*	1.123	0.09	8.0%	0.000014	0.001%
Langstone Harbour (underlying SSSI) [a]	grassland	1.38	0.26	18.8%	0.12	8.7%
Emer Bog SAC	woodland	0.598	0.00026	0.043%	0.00013	0.022%
Baddesley Common and Emer Bog (underlying SSSI)	woodland*	0.598	0.00026	0.043%	0.00013	0.022%
Portsmouth Harbour (Ramsar & SPA) [b]	grassland	Not sensitive	0.77	Not sensitive	0.34	Not sensitive
Portsmouth Harbour (underlying SSSI)	grassland	4.856	0.77	15.9%	0.34	7.0%
River Itchen SAC	woodland	0.922	1.22	132%	0.11	11.9%
River Itchen (underlying SSSI)	woodland	0.618	1.22	197%	0.11	17.8%
Solent and Southampton Water (Ramsar & SPA) [a]	woodland	0.626	0.21	33.5%	0.067	10.7%
	grassland	0.626	0.14	22.4%	0.042	6.7%
Solent and Isle of Wight Lagoons (underlying SAC) [b]	grassland	Not sensitive	0.0063	Not sensitive	0.0047	Not sensitive
Eling and Bury Marshes (underlying SSSI)	woodland	1.929	0.064	3.3%	0.021	1.1%
Gilkicker Lagoon (underlying SSSI) [c]	grassland	No data	0.00026	No data	0.0047	No data
Lee-on-the Solent to Itchen Estuary (underlying SSSI) [a,c]	grassland	No data	0.14	No data	0.042	No data
Lincegrove and Hackett's Marshes (underlying SSSI) [a]	grassland	1.348	0.000016	0.001%	0.0001	0.007%
Lower Test valley (underlying SSSI)	grassland	1.143	0.082	7.2%	0.018	1.6%
River Test (underlying SSSI)	woodland	0.58	0.94	162%	0.058	10.0%
Titchfield Haven (underlying SSSI)	grassland	1.133	0.00066	0.058%	0.00048	0.042%

Site name	Grassland or woodland	Minimum critical load (kEq/ha-year)	Maximum road contribution from PUSH 2034 Do Minimum		Maximum road contribution from PUSH 2034 Do Something	
			in kEq/ha-year	as % of minimum CL	in kEq/ha-year	as % of minimum CL
Upper Hamble Estuary and Woods (underlying SSSI) [a]	woodland*	1.368	0.034	2.5%	0.037	2.7%
Solent Maritime SAC	woodland	0.626	1.77	283%	0.51	81.5%
	grassland	0.626	1.17	187%	0.33	52.7%

[a] These designated sites also overlap with Solent Maritime SAC

Note that other sites are grouped together if they have overlapping boundaries with different designations

[b] APIS does not list any features which are sensitive to acid deposition for the following designated sites: Portsmouth Harbour (Ramsar & SPA); Solent and Isle of Wight Lagoons (SAC).

[c] APIS does not list a critical load for acid deposition for the following designated sites: Gilkicker Lagoon (SSSI); Lee-on-the-Solent to Itchen Estuary (SSSI).

*The lowest acid deposition CL has been used. In this case, the lowest CL corresponds to grassland, despite the habitat being designated as woodland.

Table 5-6 Study results: maximum modelled contribution from PUSH development scenarios to acid deposition at standalone SSSIs

Site name	Grassland or woodland	Minimum critical load (kEq/ha-year)	Maximum road contribution from PUSH 2034 Do Minimum		Maximum road contribution from PUSH 2034 Do Something	
			in kEq/ha-year	as % of minimum CL	in kEq/ha-year	as % of minimum CL
Botley Wood and Everett's and Mushes Copses	woodland	2.342	0.14	6.0%	0.12	5.1%
Browndown	grassland	1.143	0.01	0.87%	0.011	1.0%
Catherington Down	woodland*	4.856	0.0035	0.072%	0.0063	0.13%
Hook Heath Meadows	woodland*	1.123	0.0006	0.054%	0.0017	0.15%
Lye Heath Marsh	grassland	1.123	0.0004	0.031%	0.0041	0.37%
Moorgreen Meadows	woodland*	1.368	0.26	19.0%	0.062	4.5%
Portsdown	grassland	4.856	0.2	4.1%	0.1	2.1%
Sinah Common	grassland	1.338	5E-05	0.004%	2.8E-05	0.002%
Southampton Common	woodland*	1.153	0.11	9.5%	0.031	2.7%
The Moors, Bishop's Waltham	woodland*	2.18	0.047	2.2%	0.018	0.83%
The Wild Grounds	woodland*	1.133	0.0052	0.46%	0.0015	0.13%
Trodds Copse	woodland*	1.348	0.0002	0.013%	0.0006	0.045%
Waltham Chase Meadows	grassland	2.18	0.029	1.3%	0.015	0.69%
Warblington Meadow	grassland	1.348	0.0005	0.040%	0.00015	0.011%

*The lowest acid deposition CL has been used. In this case, the lowest CL corresponds to grassland, despite the habitat being designated as woodland.

Table 5-7 Study results: maximum modelled contribution from PUSH development scenarios to airborne NOx at European-designated sites and underlying SSSIs

Site name	PUSH 2034 Do Minimum Scenario			PUSH 2034 Do Something Scenario		
	Maximum road contribution (µg/m³)	Maximum contribution as % of CL	Maximum total concentration (µg/m³)	Maximum road contribution (µg/m³)	Maximum contribution as % of CL	Maximum total concentration (µg/m³)
Chichester and Langstone Harbours (Ramsar & SPA) [a]	4.9	16%	52.2	1.5	5.0%	48.2
Chichester Harbour (underlying SSSI) [a]	0.57	1.9%	23.2	0.00023	0.00077%	N/A
Langstone Harbour (underlying SSSI) [a]	6.4	21%	57.8	1.9	6.2%	53.3
Emer Bog SAC	0.0039	0.013%	N/A	0.0014	0.0046%	N/A
Baddesley Common and Emer Bog (underlying SSSI)	0.0039	0.013%	N/A	0.0014	0.0046%	N/A
Portsmouth Harbour (Ramsar & SPA)	3.9	13%	52.9	2.3	7.6%	51.2
Portsmouth Harbour (underlying SSSI)	3.9	13%	52.9	2.3	7.6%	51.2
River Itchen SAC	2.9	9.7%	70.6	1.4	4.7%	68.2
River Itchen (underlying SSSI)	2.9	9.7%	70.6	1.4	4.7%	68.2
Solent and Southampton Water (Ramsar & SPA) [a]	2.7	9.0%	60.6	1.1	3.8%	60.6
Solent and Isle of Wight Lagoons (underlying SAC)	0.17	0.57%	N/A	0.073	0.24%	N/A
Eling and Bury Marshes (underlying SSSI)	0.62	2.1%	22.7	0.22	0.75%	N/A
Gilkicker Lagoon (underlying SSSI)	0.085	0.28%	N/A	0.073	0.24%	N/A
Lee-on-the Solent to Itchen Estuary (underlying SSSI) [a]	2.7	9.0%	60.6	1.1	3.8%	42.9
Lincegrove and Hackett's Marshes (underlying SSSI) [a]	0.030	0.10%	N/A	0.0028	0.0095%	N/A
Lower Test valley (underlying SSSI)	0.96	3.2%	26.0	0.33	1.11%	25.4
River Test (underlying SSSI)	2.3	7.6%	51.2	0.38	1.26%	49.2
Titchfield Haven (underlying SSSI)	0.31	1.03%	20.0	0.0095	0.032%	N/A
Upper Hamble Estuary and Woods (underlying SSSI) [a]	0.39	1.30%	20.2	0.39	1.32%	20.1
Solent Maritime SAC	12.7	42%	91.6	6.8	23%	85.7

[a] These designated sites also overlap with Solent Maritime SAC

Note that other sites are grouped together if they have overlapping boundaries with different designations

Table 5-8 Study results: maximum modelled contribution from PUSH development scenarios to airborne NOx at standalone SSSIs

Site name	PUSH 2034 Do Minimum Scenario			PUSH 2034 Do Something Scenario		
	Maximum road contribution ($\mu g/m^3$)	Maximum contribution as % of CL	Maximum total concentration ($\mu g/m^3$)	Maximum road contribution ($\mu g/m^3$)	Maximum contribution as % of CL	Maximum total concentration ($\mu g/m^3$)
Botley Wood and Everett's and Mushes Copses	1.5	5.1%	21.5	1.2	3.9%	21.5
Browndown	0.44	1.5%	20.9	0.17	0.56%	N/A
Catherington Down	0.077	0.26%	N/A	0.090	0.30%	N/A
Hook Heath Meadows	0.016	0.054%	N/A	0.017	0.058%	N/A
Lye Heath Marsh	0.058	0.19%	N/A	0.056	0.19%	N/A
Moorgreen Meadows	3.1	10.5%	45.6	0.91	3.0%	42.7
Portsdown	1.9	6.4%	31.3	1.6	5.4%	30.7
Sinah Common	0.0019	0.0063%	N/A	0.0010	0.0033%	N/A
Southampton Common	3.8	13%	35.9	1.0	3.4%	33.1
The Moors, Bishop's Waltham	0.61	2.0%	15.0	0.21	0.70%	N/A
The Wild Grounds	0.089	0.30%	N/A	0.024	0.080%	N/A
Trodds Copse	0.12	0.38%	N/A	0.0019	0.0064%	N/A
Waltham Chase Meadows	0.71	2.4%	15.9	0.30	1.00%	N/A
Warblington Meadow	0.029	0.10%	N/A	0.013	0.04%	N/A

Table 5-9 Study results: maximum modelled contribution from PUSH development scenarios to airborne ammonia (NH_3) at European-designated sites and underlying SSSIs

Site name	Critical level (µg/m³)	Maximum road contribution from PUSH 2034 Do Minimum		Maximum road contribution from PUSH 2034 Do Something	
		in µg/m³	as % of minimum CL	in µg/m³	as % of minimum CL
Chichester and Langstone Harbours (Ramsar & SPA) [a]	3	0.67	22%	0.31	10.4%
Chichester Harbour (underlying SSSI) [a]	3	0.15	5.0%	0.000019	0.00063%
Langstone Harbour (underlying SSSI) [a]	3	0.39	13%	0.31	10.4%
Emer Bog SAC	1	0.00036	0.036%	0.00020	0.020%
Baddesley Common and Emer Bog (underlying SSSI)	1	0.00036	0.036%	0.00020	0.020%
Portsmouth Harbour (Ramsar & SPA)	3	2.0	68%	0.89	30%
Portsmouth Harbour (underlying SSSI)	3	2.0	68%	0.89	30%
River Itchen SAC	3	2.2	72%	0.19	6.3%
River Itchen (underlying SSSI)	3	2.2	72%	0.19	6.3%
Solent and Southampton Water (Ramsar & SPA) [a]	3	0.32	11%	0.094	3.1%
Solent and Isle of Wight Lagoons (underlying SAC)	3 [b]	0.014	0.47%	0.011	0.37%
Eling and Bury Marshes (underlying SSSI)	3	0.10	3.4%	0.031	1.04%
Gilkicker Lagoon (underlying SSSI)	3 [b]	0.00015	0.0049%	0.011	0.37%
Lee-on-the Solent to Itchen Estuary (underlying SSSI) [a]	3	0.32	11%	0.094	3.1%
Lincegrove and Hackett's Marshes (underlying SSSI) [a]	3	0.000033	0.0011%	0.00020	0.0066%
Lower Test valley (underlying SSSI)	3	0.20	6.8%	0.044	1.5%
River Test (underlying SSSI)	3	1.7	55%	0.10	3.3%
Titchfield Haven (underlying SSSI)	3	0.0015	0.051%	0.0011	0.037%
Upper Hamble Estuary and Woods (underlying SSSI) [a]	3	0.052	1.7%	0.058	1.9%
Solent Maritime SAC	3	3.0	100%	0.81	27%

[a] These designated sites also overlap with Solent Maritime SAC

Note that other sites are grouped together if they have overlapping boundaries with different designations

[b] APIS instructs that site-specific guidance should be sought for the NH_3 critical levels for these designated sites; the values included in the table were specified by Natural England.

Table 5-10 Study results: maximum modelled contribution from PUSH development scenarios to airborne ammonia (NH_3) at standalone SSSI sites

Site name	Critical level (µg/m^3)	Maximum road contribution from PUSH 2034 Do Minimum		Maximum road contribution from PUSH 2034 Do Something	
		in µg/m^3	as % of minimum CL	in µg/m^3	as % of minimum CL
Botley Wood and Everett's and Mushes Copses	3	0.21	7.1%	0.18	6.2%
Browndown	1	0.018	1.8%	0.029	2.9%
Catherington Down	3 [a]	0.0045	0.15%	0.0090	0.30%
Hook Heath Meadows	3	0.00067	0.022%	0.0025	0.083%
Lye Heath Marsh	3	0.0070	0.23%	0.010	0.33%
Moorgreen Meadows	3	0.40	13%	0.090	3.0%
Portsdown	3	0.51	17%	0.27	9.1%
Sinah Common	1	0.00010	0.0099%	0.00010	0.010%
Southampton Common	3	0.11	3.7%	0.037	1.2%
The Moors, Bishop's Waltham	3	0.071	2.4%	0.028	0.93%
The Wild Grounds	3	0.0070	0.23%	0.0021	0.069%
Trodds Copse	1 [a]	0.00018	0.018%	0.0012	0.12%
Waltham Chase Meadows	3	0.064	2.1%	0.036	1.2%
Warblington Meadow	3 [a]	0.00089	0.030%	0.00016	0.0054%

[a] APIS instructs that site-specific guidance should be sought for the NH_3 critical levels for these designated sites; the values included in the table were specified by Natural England.

5.2 Spatial analysis of air quality impacts on designated sites

This section comprises the outcome of the assessment described in Section 2.3.5.

For designated sites with maximum modelled pollutant levels exceeding the screening thresholds set out in Section 5.1, the modelled results were mapped onto Priority Habitats Inventory maps obtained from Natural England.[45] This analysis indicates the habitat types (i.e., mudflat, grassland, etc.) within each designated site that are predicted to experience pollutant levels exceeding the screening thresholds.

[45] Natural England Open Data, "Priority Habitat Inventory (South) (England)", https://naturalengland-defra.opendata.arcgis.com/datasets/priority-habitat-inventory-south-england, accessed 12/12/2018.

Table 5-11 Study results: spatial analysis of European-designated sites and underlying SSSIs for PUSH 2034 Do Minimum scenario

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
Chichester and Langstone Harbours (Ramsar & SPA)	woodland	Coastal and floodplain grazing marsh	154	2.0	2.0	1.9	2.0	1.3%	1.3%	1.2%	1.3%
		Coastal saltmarsh	298	4.5	4.1	2.0	3.6	1.5%	1.4%	0.68%	1.2%
		Coastal sand dunes	12	-	-	-	-	-	-	-	-
		Coastal vegetated shingle	11	5.7	5.7	4.8	5.2	53%	53%	44%	48%
		Deciduous woodland	69	3.6	3.6	1.6	3.6	5.2%	5.2%	2.4%	5.2%
		Good quality semi-improved grassland	36	-	-	-	-	-	-	-	-
		Lowland dry acid grassland	10.2	-	-	-	-	-	-	-	-
		Lowland heathland	4.3	-	-	-	-	-	-	-	-
		Lowland meadows	115	41.1	35.8	16.3	29.2	36%	31%	14%	25.3%
		Maritime cliff and slope	0.0089	-	-	-	-	-	-	-	-
		Mudflats	3814	118	84.6*	59.8	56.8	3.1%	2.2%	1.6%	1.5%
		No main habitat	125	11.3	10.1	8.4	7.3	9.0%	8.1%	6.8%	5.8%
		Purple moor grass and rush pastures	16	-	-	-	-	-	-	-	-
		Reedbeds	24	7.1	5.4	0.6	3.5	30%	23%	2.5%	14.7%
		Saline lagoons	22	1.6	1.1	0.2	0.5	7.3%	4.9%	1.1%	2.5%
	grassland	Coastal and floodplain grazing marsh	154	2.0	2.0	same as woodland		1.3%	1.3%	same as woodland	
		Coastal saltmarsh	298	4.2	3.6			1.4%	1.2%		
		Coastal sand dunes	12	-	-			-	-		
		Coastal vegetated shingle	11	5.7	5.4			53%	50%		
		Deciduous woodland	69	3.6	3.6			5.2%	5.2%		
		Good quality semi-improved grassland	36	-	-			-	-		
		Lowland dry acid grassland	10.2	-	-			-	-		

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
		Lowland heathland	4.3	-	-			-	-		
		Lowland meadows	115	37.8	30.9			32.8%	27%		
		Maritime cliff and slope	0.0089	-	-			-	-		
		Mudflats	3814	95.3	63.4			2.5%	1.7%		
		No main habitat	125	10.5	8.7			8.4%	6.9%		
		Purple moor grass and rush pastures	16	-	-			-	-		
		Reedbeds	24	6.1	3.8			26%	16%		
		Saline lagoons	22	1.3	0.7			5.7%	3.0%		
Langstone Harbour (underlying SSSI)	grassland	Coastal and floodplain grazing marsh	17.3	2.1	2.1	2.0	2.0	12%	12%	11%	12%
		Coastal saltmarsh	32	4.2	3.4	2.0	3.6	13%	11%	6.3%	11%
		Coastal sand dunes	4.6×10^{-5}	-	-	-	-	-	-	-	-
		Coastal vegetated shingle	7.0	5.8	5.2	4.8	5.2	83%	75%	69%	75%
		Deciduous woodland	4.0	3.6	3.6	1.6	3.6	90%	90%	41%	90%
		Good quality semi-improved grassland	11.5	-	-	-	-	-	-	-	-
		Lowland meadows	87	42	32	20.3	33	48%	37%	23%	38%
		Mudflats	1825	97	58	61.2	58	5.3%	3.2%	3.4%	3.2%
		No main habitat	47	11.7	8.5	9.5	8.4	25%	18%	20%	18%
		Reedbeds	10.5	6.1	3.4	0.59	3.5	58%	32%	5.6%	33%
		Saline lagoons	5.5	1.3	0.53	0.26	0.57	24%	9.7%	4.7%	10%
Portsmouth Harbour (Ramsar & SPA)	grassland	Coastal and floodplain grazing marsh	0.22	-	-	2.3×10^{-6}	-	-	-	0.0010%	-
		Coastal saltmarsh	22	-	-	-	-	-	-	-	-
		Deciduous woodland	0.61	-	-	-	-	-	-	-	-
		Lowland calcareous grassland	0.032	-	-	-	-	-	-	-	-
		Mudflats	745	66	-	52	60	8.9%	-	6.9%	8.1%
		No main habitat	80	0.24	-	0.14	0.23	0.30%	-	0.17%	0.29%

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
		Saline lagoons	4.7	-	-	-	-	-	-	-	-
Portsmouth Harbour (underlying SSSI)	grassland	Coastal saltmarsh	0.97	-	-	-	-	-	-	-	-
		Deciduous woodland	0.076	-	-	-	-	-	-	-	-
		Mudflats	26	0.0023	17	0.018	6.0×10^{-5}	0.0088%	2.3%	0.069%	0.00023%
		No main habitat	0.12	-	0.12	-	-	-	0.15%	-	-
		Saline lagoons	4.7	-	-	-	-	-	-	-	-
River Itchen SAC	woodland	Coastal and floodplain grazing marsh	128	0.67	2.9**	0.19	0.12	0.52%	2.2%	0.14%	0.10%
		Deciduous woodland	20	0.18	1.1**	0.27	0.10	0.94%	5.4%	1.4%	0.53%
		Good quality semi-improved grassland	9.7	0.0046	3.9**	3.13	0.29	0.047%	40%	32%	3.0%
		Lowland fens	22	4.5×10^{-7}	3.9×10^{-6}**	-	-	2.1×10^{-6} %	1.8×10^{-5} %	-	-
		Lowland meadows	60	2.0	5.4**	1.8	0.055	3.4%	8.9%	3.1%	0.092%
		No main habitat	3.5	0.013	0.013**	0.013	0.0025	0.38%	0.38%	0.38%	0.069%
		Purple moor grass and rush pastures	0.021	-	-	-	-	-	-	-	-
		Reedbeds	1.5	0.038	0.0**	0.018	0.028	2.5%	0.0%	1.2%	1.8%
		Traditional orchard	6.1×10^{-6}	-	-	-	-	-	-	-	-
River Itchen (underlying SSSI)	woodland	Coastal and floodplain grazing marsh	156	1.8	3.2**	0.18	0.12	1.2%	2.1%	0.12%	0.079%
		Deciduous woodland	98	1.1	2.0**	0.28	0.10	1.1%	2.0%	0.28%	0.11%
		Good quality semi-improved grassland	20	0.28	4.3**	3.1	0.29	1.4%	22%	16%	1.5%
		Lowland calcareous grassland	0.045	-	-	-	-	-	-	-	-
		Lowland fens	229	0.36	0.41**	0.042	0.0060	0.16%	0.18%	0.018%	0.0026%
		Lowland meadows	119	2.3	8.4**	4.0	0.19	1.9%	7.1%	3.3%	0.16%
		No main habitat	11	0.19	0.19**	0.013	0.0025	1.7%	1.7%	0.12%	0.022%
		Purple moor grass and rush pastures	19	-	-	-	-	-	-	-	-
		Reedbeds	1.5	-	0.050**	0.016	0.026	-	3.3%	1.0%	1.7%
		Traditional orchard	6.1×10^{-6}	-	-	-	-	-	-	-	-

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
Solent and Southampton Water (Ramsar & SPA)	woodland	Coastal and floodplain grazing marsh	571	4.2	3.8	-	0.28	0.73%	0.67%	-	0.049%
		Coastal saltmarsh	975	15	14*	0.49	1.1	1.6%	1.4%	0.051%	0.11%
		Coastal sand dunes	1.2	-	-	-	-	-	-	-	-
		Coastal vegetated shingle	20	-	-	-	-	-	-	-	-
		Deciduous woodland	186	0.64	0.61	0.065	0.22	0.34%	0.33%	0.035%	0.12%
		Good quality semi-improved grassland	42	2.5	2.4	-	-	6.0%	5.8%	-	-
		Lowland dry acid grassland	25	-	-	-	-	-	-	-	-
		Lowland fens	81	-	-	0.0015	-	-	-	0.0018%	-
		Lowland heathland	4.1	-	-	-	-	-	-	-	-
		Lowland meadows	32	-	-	-	-	-	-	-	-
		Maritime cliff and slope	6.0	-	-	-	-	-	-	-	-
		Mudflats	1609	29	16	9.5	9.8	1.8%	0.97%	0.59%	0.61%
		No main habitat	462	7.8	7.3	0.76	1.7	1.7%	1.6%	0.16%	0.36%
		Purple moor grass and rush pastures	3.3	-	-	-	-	-	-	-	-
		Reedbeds	123	1.2	1.2	-	0.55	1.0%	1.0%	-	0.45%
		Saline lagoons	57	-	-	-	-	-	-	-	-
		Traditional orchard	0.43	-	-	-	-	-	-	-	-
	grassland	Coastal and floodplain grazing marsh	571	2.3	1.8	same as woodland		0.40%	0.32%	same as woodland	
		Coastal saltmarsh	975	8.8	7.5			0.90%	0.76%		
		Coastal sand dunes	1.2	-	-			-	-		
		Coastal vegetated shingle	20	-	-			-	-		
		Deciduous woodland	186	0.46	0.46			0.25%	0.25%		
		Good quality semi-improved grassland	42	1.8	1.6			4.1%	3.9%		

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
		Lowland dry acid grassland	25	-	-			-	-		
		Lowland fens	81	-	-			-	-		
		Lowland heathland	4.1	-	-			-	-		
		Lowland meadows	32	-	-			-	-		
		Maritime cliff and slope	6.0	-	-			-	-		
		Mudflats	1609	22	10.8			1.4%	0.67%		
		No main habitat	462	4.8	4.2			1.0%	0.92%		
		Purple moor grass and rush pastures	3.3	-	-			-	-		
		Reedbeds	123	1.2	1.2			1.0%	1.0%		
		Saline lagoons	57	-	-			-	-		
		Traditional orchard	0.43	-	-			-	-		
Eling and Bury Marshes (underlying SSSI)	woodland	Coastal saltmarsh	20	0.017	0.015	0.014	0.014	0.085%	0.073%	0.068%	0.068%
		Deciduous woodland	13	-	-	-	-	-	-	-	-
		Mudflats	63	7.0	4.1	1.7	4.2	11%	6.5%	2.7%	6.7%
		No main habitat	14	0.022	0.022	0.022	0.022	0.16%	0.16%	0.16%	0.16%
Lee-on-the Solent to Itchen Estuary (underlying SSSI)	grassland	Coastal and floodplain grazing marsh	31	-	-	-	-	-	-	-	-
		Coastal saltmarsh	18	-	-	-	-	-	-	-	-
		Coastal vegetated shingle	2.5	-	-	-	-	-	-	-	-
		Deciduous woodland	16	-	-	-	-	-	-	-	-
		Good quality semi-improved grassland	1.3×10^{-5}	-	-	-	-	-	-	-	-
		Lowland dry acid grassland	0.016	-	-	-	-	-	-	-	-
		Lowland fens	0.021	-	-	-	-	-	-	-	-
		Lowland heathland	9.1	-	-	-	-	-	-	-	-
		Maritime cliff and slope	1.9	-	-	-	-	-	-	-	-
		Mudflats	367	4.7	-	7.6	4.9	1.3%	-	2.1%	1.3%

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
		No main habitat	27	-	-	-	-	-	-	-	-
		Reedbeds	3.5	-	-	-	-	-	-	-	-
		Saline lagoons	2.2	-	-	-	-	-	-	-	-
Lower Test valley (underlying SSSI)	grassland	Coastal and floodplain grazing marsh	36	0.53	0.42	-	0.28	1.5%	1.2%	-	0.77%
		Coastal saltmarsh	46	1.1	0.93	0.38	0.83	2.3%	2.0%	0.83%	1.8%
		Deciduous woodland	0.61	-	-	-	-	-	-	-	-
		Good quality semi-improved grassland	26	0.044	-	-	-	0.17%	-	-	-
		Mudflats	3.4	0.91	0.84	0.31	0.73	27%	25%	9.3%	22%
		No main habitat	12	1.7	1.7	0.73	1.6	14%	13%	5.9%	13%
		Reedbeds	8.0	0.80	0.73	-	0.55	10.0%	9.1%	-	6.8%
River Test (underlying SSSI)	woodland	Coastal and floodplain grazing marsh	43	0.60	0.59	0.056	9.0×10^{-7}	1.4%	1.4%	0.13%	2.1×10^{-6} %
		Deciduous woodland	124	0.19	0.19	0.14	-	0.15%	0.15%	0.12%	-
		Good quality semi-improved grassland	1.2	2.3×10^{-6}	3.0×10^{-8}	2.3×10^{-6}	3.9×10^{-7}	0.00019%	2.4×10^{-6}%	0.00019 %	0.000032 %
		Lowland calcareous grassland	0.0031	-	-	-	-	-	-	-	-
		Lowland fens	124	-	-	-	-	-	-	-	-
		Lowland meadows	16	-	-	-	-	-	-	-	-
		No main habitat	11	0.12	0.12	-	-	1.0%	1.1%	-	-
		Purple moor grass and rush pastures	0.29	-	-	-	-	-	-	-	-
		Reedbeds	0.70	-	-	-	-	-	-	-	-
		Traditional orchard	0.044	-	-	-	-	-	-	-	-
Upper Hamble Estuary and Woods (underlying SSSI)	woodland	Coastal and floodplain grazing marsh	0.94	1.6×10^{-9}	-	-	-	1.7×10^{-7} %	-	-	-
		Coastal saltmarsh	13	0.72	0.50**	-	0.26	5.4%	3.5%	-	1.9%
		Deciduous woodland	82	0.49	0.41**	-	0.19	0.61%	0.50%	-	0.24%
		Good quality semi-improved grassland	1.9	-	-	-	-	-	-	-	-

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
		Mudflats	26	1.9	0.48**	-	0.18	7.2%	1.8%	-	0.69%
		No main habitat	22	1.6	0.37**	-	0.022	7.4%	1.7%	-	0.10%
		Reedbeds	0.69	0.082	-	-	-	12%	-	-	-
Solent Maritime SAC	woodland	Coastal and floodplain grazing marsh	33	1.8	2.9	0.041	0.020	5.4%	8.6%	0.12%	0.061%
		Coastal saltmarsh	1188	13	17	2.5	4.3	1.1%	1.4%	0.21%	0.36%
		Coastal sand dunes	6.6	-	-	-	-	-	-	-	-
		Coastal vegetated shingle	17	-	-	-	-	-	-	-	-
		Deciduous woodland	93	0.019	0.46	0.065	5.7×10^{-5}	0.021%	0.49%	0.07%	6.1×10^{-7} %
		Good quality semi-improved grassland	22	-	-	-	-	-	-	-	-
		Lowland fens	0.052	-	-	-	-	-	-	-	-
		Lowland meadows	2.6	1.3×10^{-7}	4.2×10^{-7}	1.3×10^{-7}	1.3×10^{-7}	4.9×10^{-8} %	1.6×10^{-5} %	4.9×10^{-8} %	4.9×10^{-8} %
		Maritime cliff and slope	4.4	-	-	-	-	-	-	-	-
		Mudflats	4992	43	94	63	26	0.87%	1.9%	1.3%	0.52%
		No main habitat	395	4.6	18	9.2	2.3	1.2%	4.7%	2.3%	0.58%
		Reedbeds	27	0.99	1.1	0.0066	0.55	3.6%	3.9%	0.024%	2.0%
		Saline lagoons	3.3	-	-	-	-	-	-	-	-
	grassland	Coastal and floodplain grazing marsh	33	0.86	0.45	same as woodland		2.6%	1.4%	same as woodland	
		Coastal saltmarsh	1188	9.7	11			0.82%	0.97%		
		Coastal sand dunes	6.6	-	-			-	-		
		Coastal vegetated shingle	17	-	-			-	-		
		Deciduous woodland	93	5.7×10^{-5}	0.45			6.1E-07	0.49%		
		Good quality semi-improved grassland	22	1.7	-			7.5%	-		
		Lowland fens	0.052	-	-			-	-		
		Lowland meadows	2.6	1.3×10^{-7}	4.2×10^{-7}			4.9×10^{-8} %	1.6×10^{-5} %		

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
		Maritime cliff and slope	4.4	-	-			-	-		
		Mudflats	4992	34	101			0.68%	2.0%		
		No main habitat	395	3.5	12			0.89%	3.1%		
		Reedbeds	27	0.99	1.0			3.6%	3.7%		
		Saline lagoons	3.3	-	-			-	-		

*Ramsar exceedance area used if this area was greater than the area of exceedance for the SPA.

**The lowest acid deposition CL has been used. In this case, the lowest CL corresponds to grassland, despite the habitat being designated as woodland.

Table 5-12 Study results: spatial analysis of standalone SSSIs for PUSH 2034 Do Minimum scenario

Site name	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
			Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
Botley Wood and Everett's and Mushes Copses	Deciduous woodland	239	27.9	4.8	2.9	6.0	11.7%	2.0%	1.2%	2.5%
	No main habitat	42	-	-	-	-	-	-	-	-
	Semi-improved grassland	2.1	-	-	-	-	-	-	-	-
Browndown	Coastal vegetated shingle	6.1×10^{-4}	-	-	-	-	-	-	-	-
	Deciduous woodland	1.08	-	-	-	-	-	-	-	-
	Lowland dry acid grassland	0.32	-	-	-	-	-	-	-	-
	Lowland heathland	38.03	-	-	-	-	-	-	-	-
	No main habitat	16.96	0.0037	0.00078	-	0.0046	0.022%	0.0046%	-	0.027%
	Semi-improved grassland	8.3×10^{-5}	-	-	-	-	-	-	-	-
Catherington Down	Deciduous woodland	3.1	-	0.030	-	-	-	0.97%	-	-
	Lowland calcareous grassland	9.7	-	0.026	-	-	-	0.26%	-	-

Site name	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
			Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
Moorgreen Meadows	Deciduous woodland	6.3	4.7	2.3	2.9	1.9	74%	37%	46%	30%
	Lowland meadows	3.8	2.6	1.1	1.1	1.0	67%	28%	28%	27%
	No main habitat	1.7	1.2	1.0	1.1	0.93	72%	61%	65%	55%
	Semi-improved grassland	1.3	1.3	1.3	1.3	1.3	99%	99%	99%	99%
Portsdown	Deciduous woodland	3.9	-	-	0.33	-	-	-	8.5%	-
	Lowland calcareous grassland	61.5	17.5	5.4	20.3	16.3	28.5%	8.8%	33.0%	26.5%
	No main habitat	0.36	5.3×10^{-5}	-	0.13	5.3×10^{-5}	0.015%	-	36.5%	0.015%
Southampton Common	Deciduous woodland	56	18	17**	21	4.6	33%	31%	37%	8.3%
	Lowland heathland	0.010	N/A	-	-	-	-	-	-	-
	Lowland meadows	7.5	N/A	-	-	-	-	-	-	-
	No main habitat	23	6.0	5.4**	6.4	0.54	26%	23%	28%	2.3%
The Moors, Bishop's Waltham	Deciduous woodland	10.2	0.0071	-	-	-	0.070%	-	-	-
	Good quality semi-improved grassland	0.013	0.0071	-	-	-	0.069%	-	-	-
	Lowland fens	5.8	-	0.10**	-	-	-	1.7%	-	-
	Lowland meadows	2.2	0.59	0.030**	-	-	10%	1.4%	-	-
	No main habitat	0.65	0.96	0.020**	-	-	44%	3.1%	-	-
	Purple moor grass and rush pastures	6.6	0.50	0.010**	-	-	77%	15%	-	-
Waltham Chase Meadows	Lowland meadows	6.2	0.057	0.010	0.086	0.0085	0.91%	0.17%	1.4%	0.14%

**The lowest acid deposition CL has been used. In this case, the lowest CL corresponds to grassland, despite the habitat being designated as woodland.

Table 5-13 Study results: spatial analysis of European-designated sites and underlying SSSIs for PUSH 2034 Do Something scenario

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
Chichester and Langstone Harbours (Ramsar & SPA)	woodland	Coastal and floodplain grazing marsh	154	2.0	2.0	0.086	2.0	1.3%	1.3%	0.056%	1.3%
		Coastal saltmarsh	298	4.0	3.0	0.39	2.1	1.3%	1.0%	0.13%	0.71%
		Coastal sand dunes	12	-	-	-	-	-	-	-	-
		Coastal vegetated shingle	11	5.7	4.9	-	2.8	52%	45%	-	26%
		Deciduous woodland	69	3.6	2.8	0.018	1.6	5.2%	4.1%	0.026%	2.3%
		Good quality semi-improved grassland	36	-	-	-	-	-	-	-	-
		Lowland dry acid grassland	10.2	-	-	-	-	-	-	-	-
		Lowland heathland	4.3	-	-	-	-	-	-	-	-
		Lowland meadows	115	34	24	0.42	15	29%	21%	0.37%	13%
		Maritime cliff and slope	0.0089	-	-	-	-	-	-	-	-
		Mudflats	3814	83	47	6.7	22	2.2%	1.2%	0.17%	0.59%
		No main habitat	125	8.8	4.6	1.3	2.1	7.1%	3.7%	1.0%	1.7%
		Purple moor grass and rush pastures	16	-	-	-	-	-	-	-	-
		Reedbeds	24	4.8	2.7	-	0.34	20%	11%	-	1.4%
		Saline lagoons	22	0.91	0.47	-	0.20	4.1%	2.1%	-	0.90%
	grassland	Coastal and floodplain grazing marsh	154	2.0	2.0	same as woodland		1.3%	1.3%	same as woodland	
		Coastal saltmarsh	298	3.4	2.2			1.1%	0.75%		
		Coastal sand dunes	12	-	-			-	-		
		Coastal vegetated shingle	11	5.2	3.2			48%	29%		
		Deciduous woodland	69	3.5	1.7			5.1%	2.5%		
		Good quality semi-improved grassland	36	-	-			-	-		
		Lowland dry acid grassland	10.2	-	-			-	-		

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
		Lowland heathland	4.3	-	-			-	-		
		Lowland meadows	115	28	16			25%	14%		
		Maritime cliff and slope	0.0089	-	-			-	-		
		Mudflats	3814	58	27			1.5%	0.70%		
		No main habitat	125	5.7	2.8			4.5%	2.3%		
		Purple moor grass and rush pastures	16	-	-			-	-		
		Reedbeds	24	3.3	0.68			14%	2.9%		
		Saline lagoons	22	0.52	0.23			2.3%	1.0%		
Langstone Harbour (underlying SSSI)	grassland	Coastal and floodplain grazing marsh	17.3	2.0	2.0	0.088	2.0	12%	12%	0.51%	12%
		Coastal saltmarsh	32	3.4	1.8	0.39	2.1	10.5%	5.7%	1.2%	6.6%
		Coastal sand dunes	4.6×10^{-5}	-	-	-	-	-	-	-	-
		Coastal vegetated shingle	7.0	5.2	2.2	0.00070	2.0	75%	32%	0.010%	29%
		Deciduous woodland	4.0	3.5	1.2	0.018	1.6	88%	30%	0.45%	40%
		Good quality semi-improved grassland	11.5	-	-	-	-	-	-	-	-
		Lowland meadows	87	32	17	2.4	19	37%	19%	2.7%	22%
		Mudflats	1825	60	21	7.8	24	3.3%	1.1%	0.43%	1.3%
		No main habitat	47	6.8	3.2	2.2	3.2	14.5%	6.9%	4.73%	6.9%
		Reedbeds	10.5	3.3	0.011	-	0.34	31%	0.10%	-	3.2%
		Saline lagoons	5.5	0.54	0.14	0.0036	0.22	9.9%	2.5%	0.066%	4.0%
Portsmouth Harbour (Ramsar & SPA)	grassland	Coastal and floodplain grazing marsh	0.22	-	-	-	-	-	-	-	-
		Coastal saltmarsh	22	-	-	-	-	-	-	-	-
		Deciduous woodland	0.61	-	-	-	-	-	-	-	-
		Lowland calcareous grassland	0.032	-	-	-	-	-	-	-	-
		Mudflats	745	53	-	14	51	7.2%	-	1.9%	6.8%
		No main habitat	80	0.20	-	0.11	0.18	0.25%	-	0.13%	0.22%

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
		Saline lagoons	4.7	-	-	-	-	-	-	-	-
Portsmouth Harbour (underlying SSSI)	grassland	Coastal saltmarsh	0.97	-	-	-	-	-	-	-	-
		Deciduous woodland	0.076	-	-	-	-	-	-	-	-
		Mudflats	26	0.044	7.6	0.043	0.0038	0.17%	1.0%	0.17%	0.015%
		No main habitat	0.12	-	0.12	-	-	-	0.14%	-	-
		Saline lagoons	4.7	-	-	-	-	-	-	-	-
River Itchen SAC	woodland	Coastal and floodplain grazing marsh	128	1.8	0.60**	0.022	1.9	1.4%	0.47%	0.017%	1.5%
		Deciduous woodland	20	1.1	0.82**	0.072	0.63	5.8%	4.2%	0.37%	3.2%
		Good quality semi-improved grassland	9.7	3.9	3.8**	-	3.9	40%	39%	-	40%
		Lowland fens	22	4.5×10^{-7}	2.2×10^{-6}**	-	-	2.1×10^{-6} %	1.0×10^{-5} %	-	-
		Lowland meadows	60	3.2	2.3**	-	4.3	5.2%	3.8%	-	7.2%
		No main habitat	3.5	0.013	0.013**	-	0.013	0.38%	0.38%	-	0.38%
		Purple moor grass and rush pastures	0.021	-	-	-	-	-	-	-	-
		Reedbeds	1.5	0.36	0.17**	0.029	0.00036	24%	11%	1.9%	0.024%
		Traditional orchard	6.1×10^{-6}	-	-	-	-	-	-	-	-
River Itchen (underlying SSSI)	woodland	Coastal and floodplain grazing marsh	156	1.8	2.2**	0.021	1.9	1.2%	1.4%	0.013%	1.2%
		Deciduous woodland	98	2.0	2.1**	0.071	1.0	2.0%	2.1%	0.072%	1.1%
		Good quality semi-improved grassland	20	3.9	3.9**	0.0023	3.9	20%	20%	0.011%	20%
		Lowland calcareous grassland	0.045	-	-	-	-	-	-	-	-
		Lowland fens	229	0.29	0.35**	0.0073	0.016	0.12%	0.15%	0.0032%	0.0070%
		Lowland meadows	119	4.7	5.5**	0.074	4.4	3.9%	4.6%	0.062%	3.7%
		No main habitat	11	0.19	0.19**	-	0.065	1.7%	1.7%	-	0.58%
		Purple moor grass and rush pastures	19	-	-	-	-	-	-	-	-
		Reedbeds	1.5	0.36	0.54**	0.027	0.00015	23%	35%	1.8%	0.010%
		Traditional orchard	6.1×10^{-6}	-	-	-	-	-	-	-	-

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
Solent and Southampton Water (Ramsar & SPA)	woodland	Coastal and floodplain grazing marsh	571	0.23	4.2×10^{-6}	-	-	0.040%	7.0×10^{-7} %	-	-
		Coastal saltmarsh	975	1.3	1.2	-	0.0045	0.13%	0.13%	-	0.00046 %
		Coastal sand dunes	1.2	-	-	-	-	-	-	-	-
		Coastal vegetated shingle	20	-	-	-	-	-	-	-	-
		Deciduous woodland	186	1.9	1.5	-	-	1.0%	0.83%	-	-
		Good quality semi-improved grassland	42	1.2×10^{-6}	-	-	-	2.9×10^{-6} %	-	-	-
		Lowland dry acid grassland	25	-	-	-	-	-	-	-	-
		Lowland fens	81	-	-	-	-	-	-	-	-
		Lowland heathland	4.1	-	-	-	-	-	-	-	-
		Lowland meadows	32	-	-	-	-	-	-	-	-
		Maritime cliff and slope	6.0	-	-	-	-	-	-	-	-
		Mudflats	1609	15	13	1.3	0.94	0.94%	0.82%	0.083%	0.058%
		No main habitat	462	3.1	2.0	0.016	0.13	0.67%	0.43%	0.0034 %	0.027%
		Purple moor grass and rush pastures	3.3	-	-	-	-	-	-	-	-
		Reedbeds	123	0.44	0.24	-	-	0.36%	0.20%	-	-
		Saline lagoons	57	0.12	0.069*	-	-	0.21%	0.12%	-	-
		Traditional orchard	0.43	-	-	-	-	-	-	-	-
	grassland	Coastal and floodplain grazing marsh	571	-	-	same as woodland		-	-	same as woodland	
		Coastal saltmarsh	975	0.88	0.76			0.091%	0.078%		
		Coastal sand dunes	1.2	-	-			-	-		
		Coastal vegetated shingle	20	-	-			-	-		

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
		Deciduous woodland	186	0.41	0.33			0.22%	0.18%		
		Good quality semi-improved grassland	42	-	-			-	-		
		Lowland dry acid grassland	25	-	-			-	-		
		Lowland fens	81	-	-			-	-		
		Lowland heathland	4.1	-	-			-	-		
		Lowland meadows	32	-	-			-	-		
		Maritime cliff and slope	6.0	-	-			-	-		
		Mudflats	1609	7.5	6.3			0.47%	0.39%		
		No main habitat	462	1.6	1.4			0.35%	0.30%		
		Purple moor grass and rush pastures	3.3	-	-			-	-		
		Reedbeds	123	-	-			-	-		
		Saline lagoons	57	-	-			-	-		
		Traditional orchard	0.43	-	-			-	-		
Eling and Bury Marshes (underlying SSSI)	woodland	Coastal saltmarsh	20	0.013	0.00062	-	0.010	0.065%	0.031%	-	0.048%
		Deciduous woodland	13	-	-	-	-	-	-	-	-
		Mudflats	63	1.1	1.3×10^{-6}	-	0.0010	1.7%	2.1×10^{-6}%	-	0.0016%
		No main habitat	14	0.022	-	-	-	0.16%	-	-	-
Lee-on-the Solent to Itchen Estuary (underlying SSSI)	grassland	Coastal and floodplain grazing marsh	31	-	-	-	-	-	-	-	-
		Coastal saltmarsh	18	-	-	-	-	-	-	-	-
		Coastal vegetated shingle	2.5	-	-	-	-	-	-	-	-
		Deciduous woodland	16	-	-	-	-	-	-	-	-
		Good quality semi-improved grassland	1.3×10^{-5}	-	-	-	-	-	-	-	-
		Lowland dry acid grassland	0.016	-	-	-	-	-	-	-	-
		Lowland fens	0.021	-	-	-	-	-	-	-	-
		Lowland heathland	9.1	-	-	-	-	-	-	-	-

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
		Maritime cliff and slope	1.9	-	-	-	-	-	-	-	-
		Mudflats	367	0.85	-	1.3	0.93	0.23%	-	0.36%	0.25%
		No main habitat	27	-	-	-	-	-	-	-	-
		Reedbeds	3.5	-	-	-	-	-	-	-	-
		Saline lagoons	2.2	-	-	-	-	-	-	-	-
Lower Test valley (underlying SSSI)	grassland	Coastal and floodplain grazing marsh	36	-	-	-	-	-	-	-	-
		Coastal saltmarsh	46	0.0021	0.0030	-	-	0.0045%	0.0065%	-	-
		Deciduous woodland	0.61	-	-	-	-	-	-	-	-
		Good quality semi-improved grassland	26	-	-	-	-	-	-	-	-
		Mudflats	3.4	0.044	0.042	-	-	1.3%	1.2%	-	-
		No main habitat	12	0.15	0.13	0.0041	0.68	1.2%	1.0%	0.033%	5.4%
		Reedbeds	8.0	-	-	-	-	-	-	-	-
River Test (underlying SSSI)	woodland	Coastal and floodplain grazing marsh	43	0.057	0.056	-	0.31	0.13%	0.13%	-	0.72%
		Deciduous woodland	124	0.156	0.19	-	0.19	0.13%	0.15%	-	0.15%
		Good quality semi-improved grassland	1.2	2.3×10^{-6}	3.0×10^{-8}	-	2.3×10^{-6}	0.00019%	2.4×10^{-6}%	-	0.00019%
		Lowland calcareous grassland	0.0031	-	-	-	-	-	-	-	-
		Lowland fens	124	-	-	-	-	-	-	-	-
		Lowland meadows	16	-	-	-	-	-	-	-	-
		No main habitat	11	-	-	-	-	-	-	-	-
		Purple moor grass and rush pastures	0.29	-	-	-	-	-	-	-	-
		Reedbeds	0.70	-	-	-	-	-	-	-	-
		Traditional orchard	0.044	-	-	-	-	-	-	-	-
Upper Hamble Estuary and Woods	woodland	Coastal and floodplain grazing marsh	0.94	-	-	-	-	-	-	-	-
		Coastal saltmarsh	13	0.52	0.15**	-	-	3.9%	1.0%	-	-
		Deciduous woodland	82	0.91	0.10**	-	-	1.1%	0.12%	-	-

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
(underlying SSSI)		Good quality semi-improved grassland	1.9	-	-	-	-	-	-	-	-
		Mudflats	26	0.60	0.13**	-	0.0026	2.3%	0.48%	-	0.010%
		No main habitat	22	1.1	0.26**	-	0.056	5.1%	1.2%	-	0.25%
		Reedbeds	0.69	-	-	-	-	-	-	-	-
Solent Maritime SAC	woodland	Coastal and floodplain grazing marsh	33	0.27	0.039	0.00036	0.0096	0.81%	0.12%	0.0011%	0.029%
		Coastal saltmarsh	1188	5.3	5.1	0.39	2.1	0.45%	0.43%	0.033%	0.18%
		Coastal sand dunes	6.6	-	-	-	-	-	-	-	-
		Coastal vegetated shingle	17	-	-	-	-	-	-	-	-
		Deciduous woodland	93	1.91	1.6	-	-	2.1%	1.7%	-	-
		Good quality semi-improved grassland	22	-	-	-	-	-	-	-	-
		Lowland fens	0.052	-	-	-	-	-	-	-	-
		Lowland meadows	2.6	1.3×10^{-7}	4.2×10^{-7}	1.3×10^{-7}	1.3×10^{-7}	4.9×10^{-6} %	1.6×10^{-5} %	4.9×10^{-6} %	4.9×10^{-6} %
		Maritime cliff and slope	4.4	-	-	-	-	-	-	-	-
		Mudflats	4992	90	85	7.8	24	1.8%	1.7%	0.16%	0.48%
		No main habitat	395	12	11	2.3	1.9	3.1%	2.7%	0.59%	0.48%
		Reedbeds	27	0.44	0.27	-	-	1.6%	0.97%	-	-
		Saline lagoons	3.3	-	-	-	-	-	-	-	-
	grassland	Coastal and floodplain grazing marsh	33	0.041	0.039	same as woodland		0.12%	0.12%	same as woodland	
		Coastal saltmarsh	1188	4.3	4.1			0.36%	0.34%		
		Coastal sand dunes	6.6	-	-			-	-		
		Coastal vegetated shingle	17	-	-			-	-		
		Deciduous woodland	93	0.41	0.33			0.44%	0.36%		
		Good quality semi-improved grassland	22	-	-			-	-		
		Lowland fens	0.052	-	-			-	-		

Site name	Grassland or woodland	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
				Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
		Lowland meadows	2.6	1.3×10^{-7}	4.2×10^{-7}			4.9×10^{-6} %	1.6×10^{-5} %		
		Maritime cliff and slope	4.4	-	-			-	-		
		Mudflats	4992	63	58			1.3%	1.2%		
		No main habitat	395	7.7	6.9			1.9%	1.7%		
		Reedbeds	27	-	-			-	-		
		Saline lagoons	3.3	-	-			-	-		

*Ramsar exceedance area used if this area was greater than the area of exceedance for the SPA.
**The lowest acid deposition CL has been used. In this case, the lowest CL corresponds to grassland, despite the habitat being designated as woodland.

Table 5-14 Study results: spatial analysis of standalone SSSIs for PUSH 2034 Do Something scenario

Site name	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
			Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
Botley Wood and Everett's and Mushes Copses	Deciduous woodland	239	23	3.2	22.9	4.6	9.4%	1.3%	9.6%	1.9%
	No main habitat	42	0.047	-	0.031	-	0.11%	-	0.074%	-
	Semi-improved grassland	2.1	-	-	-	-	-	-	-	-
Browndown	Coastal vegetated shingle	6.1×10^{-4}	-	-	-	-	-	-	-	-
	Deciduous woodland	1.08	-	-	-	-	-	-	-	-
	Lowland dry acid grassland	0.32	-	-	-	-	-	-	-	-
	Lowland heathland	38.03	-	-	-	-	-	-	-	-
	No main habitat	16.96	0.17	0.0054	-	0.65	0.99%	0.032%	-	3.8%
	Semi-improved grassland	8.3×10^{-5}	-	-	-	-	-	-	-	-
Catherington Down	Deciduous woodland	3.1	-	2.0	-	-	-	64%	-	-
	Lowland calcareous grassland	9.7	-	1.0	-	-	-	11%	-	-
Moorgreen Meadows	Deciduous woodland	6.3	4.6	0.51	0.031	0.35	74%	8.1%	0.49%	5.6%
	Lowland meadows	3.8	2.3	-	-	-	61%	-	-	-

Site name	Broad habitat type	Total area (hectares)	Number of hectares affected by exceedance of screening threshold				Percentage (by area) of broad habitat affected by exceedance of screening threshold			
			Nitrogen deposition	Acid deposition	NOx	NH_3	Nitrogen deposition	Acid deposition	NOx	NH_3
	No main habitat	1.7	1.7	0.28	0.074	0.14	99%	16%	4.4%	8.4%
	Semi-improved grassland	1.3	1.3	-	-	-	99%	-	-	-
Portsdown	Deciduous woodland	3.9	0.24	-	0.066	0.14	6.2%	-	1.7%	3.5%
	Lowland calcareous grassland	61.5	31.7	1.3	8.2	25.0	52%	2.2%	13%	41%
	No main habitat	0.36	5.3×10^{-5}	-	1.0×10^{-3}	5.3×10^{-5}	0.015%	-	0.29%	0.015%
Southampton Common	Deciduous woodland	56	3.5	2.8**	3.4	-	6.2%	5.1%	6.1%	-
	Lowland heathland	0.010	-	-	-	-	-	-	-	-
	Lowland meadows	7.5	-	-	-	-	-	-	-	-
	No main habitat	23	0.49	0.45**	0.37	0.0070	2.1%	1.9%	1.6%	0.030%
The Moors, Bishop's Waltham	Deciduous woodland	10.2	-	3.8	-	-	-	38%	-	-
	Good quality semi-improved grassland	0.013	-	-	-	-	-	-	-	-
	Lowland fens	5.8	0.12	-	-	-	2.0%	-	-	-
	Lowland meadows	2.2	0.20	-	-	-	9.0%	-	-	-
	No main habitat	0.65	0.052	-	-	-	8.0%	-	-	-
	Purple moor grass and rush pastures	6.6	0.0067	-	-	-	0.10%	-	-	-
Waltham Chase Meadows	Lowland meadows	6.2	0.00017	-	-	0.067	0.0028%	-	-	1.1%

**The lowest acid deposition CL has been used. In this case, the lowest CL corresponds to grassland, despite the habitat being designated as woodland.

5.3 Results summary by designated site

5.3.1 Chichester and Langstone Harbours (Ramsar & SPA), Chichester Harbour (SSSI) and Langstone Harbour (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-15.

Note that these designated sites (Chichester and Langstone Harbours (Ramsar & SPA), Chichester Harbour (SSSI) and Langstone Harbour (SSSI)) overlap with each other as well as with Solent Maritime (SAC).

Table 5-15: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Chichester and Langstone Harbours (Ramsar, SPA and SSSIs)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Havant Road [a]	Central	47	-
Langstone Road A3023 [a]	Central	47	-
A27 [b]	North	96	96
A2030 [b]	West	71	69
Ferry Road [b]	South West	30	30

[a] These roads influence areas exceeding the screening thresholds at Chichester Harbour.

[b] These roads influence areas exceeding the screening thresholds at Langstone Harbour

Havant Road and Langstone Road A3023 do not contribute to exceedances of the CLs under the 2034 Do Something scenario, and consequently the average speeds are not provided for that scenario.

Chichester and Langstone Harbours (Ramsar & SPA):

Qualifying and notifiable features associated with this site include: Aggregations of breeding and non-breeding birds, wetland types (including tidal flats, salt, freshwater and brackish marshes), unimproved permanent pasture including scarce species such as: green-winged orchid *Orchis morio* and adders tongue *Ophioglossum vulgatum*, notable invertebrates including the long-winged conehead *Conocephalus discolour* and the moths, starwort shark *Cucullia asteris*, the sand dart *Agrotis ripae*, shore wainscot *Mythimna litoralis* and lunar horent *Sphecia bemeciformis*, higher plants *Polypogon monspeliensis, Zostera angustifolia, Zostera marina* and *Zostera noleti*.

2034 Do Minimum model results:

All four pollutants exceeded the 1% screening threshold, with similar exceedances across all pollutants. Multiple broad habitat types are affected by the exceedances, including coastal vegetated shingle, lowland meadows, reedbeds and saline lagoons. Approximately 125 ha of the site has been assigned as "No main habitat". The PHI data set indicates with low confidence that this habitat could be assigned as a mixture of coastal saltmarsh, coastal vegetated shingle, mudflat, saline lagoon and reedbeds.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and therefore an HRA Stage 2 appropriate assessment will be required to inform the respective local plans.

2034 Do Something model results:

All four pollutants are predicted to exceed the 1% threshold, though to a lesser degree than in the 2034 Do Minimum scenario. The greatest exceedances are related to acid deposition and nitrogen deposition. Multiple broad habitat types are affected by the exceedances, including coastal vegetated shingle, lowland meadows, reedbeds and saline lagoons.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and therefore an HRA Stage 2 appropriate assessment will be required to inform the respective local plans.

Chichester Harbour (SSSI):

Notifiable features associated with this site include: large numbers of breeding and over-wintering birds, wetland types (including tidal flats, salt, freshwater and brackish marshes), unimproved permanent pasture including scarce species such as: green-winged orchid *Orchis morio* and adders tongue *Ophioglossum vulgatu*, notable invertebrates including the long-winged conehead *Conocephalus discolour* and the moths, starwort shark *Cucullia asteris*, the sand dart *Agrotis ripae*, shore wainscot *Mythimna litoralis* and lunar horent *Sphecia bemeciformisand*, higher plants *Polypogon monspeliensis*, *Zostera angustifolia*, *Zostera marina* and *Zostera noleti*.

2034 Do Minimum model results:

All four pollutants exceeded the 1% screening threshold, with exceedances related to all pollutants. Broad habitat types affected by the exceedances include coastal saltmarsh, mudlfats, reedbeds, and “no main habitat”. The PHI data set indicates with low confidence that this “no main habitat” could be assigned as a mixture of coastal saltmarsh and mudflat.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

None of the pollutants exceed the 1% screening threshold in this scenario.

On the basis of available evidence and agreed thresholds, there are no likely significant effects on this SSSI, and therefore no further SSSI-specific assessment is required.

Langstone Harbour (SSSI):

Notifiable features associated with this site include: aggregations of breeding and non-breeding birds, wetland types (including tidal flats, salt, freshwater and brackish marshes), unimproved permanent pasture including scarce species such as: green-winged orchid *Orchis morio* and adders tongue *Ophioglossum vulgatum*, notable invertebrates including the long-winged conehead *Conocephalus discolour* and the moths, starwort shark *Cucullia asteris*, the sand dart *Agrotis ripa*e, shore wainscot *Mythimna literal*is and lunar horent *Sphecia bem*eciformis, higher plants *Polypogon monspeliensis*, *Zostera angustifolia*, *Zostera marin*a and *Zostera noleti*.

2034 Do Minimum model results:

All four pollutants exceeded the 1% screening threshold, with the greatest exceedances related to nitrogen deposition, NOx and acid deposition. Multiple broad habitat types are affected by the exceedances, including coastal vegetated shingle, deciduous woodland, lowland meadows, reedbeds and saline lagoons. Approximately 47 ha of the site has been assigned as "No main habitat". The PHI data set indicates with low confidence that this habitat could be assigned as a mixture of coastal saltmarsh, coastal vegetated shingle, mudflat, saline lagoon and reedbeds.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

All four pollutants are predicted to exceed the 1% threshold, though to a lesser degree than in the 2034 Do Minimum scenario. The greatest exceedances related to nitrogen deposition, ammonia and acid deposition.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.2 Emer Bog (SAC) and Baddesley Common and Emer Bog (SSSI)

Model results are mapped in Appendix 3.

Emer Bog (SAC):

This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects of the proposed development on this European site, and therefore no further HRA stages are required for air quality impacts.

Baddesley Common and Emer Bog (SSSI)

This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects on this SSSI, and therefore no further SSSI-specific assessment is required.

5.3.3 Portsmouth Harbour (Ramsar, SPA & SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-16.

Table 5-16: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Portsmouth Harbour (Ramsar, SPA & SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Haslar Road	South	35	35
Gosport Road	North West	33	-
A27	North	61	61
M27	North East	96	96
M275	East	101	102

Portsmouth Harbour (Ramsar & SPA):

Qualifying and notifiable features associated with this site include: Aggregations of breeding and non-breeding birds, intertidal mudflats, lagoon sand shrimp *Gammarus insensibili*, starlet sea anemone *Nematostella vectensisand,* higher plants *Zostera angustifolia*, *Zostera marina*, *Zostera noleti* and *Inula crithmoides*.

2034 Do Minimum model results:

Nitrogen deposition, airborne NOx and airborne NH_3 are predicted to exceed the 1% screening threshold. The broad habitat types affected by the exceedances are coastal and floodplain grazing marsh, mudflats and "no main habitat". The PHI data set indicates with low confidence that "no main habitat" could be assigned as coastal saltmarsh.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and therefore an HRA Stage 2 appropriate assessment will be required to inform the respective local plans.

2034 Do Something model results:

Nitrogen deposition, airborne NOx and airborne NH_3 are predicted to exceed the 1% screening threshold. The broad habitat types affected by the exceedances are mudflats and "no main habitat". The PHI data set indicates with low confidence that "no main habitat" could be assigned as coastal saltmarsh.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and therefore an HRA Stage 2 appropriate assessment will be required to inform the respective local plans.

Portsmouth Harbour (SSSI):

Notifiable features associated with this site include: Aggregations of breeding and non-breeding birds, intertidal mudflats, lagoon sand shrimp *Gammarus insensibili*, starlet sea anemone *Nematostella vectensisand* higher plants *Zostera angustifolia, Zostera marina, Zostera noleti* and *Inula crithmoides.*

2034 Do Minimum model results:

All four pollutants exceeded the 1% screening threshold in very localised regions of the designated site. The exceedances only affect the mudflats broad habitat type.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

All four pollutants exceeded the 1% screening threshold in very localised regions of the designated site. The exceedances only affect the mudflats broad habitat type.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.4 River Itchen (SAC & SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-17.

River Itchen (SAC):

Qualifying and notifiable features associated with this site include: water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion*, southern damselfly *Coenagrion mercurial*, white-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*, brook lamprey *Lampetra planeri*, Atlantic salmon *Salmo salar*, bullhead *Cottus gobio*, otter *Lutra lutra*, rare pea mussel *Pisidium tenuilineatum*, scare riffle beetles *Riolus cupreus* and *R. subviolaceus*, scare caddisfly *Metalype fragilis* and *Ylodes conspersus*, mining bee *Macropis europaea*, very rare “dung” fly *Cosmetopus dentimanus*, wet and mixed woodland, unimproved grassland (including fen, marsh and swamp habitat types) and neutral grassland.

Table 5-17: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at River Itchen (SAC & SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Woodmill Lane	South	38	38
A27	South	46	46
M27	South	94	94
B3037	Central	44	44
Riverside	Central	37	37
Twyford Road A335	West	32	-
Highbridge Road	North	53	53
Kiln Lane	North	37	37

2034 Do Minimum model results:

All four pollutants exceeded the 1% threshold, with the greatest exceedance related to nitrogen deposition. Multiple broad habitat types are affected by the exceedances, including coastal and floodplain grazing marsh, good quality semi-improved grassland, lowland meadows, and reedbeds. Approximately 3.55 ha of the site has been assigned as "No main habitat". The PHI data set indicates with low confidence that this habitat could be assigned as a mixture of coastal and floodplain grazing marsh, lowland meadow, lowland fen, deciduous woodland, purple moor grass and rush pasture and reedbeds.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and therefore an HRA Stage 2 appropriate assessment will be required to inform the respective local plans.

2034 Do Something model results:

All four pollutants exceeded the 1% threshold, with the greatest exceedance related to nitrogen deposition. Multiple broad habitat types are affected by the exceedances, including coastal and floodplain grazing marsh, good quality semi-improved grassland, lowland meadows, and reedbeds.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and therefore an HRA Stage 2 appropriate assessment will be required to inform the respective local plans.

River Itchen (SSSI):

Notifiable features associated with this site include: water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion*, southern damselfly *Coenagrion mercurial*, white-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*, brook lamprey *Lampetra planeri*, Atlantic salmon *Salmo salar*, bullhead *Cottus gobio*, otter *Lutra lutra*, rare pea mussel *Pisidium tenuilineatum*, scare riffle beetles *Riolus cupreus* and *R. subviolaceus*, scare caddisfly *Metalype fragilis* and *Ylodes conspersus*, mining bee *Macropis europaea*, very rare “dung” fly *Cosmetopus dentimanus*, wet and mixed woodland, unimproved grassland (including fen, marsh and swamp habitat types) and neutral grassland.

2034 Do Minimum model results:

All four pollutants exceeded the 1% threshold, with the greatest exceedance related to acid deposition. Multiple broad habitat types are affected by the exceedances, including coastal and floodplain grazing marsh, good quality semi-improved grassland, lowland meadows, and reedbeds. Approximately 11.09 ha of the site has been assigned as "No main habitat". The PHI data set indicates with low confidence that this habitat could be assigned as a mixture of coastal and floodplain grazing marsh, lowland meadow, lowland fen, deciduous woodland, purple moor grass and rush pasture and reedbeds.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

All four pollutants exceeded the 1% threshold, with the greatest exceedance related to acid deposition.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.5 Solent and Southampton Water (Ramsar & SPA), Solent and Isle of Wight Lagoons (SAC) and underlying SSSIs

5.3.5.1 Solent and Southampton Water (Ramsar & SPA)

Areas of Solent and Southampton Water (Ramsar & SPA) overlap with Solent Maritime (SAC).

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-18.

Qualifying features associated with this site include: large numbers of breeding and over-wintering birds, nationally important invertebrates, littoral sediments (mud and sand flats), coastal saltmarsh, broadleaved semi-natural woodland, neutral grassland, fen habitat, marsh habitat (including salt and freshwater marshes), broadleaved woodland purple emperor *Apatura iris* and the rare leaf beetle *Orsodacne lineola*.

2034 Do Minimum model results:

All four pollutants exceeded the 1% threshold, with the greatest exceedances related to acid deposition and nitrogen deposition. Multiple broad habitat types are affected by the exceedances, including coastal saltmarsh, good quality semi-improved grassland, mudflats and reedbeds. Approximately 462 ha of the site has been assigned as "No main habitat". The PHI data set indicates with low confidence that this habitat could be assigned as a mixture of coastal vegetated shingle, coastal saltmarsh, coastal and floodplain grazing marsh, deciduous woodland and reedbeds.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and therefore an HRA Stage 2 appropriate assessment will be required to inform the respective local plans.

2034 Do Something model results:

All four pollutants exceeded the 1% threshold, though to a lesser extent than with the 2034 Do Minimum scenario. The greatest exceedance related to nitrogen deposition. Multiple broad habitat types are affected by the exceedances, including deciduous woodland, mudflats and saline lagoons.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and therefore an HRA Stage 2 appropriate assessment will be required to inform the respective local plans.

Table 5-18: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Solent and Southampton Water (Ramsar & SPA)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
M271	North West (Lower Test Valley)	107	107
Redbridge Causeway	North West (Lower Test Valley)	93	93
Redbridge Flyover A33	North West (Lower Test Valley)	99	98
A3024	North West (Lee-on-the-Solent to Itchen Estuary)	57	57
Athelstan Road	North West (Lee-on-the-Solent to Itchen Estuary)	-	37
Peartree Avenue	North West (Lee-on-the-Solent to Itchen Estuary)	36	36
A3025	North West (Lee-on-the-Solent to Itchen Estuary)	36	36
Millbank Street	North West (Lee-on-the-Solent to Itchen Estuary)	36	37
Weston Parade/Abbey Hill/Victoria Road	Central (Lee-on-the-Solent to Itchen Estuary)	38	38
M27	Central (Upper Hamble Estuary and Woods)	100	100
A3051	Central (Upper Hamble Estuary and Woods)	51	51
Stubbington Lane	South East (Lee-on-the-Solent to Itchen Estuary)	37	-

5.3.5.2 Solent and Isle of Wight Lagoons (SAC) and Gilkicker Lagoon (SSSI)

Model results are mapped in Appendix 3.

Solent and Isle of Wight Lagoons (SAC):

This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects of the proposed development on this European site, and therefore no further HRA stages are required for air quality impacts.

Gilkicker Lagoon (SSSI)

Gilkicker Lagoon is almost fully encompassed within the boundary of the Solent and Isle of Wight Lagoons designated site. This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects on this SSSI, and therefore no further SSSI-specific assessment is required.

5.3.5.3 Eling and Bury Marshes (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-19.

Notifiable features associated with this site include: aggregations of non-breeding birds, sheltered muddy shores (including estuarine muds), coastal saltmarsh, and woodland.

Table 5-19: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Eling and Bury Marshes (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Redbridge Causeway A35	North West	93	93
Redbridge Road A33	North	99	98

2034 Do Minimum model results:

All four pollutants exceeded the 1% threshold, with the greatest exceedances related to nitrogen deposition and ammonia. Broad habitat types affected by the exceedances include coastal saltmarsh, mudlfats, and “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as a mixture of coastal vegetated shingle, mudflat and saltmarsh.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

Nitrogen deposition, acid deposition and NH_3 were predicted to exceed the 1% threshold. Broad habitat types affected by the exceedances include coastal saltmarsh, mudlfats, and “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as a mixture of coastal vegetated shingle, mudflat and saltmarsh.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.5.4 Lee-on-the Solent to Itchen Estuary (SSSI)

This designated site overlaps with Solent Maritime (SAC) as well as Solent and Southampton Water (Ramsar & SPA).

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-20.

Notifiable features associated with this site include: aggregations of non-breeding birds, tertiary fish and amphibia and vascular plant assemblages.

Table 5-20: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Lee-on-the Solent to Itchen Estuary (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Bitterne Road West A3024	North West	57	57

2034 Do Minimum model results:

Nitrogen deposition, NOx and NH_3 were predicted to exceed the 1% screening threshold and areas of the designated site corresponding to mudflats.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

Nitrogen deposition, NOx and NH_3 were predicted to exceed the 1% screening threshold and areas of the designated site corresponding to mudflats, though to a lesser extent than under the 2034 Do Minimum scenario.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.5.5 Lincegrove and Hackett's Marshes (SSSI)

This designated site overlaps with Solent Maritime (SAC) as well as Solent and Southampton Water (Ramsar & SPA).

Model results are mapped in Appendix 3.

This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects on this SSSI, and therefore no further SSSI-specific assessment is required.

5.3.5.6 Lower Test valley (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-21.

Notifiable features associated with this site include: fen meadow, grassland, swamp, reedbeds and coastal saltmarsh.

Table 5-21: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Lower Test valley (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
M271	West	107	107
Redbridge Causeway	South	93	93
Redbridge Flyover A33	South East	99	98

2034 Do Minimum model results:

All four pollutants exceeded the 1% threshold, with the greatest exceedances related to acid deposition, nitrogen deposition and ammonia, respectively. Multiple broad habitat types are affected by the exceedances, including coastal and floodplain grazing marsh, coastal saltmarsh, mudflats, reedbeds and areas designated as “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as a mixture of coastal and floodplain grazing marsh, lowland fen, reedbed, coastal vegetated shingle and saltmarsh.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

All four pollutants exceeded the 1% threshold, though to a lesser extent than under the 2034 Do Minimum scenario. The greatest exceedance is related to nitrogen deposition. Multiple broad habitat types are affected by the exceedances, including coastal and floodplain grazing marsh, coastal saltmarsh, mudflats, and areas designated as “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as a mixture of coastal and floodplain grazing marsh, lowland fen, reedbed, coastal vegetated shingle and saltmarsh.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.5.7 River Test (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-22.

Notifiable features associated with this site include: base rich, low- energy lowland rivers and streams, fen meadow, calcareous grassland, swamp, reedbed and woodland.

Table 5-22: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at River Test (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
M27	South	95	95
Bypass Road A27	North	47	47

2034 Do Minimum model results:

All four pollutants exceeded the 1% threshold. Broad habitat types affected by the exceedance are coastal and floodplain grazing marsh, deciduous woodland, good quality semi-improved grassland, and "no main habitat". The PHI data set indicates with low confidence that "no main habitat" could be assigned as a mixture of coastal and floodplain grazing marsh, lowland fen, lowland meadow, reedbed and deciduous woodland.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

All four pollutants exceeded the 1% threshold, though to a lesser extent than under the 2034 Do Minimum scenario. Broad habitat types affected by the exceedance are coastal and floodplain grazing marsh, deciduous woodland, good quality semi-improved grassland, and "no main habitat". The PHI data set indicates with low confidence that "no main habitat" could be assigned as a mixture of coastal and floodplain grazing marsh, lowland fen, lowland meadow, reedbed and deciduous woodland.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.5.8 Titchfield Haven (SSSI)

Model results are mapped in Appendix 3.

This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects on this SSSI, and therefore no further SSSI-specific assessment is required.

5.3.5.9 Upper Hamble Estuary and Woods (SSSI)

This designated site overlaps with Solent Maritime (SAC) as well as Solent and Southampton Water (Ramsar & SPA).

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-23.

Table 5-23: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Upper Hamble Estuary and Woods (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
M27	South West	100	100
A3051	North East	51	51

Notifiable features associated with this site include: calcareous grassland, swamp, reedbed, sheltered muddy shores (including estuarine muds), saltmarsh and woodland.

2034 Do Minimum model results:

Nutrient nitrogen, acid deposition and NH_3 are predicted to exceed the 1% threshold, with the greatest exceedance related to nitrogen deposition. Multiple broad habitat types are affected by the exceedances, including coastal and floodplain grazing marsh, reedbeds, and areas designated as “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as a mixture of mudflat, coastal saltmarsh, lowland fen and deciduous woodland.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

Nutrient nitrogen, acid deposition and NH_3 are predicted to exceed the 1% threshold, with the greatest exceedance related to nitrogen deposition. Multiple broad habitat types are affected by the exceedances, including coastal saltmarsh, mudflats, reedbeds, and areas designated as “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as a mixture of mudflat, coastal saltmarsh, lowland fen and deciduous woodland.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.6 Solent Maritime (SAC)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-24.

Qualifying and notifiable features associated with this site include: estuaries, spartina swards *Spartinion maritimae*, annual vegetation of drift lines, Atlantic salt meadows *Glauco-Puccinellietalia maritimae*, sandbanks which are slightly covered by sea water, mud and sandflats not covered by seawater at low tide, coastal lagoons, Desmoulin's whorl snail *Vertigo moulinsiana*, perennial vegetation of stony banks, salicornia and other annuals colonising mud and sand, shifting dunes along the shoreline with *Ammophila arenaria* (“white dunes”) and a population of childing pink *Petrorhagia nanteuilii*.

2034 Do Minimum model results:

All four pollutants exceeded the 1% threshold, with the greatest exceedance related to nitrogen deposition. Multiple broad habitat types are affected by the exceedances, including coastal floodplain and grazing marsh, coastal saltmarsh, mudlfats, reedbeds and areas designated as “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as a mixture of coastal vegetated shingle, mudflat, coastal saltmarsh and saline lagoons.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and therefore an HRA Stage 2 appropriate assessment will be required to inform the respective local plans.

2034 Do Something model results:

All four pollutants exceeded the 1% threshold, with the greatest exceedance related to nitrogen deposition. Multiple broad habitat types are affected by the exceedances, including coastal floodplain and grazing marsh, deciduous woodland, mudlfats, reedbeds and areas designated as “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as a mixture of coastal vegetated shingle, mudflat, coastal saltmarsh and saline lagoons.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and therefore an HRA Stage 2 appropriate assessment will be required to inform the respective local plans.

Table 5-24: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Lee-on-the Solent Maritime (SAC)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Havant Road	East (Chichester & Langstone Harbours)	47	-
Langstone Road A3023	East (Chichester & Langstone Harbours)	47	-
A27	East (Chichester & Langstone Harbours)	96	96
A2030	East (Chichester & Langstone Harbours)	71	69
Ferry Road	East (Chichester & Langstone Harbours)	30	30
M27	Central (Upper Hamble Estuary and Woods)	95	95
A3051	Central (Upper Hamble Estuary and Woods)	51	51
Redbridge Causeway	West (Lower Test Valley)	93	93
Redbridge Flyover A33	West (Lower Test Valley)	99	98
M271	West (Lower Test Valley)	107	107

5.3.7 Botley Wood and Everett's and Mushes Copses (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-25.

Notifiable features associated with this site include: invertebrate assemblages, woodland (broadleaved semi-natural woodland and lowland wet woodland) and neutral grassland. Despite coniferization it is of exceptional importance for its rich insect populations and is a nationally outstanding woodland for butterflies, with over 30 species breeding annually.

Table 5-25: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Botley Wood and Everett's and Mushes Copses (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
M27	South	104	104
Whiteley Way (M27 J9 to Parkway South Roundabout)	South West	80	80
Parkway	South West	49	49
Whiteley Way (Parkway South Roundabout to Whiteley Farm Roundabout)	West	48	48

2034 Do Minimum model results:

All four pollutants exceeded the 1% threshold, in areas of the designated site assigned to deciduous woodland.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

All four pollutants exceeded the 1% threshold, in areas of the designated site assigned to deciduous woodland, semi-improved grassland, and “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as deciduous woodland

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.8 Browndown (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-26.

Notifiable features associated with this site include: Combination of lichen species, invertebrate assemblages, grass and dune heaths, vascular plant assemblages and coastal vegetated shingle which includes dry acid grassland and lichen rich acid grassland.

Table 5-26: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Browndown (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Cherque Way	North	64	64
Portsmouth Road/Privett Road	North	50	50
Browndown Road	North East	44	44
Stokes Bay Road	East	-	47

2034 Do Minimum model results:

Nitrogen deposition and NH_3 are predicted to exceed the 1% threshold, with the greatest exceedance related to ammonia. The broad habitat types affected by the exceedances are semi-improved grassland, lowland heathland, and areas designated as “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as coastal vegetated shingle.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

Nitrogen deposition and NH_3 are predicted to exceed the 1% threshold, with the greatest exceedance related to ammonia. The broad habitat types affected by the exceedances are lowland heathland and areas designated as “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as coastal vegetated shingle.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.9 Catherington Down (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-27.

Notifiable features associated with this site include: lowland calcareous grassland and oak woodland.

Table 5-27: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Catherington Down (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Lovedean Lane	West	49	49
Roads Hill	South	41	41
Catherington Lane	East	-	36

This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects on this SSSI, and therefore no further SSSI-specific assessment is required.

5.3.10 Hook Heath Meadows (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-28.

Notifiable features associated with this site include: a mixture of woodland and agriculturally unimproved acid pasture.

This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects on this SSSI, and therefore no further SSSI-specific assessment is required.

Table 5-28: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Hook Heath Meadows (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Pitymoor Lane	North	-	43

5.3.11 Lye Heath Marsh (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-29.

Notifiable features associated with this site include: neutral pasture and semi-improved grassland (fen, marsh and swamp). The juxtaposition of habitats and abundant nectar sources, coupled with light grazing and sheltered aspects, make this a very significant site for invertebrates, particularly hoverflies which include two notable species *Xylota tarda* and *Helophalus trivittatus*.

Table 5-29: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Lye Heath Marsh (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Pigeon House Lane	West	44	44

This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects on this SSSI, and therefore no further SSSI-specific assessment is required.

5.3.12 Moorgreen Meadows (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-30.

Notifiable features associated with this site include: neutral hay meadow, neutral pasture and lowland wet woodland. The meadows lie on alluvium and clay with thin deposits of peat. The sward comprises at least 17 codominant herbs and grasses and is of exceptional scientific importance for its populations of marsh orchids *Dactylorhiza*. In particular the site includes a geographically isolated population of the northern marsh Orchid *D. purpurella*, the nearest other localities being in Wales, Staffordshire and Yorkshire.

2034 Do Minimum model results:

All four pollutants exceeded the 1% threshold, with large exceedances related to all pollutants. Approximately 1.68 ha of the site has been assigned as "No main habitat". The PHI data set indicates with low confidence that this habitat could be assigned as a mixture of lowland mire, rush pasture and deciduous woodland.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

All four pollutants exceeded the 1% threshold, though to a lesser extent than under the 2034 Do Minimum scenario. The greatest exceedances relate to acid deposition and nitrogen deposition respectively.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

Table 5-30: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Moorgreen Meadows (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
M27	West	91	91
Botley Road	South	35	35
Tollbar Way	East	51	50
Bubb Lane	North	43	43
Moorgreen Road	North	37	37

5.3.13 Portsdown (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-31.

Notifiable features associated with this site include: calcareous grassland and invertebrate assemblages. The insect fauna has been studied in detail and includes a comprehensive range of chalk downland butterflies *Lepidoptera*, beetles *Coleoptera*, bees and allied insects *Hymenoptera*. Of interest is the occurrence in an atypical habitat of the bush cricket *Conocephalus discolor* and a substantial population of the largest of the British bush crickets *Tettigonia viridissima*.

Table 5-31: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Portsdown (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
M27	South West	96	96
Portsdown Hill Road B2177	North	50	50
James Callaghan Drive	North West	43	43
London Road	East	33	33

2034 Do Minimum model results:

All four pollutants exceeded the 1% threshold, with the greatest exceedance related to NOx. The broad habitat types affected by the exceedances are deciduous woodland, lowland calcareous grassland and “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as lowland calcareous grassland.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

All four pollutants exceeded the 1% threshold with the greatest exceedance related to nitrogen deposition. The broad habitat types affected by the exceedances are deciduous woodland, lowland calcareous grassland and "no main habitat". The PHI data set indicates with low confidence that "no main habitat" could be assigned as lowland calcareous grassland.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.14 Sinah Common (SSSI)

Model results are mapped in Appendix 3.

This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects on this SSSI, and therefore no further SSSI-specific assessment is required.

5.3.15 Southampton Common (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-32.

Notifiable features associated with this site include: woodland, grassland (including fen, marsh and swamp habitat types) and large amphibian populations (including a large great crested newt population), that predominantly inhabit the boating lake during summer and spring and disperse widely over the remainder of the SSSI during the remainder of the year.

2034 Do Minimum model results:

All four pollutants exceeded the 1% threshold, with the greatest exceedance related to airborne NOx. The broad habitat types affected by the exceedances are deciduous woodland, lowland meadows, lowland heathland and "no main habitat". The PHI data set indicates with low confidence that "no main habitat" could be assigned as assigned as a mixture of lowland heath, lowland dry acid grassland and lowland meadow.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

All four pollutants exceeded the 1% threshold, though to a lesser extent than under the 2034 Do Minimum scenario. The greatest exceedance related to airborne NOx. The broad habitat types affected by the exceedances are deciduous woodland, lowland meadows, lowland heathland and "no main habitat". The PHI data set indicates with low confidence that "no main habitat" could be assigned as assigned as a mixture of lowland heath, lowland dry acid grassland and lowland meadow.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

Table 5-32: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Southampton Common (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Burgess Road A35	North	31	31
The Avenue	East	48	48
Hill Lane	West	44	44
Northlands Road	South	37	37

5.3.16 The Moors, Bishop's Waltham (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-33.

Notifiable features associated with this site include: wet woodland and unimproved grassland (including fen, marsh and swamp habitat types).

Table 5-33: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at The Moors, Bishop's Waltham (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Coppice Hill B2177	West	57	57
Shore Lane	North West	34	34
Hoe Road	North	48	48

2034 Do Minimum model results:

Nitrogen deposition, acid deposition and NH_3 are predicted to exceed the 1% threshold, with the greatest exceedance related to nitrogen deposition. The broad habitat types affected by the exceedances include deciduous woodland, lowland fens, lowland meadows, purple moor grass and rush pastures, and “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as lowland meadow.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

Nitrogen deposition is the only pollutant predicted to exceed the 1% screening thresholds. The broad habitat types affected by the exceedances include deciduous woodland, lowland fens, lowland meadows, purple moor grass ad rush pastures, and “no main habitat”. The PHI data set indicates with low confidence that “no main habitat” could be assigned as lowland meadow.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.17 The Wild Grounds (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-34.

Notifiable features associated with this site include: a mixture of oak woodland and fen on the edge of the River Alver flood plain.

This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects on this SSSI, and therefore no further SSSI-specific assessment is required.

Table 5-34: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at The Wild Grounds (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
St Nicholas Avenue	North East	37	37
Grange Lane	East	37	37

5.3.18 Trodds Copse (SSSI)

Model results are mapped in Appendix 3.

This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects on this SSSI, and therefore no further SSSI-specific assessment is required.

5.3.19 Waltham Chase Meadows (SSSI)

Model results are mapped in Appendix 3. The major roads which influence pollutant levels are summarised in Table 5-35.

Notifiable features associated with this site include: neutral unimproved grassland and a species rich invertebrate community (including 20 species of butterfly).

Table 5-35: The maximum average speeds on the major roads which influence areas exceeding the screening thresholds at Waltham Chase Meadows (SSSI)

Road	Location relative to site	Maximum average speed (km/h)	
		2034 Do Minimum	2034 Do Something
Winchester Road B2177	West	36	36

2034 Do Minimum model results:

All four pollutants exceeded the 1% threshold. The broad habitat type affected by the exceedance is lowland meadows.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

2034 Do Something model results:

Nitrogen deposition and NH_3 are predicted to exceed the 1% screening threshold. The broad habitat type affected by the exceedance is lowland meadows.

On the basis of available evidence and agreed thresholds, likely significant effects from air quality impacts cannot be ruled-out, and will therefore require further assessment as part of the evidence base to inform the respective local plans.

5.3.20 Warblington Meadow (SSSI)

Model results are mapped in Appendix 3.

This designated site is not predicted to exceed the screening thresholds for any of the modelled pollutants under either the Do Minimum or Do Something scenarios.

On the basis of available evidence and agreed thresholds, there are no likely significant effects on this SSSI, and therefore no further SSSI-specific assessment is required.

5.4 Next steps for designated sites and the Habitat Regulations Assessment (HRA) process

5.4.1 Summary of findings

Simplified results for the assessment of air quality impacts on designated sites are provided in Table 5-36 and Table 5-37. European-designated sites are subject to the HRA process, and where likely significant effects from air quality impacts cannot be ruled out (i.e., an entry of 'No' in the tables below), an HRA Stage 2 appropriate assessment will be required to inform the respective local plans. Since the recent Sweetman II 'People over Wind and Sweetman' ruling,[46] mitigation (avoidance or reduction) measures cannot be taken into account at the screening stage of a Habitat Regulations Assessment. To ensure compliance with this ruling, we recommend that any European-designated site for which likely significant effects cannot be ruled out for the Do Minimum scenario undergo an HRA Stage 2 appropriate assessment.

Table 5-36 Summary of analysis for European-designated sites and underlying SSSIs

Site name	On the basis of available evidence and agreed thresholds, can likely significant effects from air quality impacts be ruled out for the Do Minimum scenario?	On the basis of available evidence and agreed thresholds, can likely significant effects from air quality impacts be ruled out for the Do Something scenario?
Chichester and Langstone Harbours (Ramsar & SPA) [a]	No	No

[46] People Over Wind and Peter Sweetman v Coillte Teoranta, 12 April 2018, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A62017CJ0323

Site name	On the basis of available evidence and agreed thresholds, can likely significant effects from air quality impacts be ruled out for the Do Minimum scenario?	On the basis of available evidence and agreed thresholds, can likely significant effects from air quality impacts be ruled out for the Do Something scenario?
Chichester Harbour (underlying SSSI) [a]	No	Yes
Langstone Harbour (underlying SSSI) [a]	No	No
Emer Bog SAC	Yes	Yes
Baddesley Common and Emer Bog (underlying SSSI)	Yes	Yes
Portsmouth Harbour (Ramsar & SPA)	No	No
Portsmouth Harbour (underlying SSSI)	No	No
River Itchen SAC	No	No
River Itchen (underlying SSSI)	No	No
Solent and Southampton Water (Ramsar & SPA) [a]	No	No
Solent and Isle of Wight Lagoons (underlying SAC)	Yes	Yes
Eling and Bury Marshes (underlying SSSI)	No	No
Gilkicker Lagoon (underlying SSSI) [b]	Yes	Yes
Lee-on-the Solent to Itchen Estuary (underlying SSSI) [a]	No	No
Lincegrove and Hackett's Marshes (underlying SSSI) [a]	Yes	Yes
Lower Test valley (underlying SSSI)	No	No
River Test (underlying SSSI)	No	No
Titchfield Haven (underlying SSSI)	Yes	Yes
Upper Hamble Estuary and Woods (underlying SSSI) [a]	No	No
Solent Maritime SAC	No	No

[a] These designated sites also overlap with Solent Maritime SAC.
Note that other sites are grouped together if they have overlapping boundaries with different designations

Table 5-37 Summary of analysis for standalone SSSIs

Site name	On the basis of available evidence and agreed thresholds, can likely significant effects from air quality impacts be ruled out for the Do Minimum scenario?	On the basis of available evidence and agreed thresholds, can likely significant effects from air quality impacts be ruled out for the Do Something scenario?
Botley Wood and Everett's and Mushes Copses	No	No
Browndown	No	No
Catherington Down	Yes	Yes
Hook Heath Meadows	Yes	Yes
Lye Heath Marsh	Yes	Yes
Moorgreen Meadows	No	No
Portsdown	No	No

Site name	On the basis of available evidence and agreed thresholds, can likely significant effects from air quality impacts be ruled out for the Do Minimum scenario?	On the basis of available evidence and agreed thresholds, can likely significant effects from air quality impacts be ruled out for the Do Something scenario?
Sinah Common	Yes	Yes
Southampton Common	No	No
The Moors, Bishop's Waltham	No	No
The Wild Grounds	Yes	Yes
Trodds Copse	Yes	Yes
Waltham Chase Meadows	No	No
Warblington Meadow	Yes	Yes

5.4.2 Natural England guidance

Recent guidance from Natural England to the PUSH group of local authorities suggests that an appropriate assessment should consider the following points:

- *Consider whether the sensitive qualifying features of the site would be exposed to emissions.*
- *Consider the European Site's Conservation Objectives – the 'key question' for the appropriate assessment is, in view of these objectives, can it be ascertained that, should the plan or project go ahead, there will be no adverse effect from it on the site's integrity so that the site's conservation objectives will not be undermined.*
- *Consider background pollution.*
- *Consider the designated site in its national context.*
- *Consider the best available evidence on small incremental impacts from nitrogen deposition.*
- *Consider the spatial scale and duration of the predicted impact and the ecological functionality of the affected area.*
- *Consider site survey information.*
- *Consider national, regional and local initiatives or measures which can be relied upon to reduce background levels at the site.*
- *Consider the imposition of additional mitigation measures to avoid an effect on integrity.*
- *Consider any likely in-combination effects with other live plans and projects from other sectors.*[47]

5.4.3 Evidence to support Appropriate Assessment

The following paragraphs describe a possible approach to producing the necessary evidence base for an appropriate assessment, however, the extent and scope of assessment should be discussed with Natural England before and during the appropriate assessment.

It is likely that the local plans under development by the PUSH group of local authorities have progressed since the SRTM model scenarios for this study were commissioned, and more recent SRTM model scenarios may have already been commissioned in support of this process. Where the results

[47] Guidance from Natural England to the PUSH group of local authorities, received via email on 25/06/2018.

of this study indicate that an appropriate assessment is necessary, we recommend updating the dispersion modelling results using the latest available transport modelling. This will highlight changes in the predicted impact(s) of the relevant local plan(s) on European-designated sites, and this is likely to be relevant in later stages of the HRA process.

Determination of whether the sensitive qualifying features of the site would be exposed to emissions can be assisted by desktop studies utilising the dispersion modelling results alongside GIS files with information about sensitive qualifying features (for example, the Priority Habitat Inventory GIS files, and more localized mapping files obtained from the nearest biodiversity information centre). Where the results of the desktop study indicate that sensitive qualifying features may be present within 200m of key routes, in-person site surveys may be carried out to verify the presence of sensitive qualifying features. Such surveys are also likely to be valuable sources of information in establishing a robust evidence base for an appropriate assessment.

Where it is determined that sensitive qualifying features are present within 200m of a key route and the predicted air quality impact(s) exceed the 1% screening threshold, an assessment methodology should be agreed with Natural England to account for considerations such as background levels of pollution. It may be the case that in order to demonstrate that the plan will have 'no adverse effect', mitigation measures will need to be proposed to reduce the predicted impact to below the 1% screening threshold. Further transport modelling and/or dispersion modelling may be necessary to demonstrate that the proposed mitigation measures are sufficient to achieve the necessary reduction in air quality impacts. Alternatively, evidence may be adduced to demonstrate the significance or otherwise of observed impacts from current levels of air pollution, and the potential impact of strategic development plans can be evaluated by considering this evidence alongside data relating to future trends in baseline impacts and the expected impact associated with the strategic plan.

For designated sites that are likely to be affected by in-combination effects from more than one local plan, there may also be an opportunity to work collaboratively with neighbouring local authorities. A collaborative approach is mandated by the principle of Duty-to-Cooperate, and this collaborative approach will facilitate the development of effective mitigation measure in the context of the relevant local plans.

Careful consideration should also be given to ensure that in-combination effects, i.e. from housing and industrial development in neighbouring local authorities, are included in the assessment of air quality impacts on designated sites. This study considers in-combination effects within the study area, as increased traffic flow resulting from increased development across the study area and wider PUSH region were included in the SRTM model scenarios. However, the impacts from the in-combination effects were only evaluated on designated sites within the study region, with the understanding that the in-combination effects on designated sites within New Forest District and the Isle of Wight were to be the subject of separate studies. The assessments included in this study, along with any follow-up appropriate assessment work, should be integrated with the studies undertaken by New Forest District and the Isle of Wight to ensure the in-combination effects have been comprehensively considered.

5.5 Recommendations for mitigation

The assessment has indicated that the proposed PUSH development could result in increases in impacts above the applicable thresholds of 1% of critical levels and loads at several European designated sites and SSSIs. In most cases, exceedances of these thresholds occur in close proximity to existing highways. As a result, it is not possible to fully screen out potential impacts on habitat features within these limited areas of European sites resulting from changes to traffic flows considered in this assessment.

It is recommended that Councils should consider whether further surveys could be useful to confirm the existence of protected habitats and species within the zones recommended for further investigation in Section 5.3. In the event that such surveys confirm that the protected habitats and species are not present in these zones, no further action would be needed to mitigate impacts. It may also be possible for a detailed ecological assessment to demonstrate that the forecast impact in a specific zone, while above the 1% screening criteria, nevertheless would not adversely affect the integrity of the European site.

Where impacts cannot be ruled out in this way, measures for the mitigation of impacts within these designated sites will need to be considered. Councils should select appropriate measures by considering (a) the extent of mitigation required; (b) deliverability of potential mitigation measures, and (c) cost-effectiveness of mitigation measures. Suggested mitigation measures and applicable considerations are set out in Table 5-38.

Table 5-38 Deliverable and effective mitigation measures for consideration in reducing air quality impacts at designated sites

Measure	Description
Suitable Alternative Natural Greenspaces	Offsetting of potential impacts due to air quality through developer contributions to site management, and/or contributions to provision of alternative recreational space to attract recreational visitors away from a Natura 2000 site. These sites are referred to as Suitable Alternative Natural Greenspaces (SANGs). While not directly mitigating air pollution impacts arising from increased road traffic, such measures can have the effect of mitigating damage caused by deposition of air pollutants, for example by reducing other nitrogen and ammonia inputs to a site. This approach may be used to take land out of intensive agriculture and convert it to SANG(s). A reduction in intensive agriculture activity would have the effect of reducing background levels of airborne nitrogen and ammonia, as well as deposition of nitrogen and acid. Natural England has indicated that research has been undertaken in the Solent to calculate the level of nitrogen released by different agricultural land uses and this can be used to calculate off-setting Total Nitrogen figures from land use changes.[47] This would be particularly if the agricultural land converted to SANG(s) is located in the vicinity of designated sites. SANGs also offer other benefits to designated sites, such as removing non-specialist species, or reducing damage to interest features caused by visitors and dogs. Measures (e.g. using appropriate signage) could be taken to limit access to potential areas of concern within European sites.
Reducing ammonia emissions from agricultural sources through changes to agricultural practices	This measure includes reducing overall impacts by supporting reductions in emissions from other sources, in particular ammonia emissions from agricultural activities in the near vicinity of the affected habitats.[48] While the above mitigation measure involves converting agricultural land to one or more SANGs, this measure retains the agricultural functionality of the land but aims to reduce the emissions associated with that activity. Example strategies for the control of ammonia emissions include covered storage of manures, the use of effective spreading to reduce ammonia emissions and agricultural management plans.
Reducing nitrogen from agricultural sources by introducing wetlands	Wetlands are able to remove nitrogen from water.[49] The construction of a wetland downstream from an agricultural area and upstream from a designated site is an effective strategy to reduce the amount of nitrogen reaching the designated site. This approach is likely to be particularly effective for designated sites with prominent water elements, that are also located downstream from agricultural land.
Woodland planting buffers	Tall vegetation, such as woodland trees, can serve to ‘scavenge’ nutrients and pollutants from the atmosphere.[50] This is supported by the different deposition rates applied to woodland and grassland habitats when calculating pollutant deposition (Section 2.2.7.2). While the introduction of a woodland planting buffer may reduce road traffic emission impacts on a designated site, consideration must be given to the existing space between the roadway and the designated site, and whether the introduction of a tall woodland planting buffer would alter the ecological characteristics of the designated site.
Reduced speed limits	This measure involves working with Highways England (a Duty to Co-Operate partner) to investigate the effect of reducing the speed limit or managing vehicle speeds on the key roads in the vicinity of the affected habitats. For illustrative purposes, Figure 5-1 provides an overview of the relationship between NOx emissions and vehicle speed, based on the COPERT v5 emission functions[12] used in RapidEms. These relationships indicate that a reduction in average vehicle speed from 100 km/hour to 70 or 80 km/hour could result in a

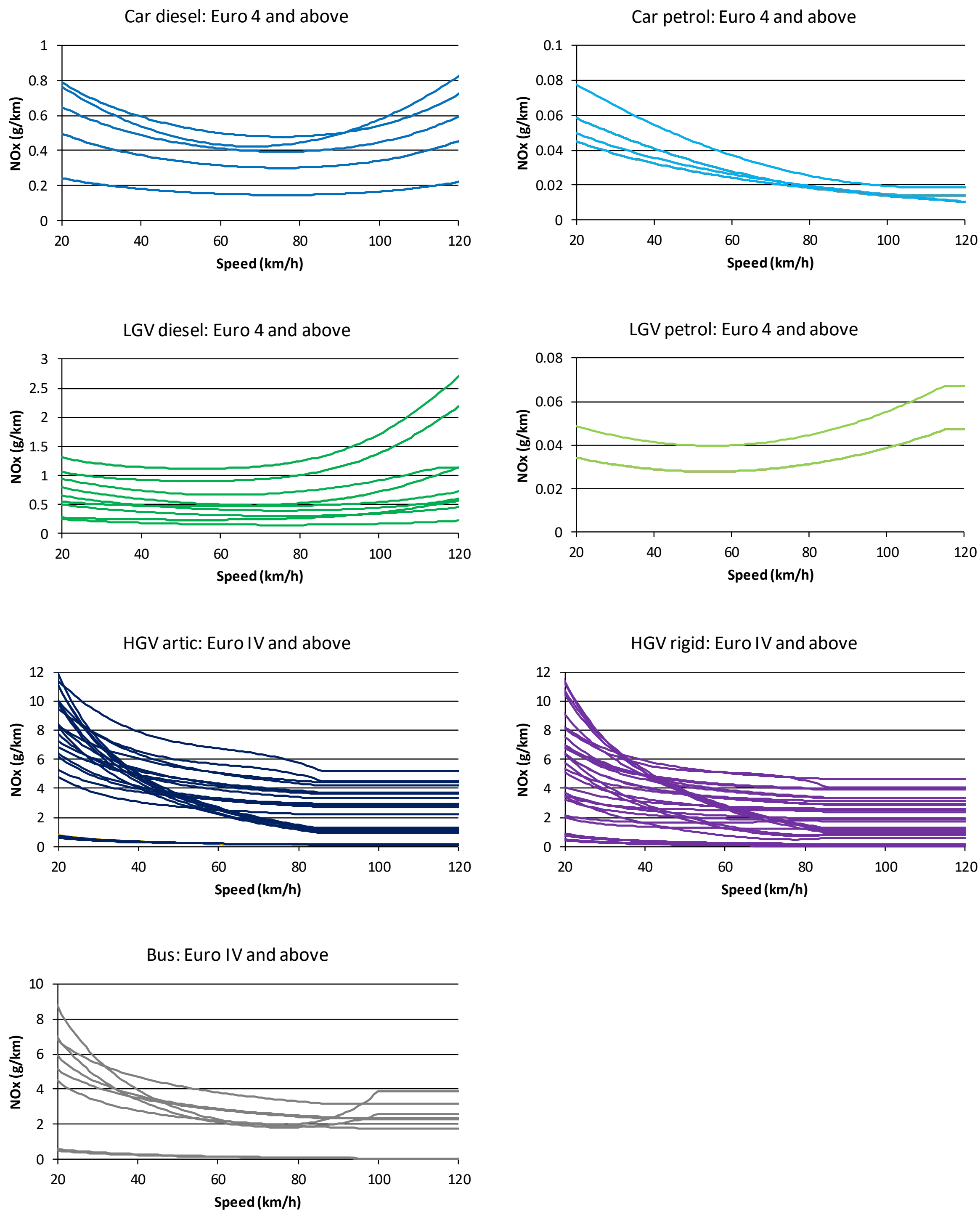
[48] CEH, “Identification of Potential “Remedies” for Air Pollution (nitrogen) Impacts on Designated Sites (RAPIDS),” Report to Defra Ref. AQ0834, 2015

[49] The Wetlands Initiative, http://www.wetlands-initiative.org/nutrient-removal/, accessed 20/06/2018.

[50] Natural England, “Environmental impacts of land management (NERR030)”, http://publications.naturalengland.org.uk/file/62082, 2009, accessed 20/06/2018.

Measure	Description
	significant decrease in NOx road emissions, depending on the make-up of vehicles on that road. This may prove effective in improving air quality at European sites due to emissions from traffic. To assist in identifying areas where this measure may be beneficial, Section 5.3 includes tables with the maximum average speeds on the major roads which influence designated sites that are predicted to exceed the 1% screening thresholds.
Planning measures	Planning measures implemented in relation to specific developments may be considered, including: • Strategic planning measures, such as a requirement to install electric vehicle charging points in new developments, provision of effective public transport links, or limitations on car parking. • Implementation of traffic management options to reduce the impact of specific groups or types of vehicles (for example, requiring particular classes of vehicles such as heavy goods vehicles travelling to and from a specific new development to use routes other than those resulting in exceedances of the threshold values). • Investment in public transport or other alternatives to diesel and petrol fuelled road transportation. This would be focused on specific developments on a case-by-case basis. Such investments could be delivered through the Community Infrastructure Levy and guided through the application of supplementary planning guidance on air quality. Further detail on these options are provided in Section 6. • Development of Supplementary Air Quality Planning Guidance. This is described further in Section 6. In particular, such a guidance document could potentially be used to set out a methodology for quantifying impacts of proposed developments on designated sites and deriving damage costs to support the implementation of mitigation measures. Supplementary Planning Guidance could also be a useful means of ensuring that developers contribute to the process of ensuring that more intense development does not result in significant air quality impacts over and above those expected from the strategic assessment of the development plan. • Delivery of air quality strategy measures will result in overall improvements in air quality which will also benefit European sites, thereby mitigating impacts resulting from the PUSH development.

Figure 5-1 Relationship between NOx emission rates and vehicle speed



6 Implementation

This study shows that overall the PUSH region will experience an improvement in air quality over the assessment period, resulting from changes to the road fleet during this time. However, it is also important that the Councils seek further opportunities to avoid or reduce the impacts of vehicle emissions on air quality, through the implementation of well-designed policies and plans that incorporate effective air quality and transport related measures, such as those discussed in Section 4.5 and Section 5.5. The PUSH partnership offers a unique opportunity for the development of a regional strategy that incorporates these principles.

The following sets out two options to be considered by the Partnership, that would offer the potential for wide scale air quality improvements.

Low Emission Strategy

A regional Low Emission Strategy would form a link between other key strategies across the Partnership, including economic and transport plans, and provide a focussed path to achieving a low emission future in the region. This would draw on the evidence presented in this study, and the assessments of air quality provided in the Councils' air quality action plans, and aim to provide a set of regional measures that are both ambitious and practicable. The measures would be identified through both an assessment of their effect on emissions and analysis of the economic implications of their implementation. These measures may include a combination of those discussed in Sections 4.5 and 0, and would aim to support the transition to low emission transport options. For example, this could entail a 'PUSH Electric Vehicle Strategy'**,** which would aim to promote the creation of infrastructure to support the use of ULEVs for local residents and businesses, through a variety of actions, such as:

- Utilise the local planning process, business support and private sector investment to support home and workplace charging as the primary charging location.
- Create a public charge point network that allows electric car users to reach their destination through a simplistic access, usage and payment model.
- Provide equal charging opportunities for residents with and without private driveways.
- Negotiate opportunities to provide plug-in vehicle demonstration opportunities on new residential and commercial schemes.
- Provide marketing and awareness campaigns that challenge the perceived and actual barriers to EV ownership.
- Work with local business partnerships to encourage investment in ULEV technology and infrastructure.
- Lead by example by rolling out a public sector ULEV campaign across all Councils.
- Provide support to the freight industry to invest in ULEV vehicles, including infrastructure installation and last-mile delivery operations.

These measures would have a beneficial effect on ambient pollutant concentrations and help to reduce impacts at designated sites resulting from vehicle emissions. One such example, of a regional low emission strategy, was published in West Yorkshire in 2016. This involves a partnership between five local councils, and offered a combined strategy covering a range of transport emissions, including cars, buses, trains, taxis and freight.

Supplementary Air Quality Planning Guidance

A key strand of the West Yorkshire Low Emissions Strategy came in the form of a supplementary planning document which focusses on the integration of air quality considerations into land-use planning and development management policies, with the aim of reducing road transport emissions. The guidance provides a template for assessing air quality impacts, which follows a three-stage process:

1. Determine the classification of a development proposal (minor, medium or major)
2. Assess and quantify the impact on local air quality
3. Establish the level of mitigation required to meet objectives set out in the National Planning Policy, Local Plan requirements and the Low Emission Strategy

The guidance sets out a clear methodology for quantifying the impacts of proposed developments in the form of damage costs and implementing mitigation measures to negate the impact. A similar example has been produced by Sussex Authorities. The guidance enables developers to calculate the payment that will be expected in order to fund appropriate mitigation and monitoring measures.

The development of a supplementary planning document for air quality in the PUSH region would ensure a unified approach to the management of air quality impacts associated with proposed developments in the area, and make it clear to developers what the expectations are regarding the funding of air quality mitigation measures.

7 Summary of recommendations

Based on the results of this study, we recommend the following:

1. **Continue local air quality monitoring**

   The modelling work undertaken in this study predicts that all sensitive receptor locations across the PUSH study area will be compliant with the annual mean air quality objectives for NO_2, PM_{10} and $PM_{2.5}$ by 2034. However, monitoring should continue in existing AQMAs to verify that expected improvements are being achieved in practice.

2. **Continue investigation and implementation of measures to improve local air quality**

   The implementation of measures included in existing Air Quality Action Plans, and the exploration of additional measures, should continue so as to achieve compliance with the air quality objectives in the shortest time possible.

3. **Undertake HRA stage 2 appropriate assessments (for European-designated sites) and further assessments (for SSSIs) as required for PUSH development**

   The model predicts that the PUSH development scenarios (both 2034 Do Minimum and 2034 Do Something) will contribute air pollutant concentrations exceeding the screening thresholds at a number of designated sites. The guidance from Natural England indicates that for European-designated sites (Ramsar sites, SPAs and SACs), predicted exceedances of the screening thresholds in areas with qualifying features will necessitate an HRA stage 2 assessment. SSSIs are not subject to an HRA, but predicted exceedances of the screening thresholds in areas with notifiable features will require further assessment.

   Recent guidance from Natural England highlights that carrying out an appropriate assessment is typically an iterative process. We recommend that a more detailed ecological analysis be undertaken for the designated sites within the PUSH study area which are predicted to experience pollutant concentrations exceeding the screening thresholds. The extent and scope of assessment should be discussed with Natural England. Further assessment is likely to include further modelling studies of areas where mitigation may be required, with further evaluation of proposed mitigation measures in order to verify that planned mitigation will be sufficient. As well as additional air quality modelling, this process may also require additional transport modelling.

4. **Consider improvements to the accuracy of the NH_3 dispersion model**

   The model results relating to the assessment of air quality impacts at designated sites should be interpreted in the context of the conservative approach which was adopted to model NH_3 concentrations. It is more likely that the model is over-predicting the concentrations and impacts related to NH_3 rather than under-predicting. The accuracy of the dispersion model can be improved by conducting NH_3 monitoring at sensitive designated sites, and using these measurements in the model verification process. The modelled airborne NOx concentrations were predicted to exceed the screening thresholds at a number of designated sites. The NOx model performance was verified and adjusted using 173 NO_2 measurements, and the model performance is therefore expected to be reasonably accurate.

5. **Leverage the joint resources and knowledge of the PUSH group of local authorities to develop planning policy**

   The PUSH group of local authorities should consider producing Supplementary Planning Guidance for developers to ensure that developments do not cause short-term exceedances or worsening of air quality, either in AQMAs or at designated sites. Planning conditions should also be utilized to ensure that developments are phased appropriately up to 2034 to minimize the risk of significant adverse impacts in the short and medium term. Additionally, the effects of construction can be controlled and mitigated by planning condition, normally requiring a Construction Environmental Management Plan to be agreed with the local planning authority prior to construction commencing.

Appendices

Appendix 1 - Air dispersion model verification and adjustment

*Amendment: The coordinates of 13 monitoring sites included in the model verification process were identified as being incorrect. The impact of the error on the model verification process was assessed. The NOx adjustment factor derived with the original monitoring locations was 1.3089. After correction of the coordinates, the adjustment factor was 1.3057. Therefore, the original adjustment factor was overpredicting NOx concentrations by 0.25% and the model results slightly over-predict impacts for NOx, NO_2, nitrogen deposition and acid deposition. The magnitude of the difference was not significant enough make a material difference to any of the results, for example the concentration and deposition maps would remain unchanged and there would be no difference between an exceedance or not of any of the objectives. Table A2-1 has been updated with the correct coordinates and modelled NO_2 annual mean concentrations.

Verification of the model involves comparison of the modelled results with any local monitoring data at relevant locations; this helps to identify how the model is performing and if any adjustments should be applied. The verification process involves checking and refining the model input data to try and reduce uncertainties and produce model outputs that are in better agreement with the monitoring results. This can be followed by adjustment of the modelled results if required. The LAQM.TG(16) guidance recommends making the adjustment to the road contribution of the pollutant only and not the background concentration these are combined with.

The approach outlined in LAQM.TG(16) section 7.508 – 7.534 (also in Box 7.14 and 7.15) has been used in this case. To verify the model, the predicted annual mean Road NOx concentrations were compared with concentrations measured at the various monitoring sites during 2014.

The model output of Road NOx (the total NOx originating from road traffic) was compared with measured Road NOx, where the measured Road NOx contribution is calculated as the difference between the total measured NOx and the background NOx value. Total measured NOx for each monitoring site was calculated from the measured NO_2 concentration using Version 5.1 of the Defra NOx/NO_2 calculator available from the LAQM website[51], as this is the version of the calculator recommended for the year 2014. The calculator was used for NO_2 measurements from each local authority separately, as it was determined that the air dispersion model provided a better fit for the measured NO_2 data if the general calculator inputs (regional concentrations of ozone, oxides of nitrogen and nitrogen dioxide) were tailored to each local authority individually. Background NOx values for 2014 were obtained from the 2013 reference year background maps available on the LAQM website.

The initial comparison of the modelled vs measured Road NOx identified that the model was under-predicting the Road NOx contribution at most locations. Refinements were subsequently made to the model inputs to improve model performance where possible.

The gradient of the best fit line for the modelled Road NOx contribution vs. measured Road NOx contribution was then determined using linear regression and used as a global/domain wide Road NOx adjustment factor. This factor was then applied to the modelled Road NOx concentration at each discretely modelled receptor point to provide adjusted modelled Road NOx concentrations. A linear regression plot comparing modelled and monitored Road NOx concentrations before and after adjustment is presented in Figure A1-1. A primary NOx adjustment factor (PAdj) of **1.3089** based on model verification using all of the included 2014 NO_2 measurements was applied to all modelled Road NOx data prior to calculating an NO_2 annual mean.

[51] https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

The total annual mean NO_2 concentrations were then determined for each calibration point using the NOx/NO_2 calculator to combine background and adjusted road contribution concentrations. For this step of the process, regional concentrations of ozone, oxides of nitrogen and nitrogen dioxide were set to those of the local authority where the calibration point was located. The following relationship was determined for conversion of total NOx concentrations to total NO_2 concentrations:

$$(NO_2 \text{ in } \mu g/m^3) = -0.0020(NOx \text{ in } \mu g/m^3)^2 + 0.7157(NOx \text{ in } \mu g/m^3)$$

A plot comparing modelled and monitored total NO_2 concentrations before and after adjustment during 2014 is presented in Figure A1-2.

Figure A1.1 Comparison of modelled Road NO_x Vs Measured Road NO_x before and after primary adjustment (all included sites)

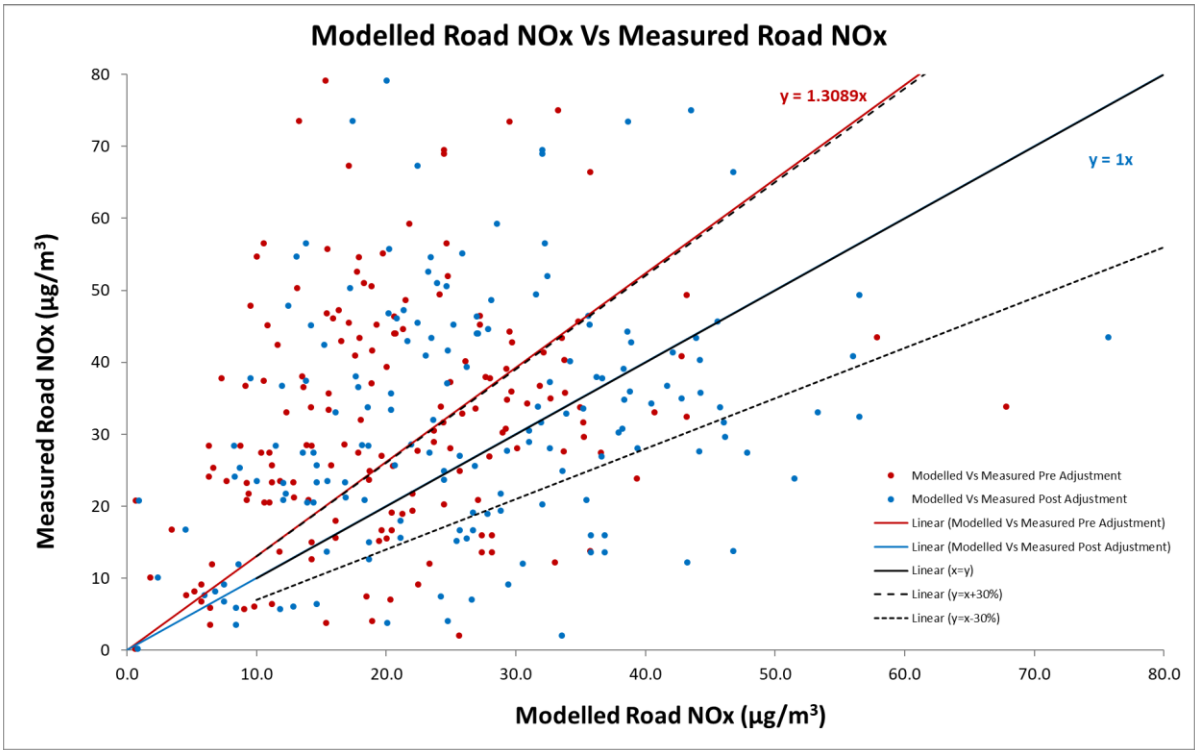
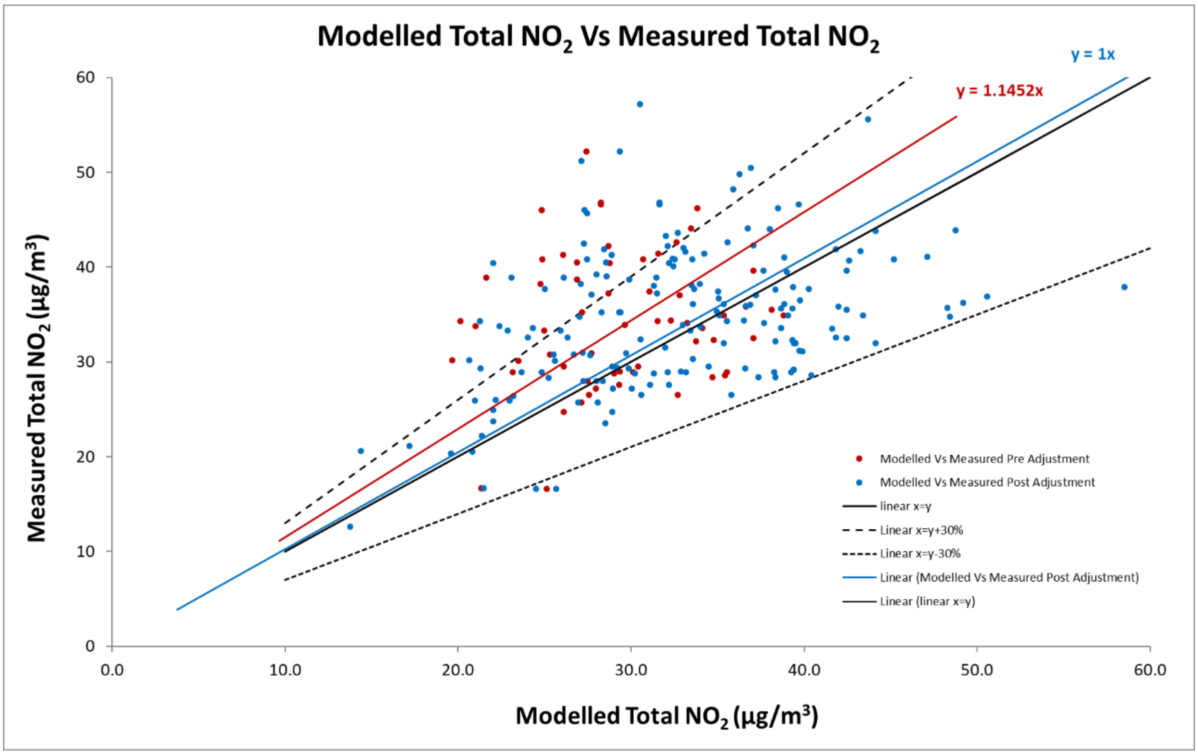


Figure A1.2: Total modelled vs. measured NO_2 annual mean 2014



To evaluate the model performance and uncertainty, the Root Mean Square Error (RMSE) for the observed vs predicted NO_2 annual mean concentrations was calculated, as detailed in Technical Guidance LAQM.TG(16). The calculated RMSE is presented in Table A2-1.

In this case the RMSE was calculated at **8.4 µg/m³**.

Table A2-1: Modelled and measured NO_2 concentrations for the 2014 reference year and calculated RMSE value

Council	Site ID	Easting	Northing	Measured NO_2 annual mean concentration 2014 (µg/m3)	Modelled NO_2 annual mean concentration 2014 (µg/m³)
East Hampshire District	EHDC: HR1	470554	113582	33.3	22.9
East Hampshire District	EHDC: HR7	470658	113258	25.9	21.0
Eastleigh Borough	EBC: AL	445908	115544	29.4	29.2
Eastleigh Borough	EBC: AR	443291	122842	12.6	13.8
Eastleigh Borough	EBC: BEL	443778	119303	30.3	33.6
Eastleigh Borough	EBC: BR	446604	119149	38.1	33.5
Eastleigh Borough	EBC: BR2	446051	119171	37.1	27.7
Eastleigh Borough	EBC: CC	443054	118962	32.6	24.0
Eastleigh Borough	EBC: DD	443559	118751	35.7	48.3
Eastleigh Borough	EBC: FOR	447427	118780	25.9	23.0
Eastleigh Borough	EBC: HG	445347	120367	21.1	17.2
Eastleigh Borough	EBC: HL	447717	110359	36.7	35.1
Eastleigh Borough	EBC: HL2	447745	110478	37.7	33.6
Eastleigh Borough	EBC: HSB	451431	113025	40.4	22.0
Eastleigh Borough	EBC: HSB2	451184	113030	33.6	24.3
Eastleigh Borough	EBC: LR13	443842	119527	48.2	35.9
Eastleigh Borough	EBC: MC	444239	120060	31.5	32.0
Eastleigh Borough	EBC: MS	445707	119619	36.1	33.6
Eastleigh Borough	EBC: NH	445121	122183	33.7	34.0
Eastleigh Borough	EBC: OX	444543	120187	23.5	28.5
Eastleigh Borough	EBC: PC	444656	120775	32.0	35.4
Eastleigh Borough	EBC: SC	443959	119673	31.0	27.2
Eastleigh Borough	EBC: SR1	445450	118144	51.2	27.1
Eastleigh Borough	EBC: SRAN	445495	118237	42.5	27.3
Eastleigh Borough	EBC: SSQ	443483	118612	31.2	39.7
Eastleigh Borough	EBC: TP	445311	119147	28.3	25.3
Eastleigh Borough	EBC: UNC	448090	112635	29.3	29.9
Eastleigh Borough	EBC: WA	444484	119441	39.2	28.0
Fareham Borough	FBC: BL1	458376	106109	40.8	27.5
Fareham Borough	FBC: DC1	457183	106203	30.1	25.6
Fareham Borough	FBC: E1/2/3	457594	105280	39.6	42.5
Fareham Borough	FBC: FAR1	457594	105280	32.5	42.5
Fareham Borough	FBC: FAR2	457954	106027	46.8	31.7
Fareham Borough	FBC: G10	457675	105616	40.4	32.2
Fareham Borough	FBC: G11	457668	105461	29.0	32.9
Fareham Borough	FBC: G12	457683	105630	42.2	32.1

Council	Site ID	Easting	Northing	Measured NO_2 annual mean concentration 2014 (µg/m3)	Modelled NO_2 annual mean concentration 2014 (µg/m^3)
Fareham Borough	FBC: G14	457631	105494	37.0	37.2
Fareham Borough	FBC: G1A	457726	105627	35.8	42.0
Fareham Borough	FBC: G2A	457627	105138	34.1	37.7
Fareham Borough	FBC: G3	457721	104855	33.6	38.7
Fareham Borough	FBC: G4	457598	105213	32.2	38.3
Fareham Borough	FBC: G6	457599	105410	37.4	35.0
Fareham Borough	FBC: G7	457583	105354	46.2	38.5
Fareham Borough	FBC: G8Z	457656	105049	34.3	35.5
Fareham Borough	FBC: GR/RL	457563	105298	28.6	40.4
Fareham Borough	FBC: HR2	457822	106106	34.3	21.3
Fareham Borough	FBC: HR3A	457787	106140	30.2	20.7
Fareham Borough	FBC: HR4	457857	106076	33.8	22.4
Fareham Borough	FBC: PS1/1A/1B	457939	106012	38.7	29.9
Fareham Borough	FBC: PS2	457937	106021	41.3	28.9
Fareham Borough	FBC: PS3	457935	106033	46.0	27.3
Fareham Borough	FBC: PS4/5/6	457954	106027	46.6	31.7
Fareham Borough	FBC: RM1	455745	107825	29.5	34.5
Gosport Borough	GBC: GOS1	458987	102786	29.5	28.9
Gosport Borough	GBC: GP13	458066	104232	26.5	30.6
Gosport Borough	GBC: GP21	460047	99619	38.9	23.1
Gosport Borough	GBC: GP22	460061	99603	38.2	27.1
Gosport Borough	GBC: GP7	459572	101800	34.4	36.5
Gosport Borough	GBC: GP9/10/11	458987	102786	24.7	28.9
Havant Borough	HBC: 13	471988	106076	20.3	19.6
Havant Borough	HBC: 14*	471777	106759	21.0	19.6
Havant Borough	HBC: 15*	471894	108403	14.9	28.9
Havant Borough	HBC: 18*	468264	109415	22.4	31.1
Havant Borough	HBC: 2*	471742	105794	26.6	32.1
Havant Borough	HBC: 20*	471693	105920	29.2	24.5
Havant Borough	HBC: 21*	471589	106132	42.5	23.7
Havant Borough	HBC: 22*	471573	106200	34.7	28.3
Havant Borough	HBC: 23*	471571	106374	45.8	25.5
Havant Borough	HBC: 25(B)	468479	107721	26.0	30.2
Havant Borough	HBC: 26*	467228	107849	24.9	22.2
Havant Borough	HBC: 3*	472198	102048	32.7	32.5
Havant Borough	HBC: 4*	474866	106425	23.2	26.9
Havant Borough	HBC: 5*	471789	106205	24.8	27.2
Havant Borough	HBC: 6(B)	471555	106298	35.3	38.3
Havant Borough	HBC: 7(B)	471180	106063	26.4	35.0
Havant Borough	HBC: 8*	467322	107976	26.5	23.2
Havant Borough	HBC: 9(B)	468308	109552	38.9	26.1
Havant Borough	HBC: W10	471368	106805	30.7	27.6

Council	Site ID	Easting	Northing	Measured NO_2 annual mean concentration 2014 (µg/m3)	Modelled NO_2 annual mean concentration 2014 (µg/m^3)
Portsmouth City	PCC: 1	463872	99874	42.6	35.6
Portsmouth City	PCC: 10	467107	104850	16.7	21.5
Portsmouth City	PCC: 11	466869	103457	33.3	25.9
Portsmouth City	PCC: 12	466074	103747	30.9	29.7
Portsmouth City	PCC: 14	466109	103736	27.2	30.0
Portsmouth City	PCC: 15	466120	101324	27.6	32.2
Portsmouth City	PCC: 16	465474	104205	32.3	39.3
Portsmouth City	PCC: 18	466097	101332	28.9	33.2
Portsmouth City	PCC: 19	466392	100226	37.2	31.5
Portsmouth City	PCC: 2	463705	99371	16.6	25.7
Portsmouth City	PCC: 20	466712	99415	28.9	24.8
Portsmouth City	PCC: 21	465209	98964	35.2	29.4
Portsmouth City	PCC: 22	464778	99306	30.8	26.7
Portsmouth City	PCC: 23	464974	99766	28.8	31.3
Portsmouth City	PCC: 24	465111	100737	40.5	28.6
Portsmouth City	PCC: 25	465036	101547	52.2	29.3
Portsmouth City	PCC: 26	464900	101976	40.8	33.6
Portsmouth City	PCC: 3	463408	99460	25.7	28.1
Portsmouth City	PCC: 30	464478	101457	44.1	36.7
Portsmouth City	PCC: 32	464559	100980	34.9	39.1
Portsmouth City	PCC: 34	464425	100893	35.5	42.4
Portsmouth City	PCC: 35	463837	99759	41.4	34.2
Portsmouth City	PCC: 36	464502	99330	34.8	27.0
Portsmouth City	PCC: 4	463190	100390	28.0	28.4
Portsmouth City	PCC: 5	464230	102194	28.9	39.3
Portsmouth City	PCC: 6	464331	102197	34.9	43.4
Portsmouth City	PCC: 7	464291	102279	26.5	35.8
Portsmouth City	PCC: 8	466690	104355	28.4	38.3
Portsmouth City	PCC: 9	465621	105528	33.9	33.0
Portsmouth City	PCC: C2	464925	102129	45.7	27.4
Portsmouth City	PCC: C4	465403	103952	22.2	21.4
Portsmouth City	PCC: C6	466004	102348	35.9	36.6
Portsmouth City	PCC: C7	464397	101270	36.5	39.8
Southampton City	SCC: CM1	442583	112248	32.0	39.4
Southampton City	SCC: CM4	442304	112771	41.0	38.8
Southampton City	SCC: CM5	439702	112248	42.0	33.0
Southampton City	SCC: CM6	443751	111121	44.0	38.0
Southampton City	SCC: N100	444386	114450	20.5	20.8
Southampton City	SCC: N101	437543	113726	41.7	43.3
Southampton City	SCC: N102	441678	115278	33.3	33.4
Southampton City	SCC: N103	438805	112902	34.9	35.1
Southampton City	SCC: N104	439218	112850	42.3	37.1
Southampton City	SCC: N106	439754	113982	43.6	32.7

Council	Site ID	Easting	Northing	Measured NO_2 annual mean concentration 2014 (µg/m3)	Modelled NO_2 annual mean concentration 2014 (µg/m^3)
Southampton City	SCC: N107	442367	112896	50.5	36.9
Southampton City	SCC: N109	442585	113248	38.9	31.5
Southampton City	SCC: N110	442583	112248	29.2	39.4
Southampton City	SCC: N111	442583	112248	29.2	39.4
Southampton City	SCC: N112	442583	112248	29.2	39.4
Southampton City	SCC: N113	444122	113292	37.9	58.5
Southampton City	SCC: N114	444131	113326	39.5	39.0
Southampton City	SCC: N115	437939	113473	37.9	39.4
Southampton City	SCC: N116	437951	113407	41.9	41.9
Southampton City	SCC: N118	442472	113068	38.2	34.0
Southampton City	SCC: N120	442555	111021	43.8	44.1
Southampton City	SCC: N122	440000	112633	32.6	41.8
Southampton City	SCC: N123	442351	112302	36.2	49.2
Southampton City	SCC: N124	439741	112746	41.1	47.1
Southampton City	SCC: N125	443126	112645	40.7	42.6
Southampton City	SCC: N126	442369	112283	36.9	50.6
Southampton City	SCC: N129	442555	111021	32.0	44.1
Southampton City	SCC: N130	439346	112822	46.6	39.7
Southampton City	SCC: N131	439379	114185	41.6	33.1
Southampton City	SCC: N133	438608	113018	32.4	30.6
Southampton City	SCC: N134	438969	112863	39.6	37.7
Southampton City	SCC: N135	443714	111052	35.6	38.7
Southampton City	SCC: N136	443731	111053	35.6	39.3
Southampton City	SCC: N137	443990	113340	36.0	36.9
Southampton City	SCC: N138	441694	115288	49.8	36.3
Southampton City	SCC: N140	441629	112332	55.6	43.7
Southampton City	SCC: N141	441915	110993	43.9	48.8
Southampton City	SCC: N143	439468	114146	40.1	32.4
Southampton City	SCC: N144	443147	112709	33.5	41.6
Southampton City	SCC: N146	443164	112741	31.1	39.9
Southampton City	SCC: N149	441552	115247	36.1	35.4
Southampton City	SCC: N151	439396	114176	40.9	32.4
Southampton City	SCC: N153	437325	113860	37.7	40.3
Southampton City	SCC: N154	442237	111083	40.8	45.2
Southampton City	SCC: N155	442405	111083	36.1	38.9
Southampton City	SCC: N157	442375	110970	34.8	48.4
Southampton City	SCC: N158	443802	111123	37.6	38.4
Southampton City	SCC: N159	443745	111147	29.3	36.6
Southampton City	SCC: N160	442219	112880	32.0	39.5
Southampton City	SCC: N161	442703	114127	35.2	29.3
Southampton City	SCC: N162	442877	114342	41.9	28.5
Southampton City	SCC: N163	442950	114381	32.6	26.3
Southampton City	SCC: N164	442796	114258	39.0	28.6

Council	Site ID	Easting	Northing	Measured NO_2 annual mean concentration 2014 (µg/m3)	Modelled NO_2 annual mean concentration 2014 (µg/m^3)
Southampton City	SCC: N165	442767	114184	57.2	30.5
Southampton City	SCC: N167	439757	114013	38.0	31.3
Southampton City	SCC: N168	439736	114025	43.3	32.0
Test Valley Borough	TVBC: CHIL12	441763	118089	37.7	25.0
Test Valley Borough	TVBC: CHIL13	442137	117670	24.9	22.0
Test Valley Borough	TVBC: CHIL14	442264	117625	28.0	28.0
Winchester City	WCC: Site 5 (District Study)	465917	112050	20.6	14.4
Winchester City	WCC: Site 6 (District Study)	457199	111391	29.3	21.3
Winchester City	WCC: Site 8 (District Study)	453680	108312	23.7	22.0
				RMSE (all sites in this table)	**8.4**

*Site location updated from previous report

The precise location of the study area boundary was updated towards the end of the delivery period for this project. As a result, there are 9 NO_2 diffusion monitoring sites that were excluded from the original study area but are located within the final study area. These 9 sites were not included in the original model verification process, however, the metrics for these additional 9 sites are presented in the table below for comparative purposes. The RMSE for these 9 sites is 12.5, which is higher than the RMSE of 8.4 calculated for the monitoring sites used in the model verification process. The model consistently underestimates NO_2 annual mean concentrations at these 9 sites, the majority of which are located in Romsey (Test Valley).

Table A2-2: Modelled and measured NO_2 concentrations for the 2014 reference year and calculated RMSE value

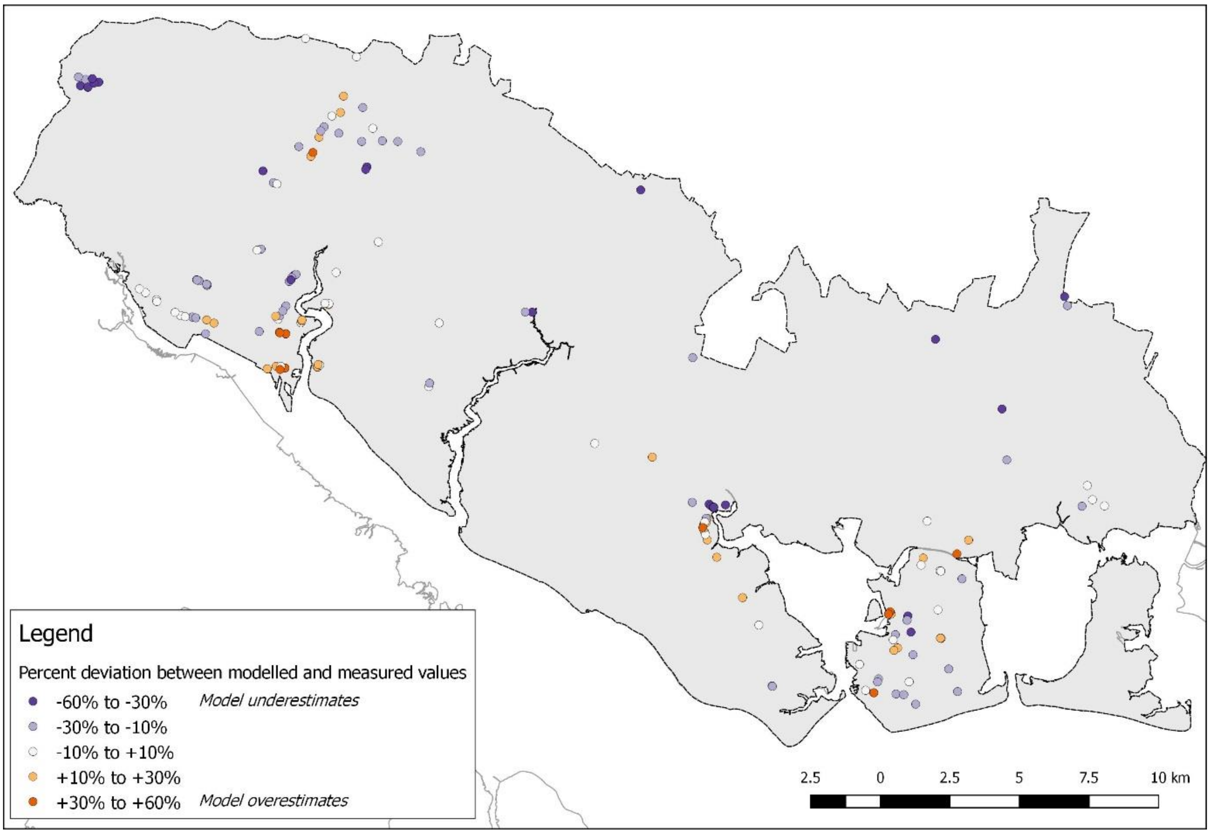
Council	Site ID	Easting	Northing	Measured NO_2 annual mean concentration 2014 (µg/m3)	Modelled NO_2 annual mean concentration 2014 (µg/m^3)
Test Valley Borough	ROM1	435382	121377	15.6	12.3
Test Valley Borough	ROM2	435135	121461	15.8	12.6
Test Valley Borough	ROM3	435205	121147	20.9	12.5
Test Valley Borough	ROM5A	435474	121089	35.0	14.8
Test Valley Borough	ROM7	435480	121103	32.1	14.5
Test Valley Borough	ROM8	435867	121277	35.2	22.2
Test Valley Borough	ROM9	435697	121244	29.4	18.1
Test Valley Borough	ROM10	435630	121403	28.6	16.3
Winchester City	WCC: Site 7 (District Study)	455330	117406	29.6	17.2
				RMSE (all sites in this table)	**12.5**

Figure A1.3 presents an overview of the percent deviation for modelled vs measured NO_2 annual mean values in 2014. Percent deviation is calculated by subtracting the measured value from the modelled value, and then dividing the result by the measured value. A negative percent deviation value (shown in purple in the figure) indicates that the model is underestimating the measured value, while a positive percent deviation (shown in orange) indicates that the model is overestimating the measured value.

The following observations can be made from Figure A1.3:

- There is a cluster of dark purple monitoring sites to the northwest corner of the map corresponding to the monitoring sites located in Romsey; as discussed above, these sites were not included in the model verification process and are underestimated by the model. Several of these monitoring sites appear to be located in along busy roads where the road geometry forms a street canyon. Street canyons, which have not been explicitly modelled in this study, have the effect of hindering pollutant dispersion and leading to pollution hotspots.
- Several other dark purple sites are located towards the northern edge of the study area boundary, in rural areas, suggesting that the model may have a tendency to underestimate concentrations in rural locations.
- There is a cluster of purple sites in Fareham, along Hartlands Rd and just north of the Portland Street AQMA. These sites are located across the street from a bus station, and would be exposed to high vehicle emissions from idling buses which were not explicitly accounted for in the model.
- The model also has a tendency to underestimate concentrations in urban settings where there are street canyon effects, i.e. where there are narrow streets flanked by tall buildings and dispersion of air pollutants is hindered.
- The model has a tendency to overestimate NO_2 concentrations in the Southampton port area. These sites are likely to be exposed to relatively high wind levels, compared to sites located farther inland, and the high wind levels would assist with the dispersion of air pollutants.

Figure A1.3: Percent deviation for modelled vs measured NO_2 annual mean 2014



The model output of Road PM_{10} (the total PM_{10} originating from road traffic) was compared with measured Road PM_{10}, where the measured Road PM_{10} contribution is calculated as the difference between the total measured PM_{10} and the background PM_{10} value.

The initial comparison of the modelled vs measured Road PM_{10} identified that the model was under-predicting the Road PM_{10} contribution at most locations. Refinements were subsequently made to the model inputs to improve model performance where possible.

The gradient of the best fit line for the modelled Road PM_{10} contribution vs. measured Road PM_{10} contribution was then determined using linear regression and used as a global/domain wide Road PM_{10} adjustment factor. This factor was then applied to the modelled Road PM_{10} concentration at each discretely modelled receptor point to provide adjusted modelled Road PM_{10} concentrations. A linear regression plot comparing modelled and monitored Road PM_{10} concentrations before and after adjustment is presented in Figure A1-3. A primary PM_{10} adjustment factor (PAdj) of **3.8962** based on model verification using all of the included 2014 PM_{10} measurements was applied to all modelled Road PM_{10} data prior to calculating an PM_{10} annual mean.

A plot comparing modelled and monitored total PM_{10} concentrations before and after adjustment during 2014 is presented in Figure A1-4.

To evaluate the model performance and uncertainty, the Root Mean Square Error (RMSE) for the observed vs predicted PM_{10} annual mean concentrations was calculated, as detailed in Technical Guidance LAQM.TG(16). The calculated RMSE is presented in Table A2-2.

In this case the RMSE was calculated at **6.5 µg/m³**.

Limited measurement data was available for the verification of the modelled Road $PM_{2.5}$ and Road NH_3 data. Using PM_{10} and NOx as an example, the TG16 guidance states that 'in the absence of any PM_{10} data for verification, it may be appropriate to apply the road NOx adjustment to the modelled road-PM_{10}'.

In this case, the primary PM_{10} adjustment factor (PAdj) of **3.8962** was applied to all modelled Road $PM_{2.5}$ and Road NH_3 data prior to calculating their respective annual means. The PM_{10} adjustment factor (**3.8962**) was used in preference of that calculated for NOx (**1.3089**) as this represented the worst-case scenario and a more cautious approach when determining the effects of future modelled scenarios.

Table A2-3 Modelled and measured PM_{10} concentrations for the 2014 reference year and calculated RMSE value

Council	Site ID	Easting	Northing	Measured PM_{10} annual mean concentration 2014 (µg/m³)	Modelled PM_{10} annual mean concentration 2014 (µg/m³)
Portsmouth City	PCC: C2	464925	102129	32.4	19.8
Portsmouth City	PCC: C4	465403	103952	18.5	18.2
Portsmouth City	PCC: C6	466004	102348	26.9	23.0
Portsmouth City	PCC: C7	464397	101270	17.5	27.2
Gosport	GBC: GOS1	458987	102786	24.0	20.8
Southampton City	SCC: CM1	442583	112248	20.9	21.4
				RMSE (all included sites)	**6.5 µg/m³**

Figure A1-4 Comparison of modelled Road PM_{10} Vs Measured Road PM_{10} before and after primary adjustment (all included sites)

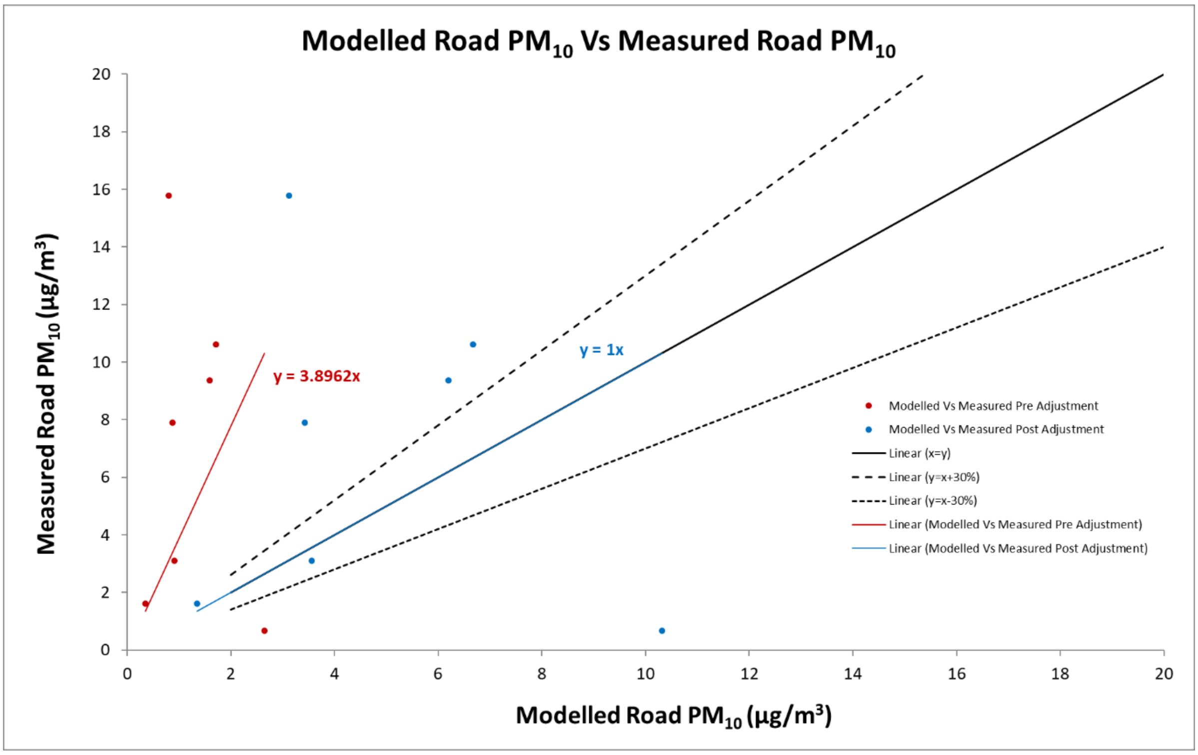
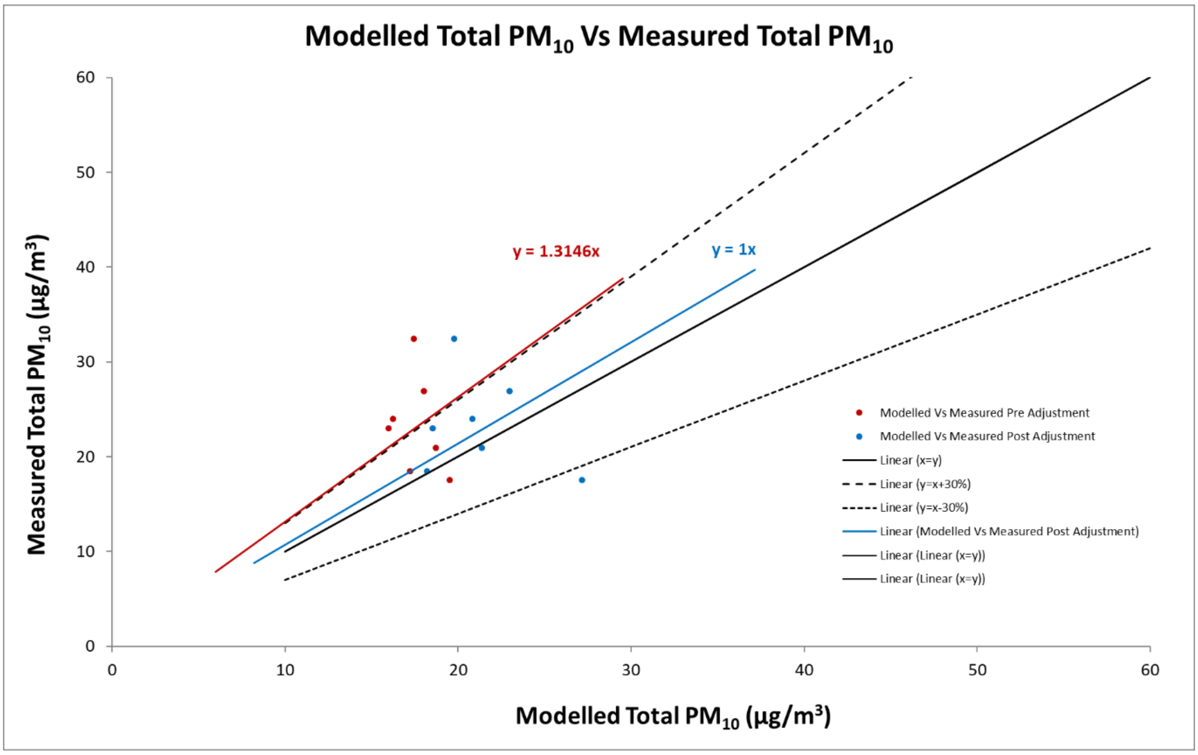


Figure A1-5 Total modelled vs. measured PM_{10} annual mean 2014



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