Lower Thames Crossing

6.1 Environmental Statement Chapter 5 – Air Quality

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Lower Thames Crossing

6.1 Environmental Statement
Chapter 5 – Air Quality

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5 Air Quality

5.1 Introduction

5.1.1 This chapter presents the assessment of the likely significant effects of the A122 Lower Thames Crossing (‘the Project’) on local air quality. The assessment considers local air quality impacts on sensitive receptors at human exposure locations and on designated habitats for ecology during construction and operation. The assessment reports on the change in concentrations of nitrogen dioxide (NO_2) and particulate matter where particles are less than 10 micrometres in diameter (PM_{10}) and less than 2.5 micrometres in diameter ($PM_{2.5}$), at human exposure locations. These effects are determined in relation to compliance with Air Quality Strategy (AQS) objectives and Limit Values. The assessment also reports on changes in nitrogen (N) deposition in designated habitats, which is used to inform the assessment of air quality effects on ecology reported in Chapter 8 Terrestrial Biodiversity (Application Document 6.1).

5.1.2 The assessment follows the methodology set out in Design Manual for Roads and Bridges (DMRB) LA 105 Air Quality (Highways England, 2019).

5.1.3 This chapter is supported by Figures 5.1 to 5.7 (Application Document 6.2), and additional information (mainly full monitoring and modelling data tables) is contained in the following appendices (Application Document 6.3):

a. Appendix 5.1: Air Quality Methodology
b. Appendix 5.2: Air Quality Baseline Conditions
c. Appendix 5.3: Air Quality Construction Phase Results
d. Appendix 5.4: Air Quality Operational Phase Results
e. Appendix 5.5: Air Quality Legislation and Policy
f. Appendix 5.6: Project Air Quality Action Plan

5.2 Legislative and policy framework

5.2.1 This assessment has been undertaken in accordance with relevant legislation and having regard to national and local plans and policies.

5.2.2 Appendix 5.5: Air Quality Legislation and Policy (Application Document 6.3) sets out how the Applicant has considered and addressed those policies in the National Policy Statements (NPSs) which relate to the assessment of effects considered in this chapter of the Environmental Statement (ES). Policies in the NPSs which relate to decision making in relation to matters of relevance to this topic of the ES are addressed in the Planning Statement (Application Document 7.2).

Legislative requirements

5.2.3 Relevant air quality legislation that has been considered during the assessment is presented in Appendix 5.5: Air Quality Legislation and Policy (Application Document 6.3).

National policy

5.2.4 Nationally Significant Infrastructure Projects (NSIPs) are determined in accordance with the decision-making framework in the Planning Act 2008 (as amended) and relevant NPSs, as well as any other matters that are both important and relevant (which may include the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2021).

5.2.5 The National Policy Statement for National Networks (NPSNN) (Department for Transport, 2014) sets out the Government's policies to deliver NSIPs on the national road and rail networks in England. Modifications to the nationally significant energy infrastructure are required as part of the project. Four utilities diversions constitute NSIPs in their own right, and therefore the Project will also be assessed against the following energy policy statements:

a. Overarching National Policy Statement for Energy (EN-1) (Department of Energy and Climate Change, 2011a)

b. National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (Department of Energy and Climate Change, 2011b)

c. National Policy Statement for Electricity Network Infrastructure (EN-5) (Department of Energy and Climate Change, 2011c).

5.2.6 However, the NPSNN forms the "case-making" basis for the Project, and the need for nationally significant utilities diversions arises solely from the need for the road element of the Project.

5.2.7 National Highways has taken these policy requirements into account during the development and design of the Project and the preparation of this ES.

5.2.8 The NPPF, sets out the Government's planning policies. It provides a framework within which locally prepared plans for housing and other development can be produced.

5.2.9 The NPPF does not contain specific policies for NSIPs. However, the NPPF advises that local authorities' planning policies should take into account NSIPs which are located within their local areas. Paragraph 1.17 of the NPSNN states that the NPS and NPPF are consistent, and paragraph 1.18 explains that the NPPF is an important and relevant consideration, 'but only to the extent relevant to the project'.

5.2.10 Appendix 5.5: Air Quality Legislation and Policy (Application Document 6.3) lists the planning policies at a national level and the Project response.

5.2.11 Further information on how the application has responded to national planning policies is available in the Planning Statement (Application Document 7.2).

Defra Air Quality Action Plan

5.2.12 In July 2017, the Department for Environment, Food and Rural Affairs (Defra) released the UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations (Defra, 2017). The plan includes zone plans for 37 zones identified as having issues with achieving Limit Values. The study area for the air quality assessment intersects four of the zones described in the Action Plan, namely the Greater London Urban Area, Southend Urban Area, South East and Eastern zones.

Local policy framework

5.2.13 Consideration has been given to county policies within Kent and Essex, the Updated London Plan and local policies relating to air quality within the following local authorities within the study area: Maidstone Borough Council, Tonbridge and Malling District Council, Gravesham Borough Council, Medway Council, Dartford Borough Council, Thurrock Council, London Borough of Havering and Brentwood Borough Council. These are outlined in Appendix 5.5: Air Quality Legislation and Policy (Application Document 6.3) and are considered further within the Planning Statement (Application Document 7.2).

5.3 Assessment methodology

Standards and guidance

5.3.1 The following standards and guidance documents have been used in devising the methodology for data collection and assessment of air quality impacts:

a. DMRB LA 105 Air Quality (Highways England, 2019)

b. Local Air Quality Management Technical Guidance (TG22) (LAQM.TG (22)) (Defra, 2022)

c. Guidance on the assessment of dust from demolition and construction (Institute of Air Quality Management, 2014)

d. The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance (Greater London Authority, 2014)

Scope of the assessment

5.3.2 The air quality baseline conditions have been established based on desk-based studies, monitoring and modelling. The assessment of the air quality effects from the Project comprises the following:

a. Construction phase dust assessment

b. Consideration of impacts from plant and river vessels during construction

c. Construction phase combined assessment of additional construction traffic and traffic management

d. Operational phase assessment

e. Significance assessment

f. Compliance risk assessment

5.3.3 No aspects have been scoped out for the assessment of impacts on air quality as a result of the Project.

5.3.4 This assessment also informs other chapters of the ES including Chapter 8: Terrestrial Biodiversity and Chapter 13: Population and Human Health (Application Document 6.1). A separate Health and Equalities Impact Assessment (HEqIA) has been submitted as part of the Development Consent Order (DCO) application (Application Document 7.10), which determines the human health effects of the changes in air quality associated with the Project and has also been informed by the results presented in this chapter.

Temporal scope

5.3.5 The environmental assessment uses defined temporal scopes to characterise the duration of potential effects. The temporal scope refers to the time periods over which impacts may be experienced by receptors.

5.3.6 Temporary (short- and medium-term) effects are typically those associated with demolition and construction works, and permanent (long-term) effects are typically those associated with the completed and operational development.

5.3.7 For air quality, the effects at receptors are generally not described as short, medium or long term in duration. However, the larger the impact magnitude defined, the longer the time expected to be required for that impact to be reversed, and this is a consideration of the significance assessment.

Limits of deviation and Rochdale Envelope

5.3.8 The Project's application of the Rochdale Envelope is summarised in Chapter 2: Project Description. The Limits of Deviation (LOD) for the project (defined in the Draft DCO (Application Document 3.1)) represent an 'envelope' within which the Project would be constructed and have informed the reasonable worst-case approach to assessment for the purposes of this chapter.

5.3.9 An assessment has been conducted within the LOD outlined within Chapter 2: Project Description. The lateral LOD for the Project has been reviewed with respect to sensitive receptors identified within this Chapter and is not considered to have the potential to have a material impact on the air quality effects reported.

Use of the River

5.3.10 Based on the predicted vessel movements associated with the construction of the Project, as outlined in Chapter 2: Project Description, this Chapter considers the requirement for assessment of the use of the river and a qualitative assessment has been undertaken.

5.3.11 Material supply vessels have been excluded from the preliminary Navigation Risk Assessment (pNRA) (Application Document 7.15), although Project vessels were included. Project vessels are those that would be used for temporary works site investigations and during temporary construction works. The reason for the exclusion of material supply vessels from the pNRA is that the imports would be to existing established facilities. The use of established facilities would not give rise to the use of any vessels or any additional vessel movements that would not otherwise be likely to occur in the absence of the Project. Therefore, these movements would be in the scope under existing navigational risk assessments of the Port of London Authority (PLA) and any other Statutory Harbour Authority (SHA) (e.g., Port of Tilbury London Limited (PoTLL) if movements enter their limits). This position was agreed with the PLA and PoTLL in a meeting on 10 May 2021.

Scoping Opinion

5.3.12 A Scoping Report (Highways England, 2017) was submitted to the Planning Inspectorate on 2 November 2017, setting out the proposed approach to this Environmental Impact Assessment (EIA). A Scoping Opinion was received from the Secretary of State on 13 December 2017, which included comments on the scope of assessment from the Planning Inspectorate and Statutory Environmental Bodies. These comments have been taken into account in the preparation of this chapter, and the Project response is set out in Appendix 4.1: The Inspectorate's Scoping Opinion and National Highways' Responses (Application Document 6.3).

5.3.13 It should be noted that the air quality assessment methodology has been updated from that outlined in the Scoping Report following the issue of DMRB LA 105 Air Quality (Highways England, 2019), which supersedes DMRB Volume 11, Section 3, Part 1, HA 207/07 (Highways Agency, 2007) and the four associated Interim Advice Notes. The assessment follows the requirements of DMRB LA 105 (Highways England, 2019) to ensure that the latest standard is followed to determine whether the Project complies with the NPSNN. DMRB LA 105 (Highways England, 2019) provides guidance to determine whether the Project results in a significant impact on air quality or affects the UK's ability to comply with the Air Quality Directive (Directive 2008/50/EC). This information is required by the decision maker as described in Table 1.2 in Appendix 5.5: Air Quality Legislation and Policy (Application Document 6.3). Whilst the guidance has been updated, the general assessment principles are unchanged and have been discussed with stakeholders.

Consultation

Project consultation

5.3.14 Statutory Consultation under Section 42 of the Planning Act 2008 was undertaken on the Project from 10 October 2018 to 20 December 2018. This provided an opportunity for consultees to comment on the Preliminary Environmental Information Report (PEIR) (Highways England, 2018). A summary of the responses to the Statutory Consultation can be found in the Consultation Report (Application Document 5.1). Consultees comprised prescribed bodies, local authorities, people with an interest in land affected by the Project and local communities.

5.3.15 The Project design continued to be developed, which resulted in changes in the Project. These formed the basis for the Supplementary Consultation, which was undertaken from 29 January 2020 to 2 April 2020. A Design Refinement Consultation was undertaken from 14 July 2020 to 12 August 2020.

5.3.16 A Community Impacts Consultation was undertaken from 14 July 2021 to 8 September 2021. This sought feedback on the impacts of the Project at a local ward level, as well as the mitigation proposed for those impacts. Changes to the Project since the Design Refinement Consultation were also presented, along with a summary of how feedback to earlier consultation had shaped the development of the Project.

5.3.17 Prior to the submission of this DCO application, Local Refinement Consultation was held between 12 May 2022 and 20 June 2022. This provided local communities with the opportunity to comment on proposed refinements to the Project.

5.3.18 These Consultations all included information about the environmental impacts associated with the refinements presented for consultation. A summary of the responses to these consultation stages can also be found in the Consultation Report (Application Document 5.1).

Stakeholder engagement

5.3.19 A summary of the stakeholder engagement specific to air quality during the EIA process is provided in Table 5.1.

Table 5.1 Stakeholder engagement

Stakeholder	Date of meeting / communication	Summary of discussions
London Borough of Havering	11 July 2017	EIA Bilateral Meeting – Overview of proposed air quality assessment methodology for the ES, including the baseline monitoring survey and the construction and operational assessments. It was agreed to provide the proposed locations for Project air quality monitoring sites to London Borough of Havering for comment.
Gravesham Borough Council	20 July 2017	EIA Bilateral Meeting – Overview of proposed air quality assessment methodology for the ES, including the baseline monitoring survey and construction and operational assessments. It was agreed that additional baseline monitoring sites would be added in some locations (e.g., Thong Lane). It was also agreed to use Gravesend-Broadness meteorological station for modelling impacts around Gravesham, and that background Defra air quality maps would be compared against monitoring data to ensure they are representative.
Thurrock Council	25 July 2017	EIA Bilateral Meeting – Overview of proposed air quality assessment methodology for the ES, including the baseline monitoring survey and construction and operational assessments.
Thurrock Council	12 October 2017	Air Quality Meeting – Overview of proposed air quality assessment methodology for the ES, including the baseline monitoring survey and construction and operational assessments. It was agreed that additional baseline monitoring sites would be installed in some locations (e.g., Baker Street).

Stakeholder	Date of meeting / communication	Summary of discussions
London Borough of Havering	27 November 2017	Air Quality Meeting – Overview of proposed air quality assessment methodology for the ES, including the baseline monitoring survey and construction and operational assessments. It was agreed that background Defra air quality maps would be compared against monitoring data to ensure they are representative.
Kent County Council	29 November 2017	Air Quality Meeting – Overview of proposed air quality assessment methodology for the ES, including the baseline monitoring survey and construction and operational assessments.
Brentwood Borough Council	06 February 2018	Air Quality Assessment Summary – Overview of proposed air quality assessment methodology for the ES, including the baseline monitoring survey and construction and operational assessments.
Stakeholder Advisory Panel Meeting	19 March 2018	Meeting on EIA progress and Environmental Scoping Report with representatives from Essex County Council, Kent County Council, Gravesham Borough Council, Medway Council, Thurrock Council and Transport for London.
Environment Non-Governmental Organisation Joint Meeting	20 March 2018	Meeting to discuss environmental constraints, surveys, and mitigation approach. Attended by representatives from Essex Wildlife Trust, Kent Wildlife Trust, Royal Society for the Protection of Birds and The Woodland Trust.
Medway Council	24 April 2018	Air Quality Meeting – Overview of proposed air quality assessment methodology for the ES, including the baseline monitoring survey and construction and operational assessments.
Gravesham Borough Council	05 July 2018	Meeting to discuss queries regarding the route design, statutory consultation and for issues and concerns to be raised.
Local authorities and Statutory Environmental Bodies	21 April 2020 Workshop 22 April 2020 Workshop	Preliminary Environmental Impacts and Mitigation Workshop North. Preliminary Environmental Impacts and Mitigation Workshop South. To provide an update on the methodology for assessment of potential effects, significance of effects and approach to mitigation.
Local authorities and Statutory Environmental Bodies	Part 1 23 June 2020 Part 2 25 June 2020	Environmental Impacts and Mitigation and the Register of Environmental Actions and Commitments (REAC). Review Workshop to provide recap on approach to environmental assessment and mitigation.
Medway Council	03 July 2020	Meeting to discuss the air quality assessment results from the ES. The discussion focused on

Stakeholder	Date of meeting / communication	Summary of discussions
		the air quality monitoring and operational modelling results in Medway borough, particularly for M2 junction 1 to Junction 2 and the A228, where exceedances (and perceptible worsenings) of the annual mean NO_2 AQS objective were predicted in the Project opening year.
Brentwood Borough Council Dartford Borough Council Gravesham Borough Council London Borough of Havering Medway Council Thurrock Council Kent County Council	15 September 2020	Air Quality Meeting – Overview of air quality assessment for the ES, including the baseline monitoring survey, DMRB LA 105 (Highways England, 2019) methodology, study area, and the construction and operational modelling methodology. Presentation of ES assessment findings, including significance of effects and mitigation requirements.
London Borough of Havering	15 October 2020	Discussion with London Borough of Havering on the Statement of Common Ground Issues Log for Air Quality. Matters discussed included baseline air quality surveys, scope of assessment, assessment methodology, mitigation measures and monitoring.
Medway Council	11 February 2021	Meeting to discuss the air quality impacts of the Project on the A228, including the feasibility of potential options to mitigate the impact such as a Clean Air Zone and Heavy Goods Vehicle ban. Medway Council confirmed that it has no plans to declare an Air Quality Management Area (AQMA) on the A228 based on its own air quality monitoring data, which shows that air quality meets AQS objectives at properties along the A228 corridor. It was suggested that the results of Project air quality monitoring and modelling may be pessimistic compared with Medway Council air quality monitoring data.
Medway Council	16 March 2021	Meeting to further discuss the air quality of the Project on the A228. Project air quality monitoring along the A228 was compared to Medway monitoring data and was shown to be in good agreement when comparing data for the same year (2019). The Project monitoring data used to inform the ES was shown to be higher because it had been year adjusted to the 2016 base year. Medway Council confirmed that it was happy that the monitoring data was robust. Project model results were presented based on predictions derived from Defra air quality

Stakeholder	Date of meeting / communication	Summary of discussions
		modelling tools and the Long Term Trend (LTT) forecast gap analysis methodology (as described in paragraphs 5.3.93 to 5.3.97 in this chapter). Medway Council acknowledged that the model results presented in the ES were likely to be pessimistic for the opening year due to the LTT uplift factors applied to the Defra based predictions. The vehicle emissions factors and background pollution maps provided by Defra and used by local authorities would predict concentrations well below the AQS objectives in the opening year of the Project, if used in this assessment without the application of LTT uplift factors. It was agreed that further work would be undertaken to explore the feasibility of introducing measures to reduce the air quality impact of the Project on the A228.
Thurrock Council	23 September 2020 08 June 2021	Discussion with Thurrock Council on the Statement of Common Ground Issues Log for Air Quality. Matters discussed included baseline air quality surveys, scope of assessment, assessment methodology, mitigation measures and monitoring.
Community Impacts Public Health Advisory Group (CIPHAG) Briefing 1	03 October 2022	A briefing on how and why the likely significant environmental effects and mitigation have changed in the assessments since October 2020 submission. The briefing included a summary of the likely air quality effects and associated mitigation reported in this chapter.
Medway Council	07 October 2022	Discussion on environmental impacts in Medway, including the likely air quality effects and associated mitigation reported in this chapter. Operational air quality effects on the A228 and A2, London Road were discussed and it was agreed recent Medway Council monitoring data would be reviewed to understand the level of air quality risk along these corridors, given that the model was likely to provide more pessimistic air quality predictions for 2030 compared to Defra methodology.
	Councils contacted to obtain air quality monitoring data:	

Stakeholder	Date of meeting / communication	Summary of discussions
	Basildon Borough Council* Brentwood Borough Council* Broxbourne Borough Council Castle Point Borough Council* Chelmsford City Council Dartford Borough Council* Enfield London Borough Council Epping Forest District Council Gravesham Borough Council* London Borough of Havering*	Maidstone Borough Council Medway Council* Royal Borough of Greenwich Council Sevenoaks District Council* Southend-on-Sea Borough Council Swale Borough Council Tandridge District Council Thurrock Council* Tonbridge and Malling Borough Council* Uttlesford District Council

* indicates councils notified of air quality survey and monitoring locations in July 2017

Study area

5.3.20 The study area for air quality is defined separately for construction dust, construction traffic and operational traffic and is presented in Figures 5.1 to 5.3 (Application Document 6.2). Justification for the study areas defined is described in paragraphs 5.3.21 to 5.3.37 below.

Construction phase

Construction dust

5.3.21 In accordance with DMRB LA 105 (Highways England, 2019), the construction dust assessment study area includes a 200m buffer around anticipated construction works (which represents the area most at risk of being impacted by construction dust), including haul routes, compound areas and soil storage areas. All sensitive receptors (human and designated habitats for ecology) within distance bands 0 – 50m, 50 – 100m and 100 – 200m of the construction works have been identified and are presented in Figure 5.1: Construction Dust Study Area (Application Document 6.2). To provide a precautionary approach, it has been assumed that construction activities could occur up to the boundary of the Order Limits.

Construction traffic and traffic management measures

5.3.22 DMRB LA 105 (Highways England, 2019) recommends that the impact of construction activities on vehicle movements should be assessed where construction traffic impacts are likely to be for more than two years. Construction activities are programmed to last for a period of approximately six years, and therefore in accordance with DMRB LA 105 (Highways England, 2019), an assessment of construction phase traffic impacts was also undertaken.

5.3.23 Forecast construction traffic movements from the Lower Thames Area Model (LTAM) have been provided for each year of the construction programme (2025 to 2030), using the opening year model (2030).

5.3.24 For the without Lower Thames Crossing construction scenario, that is where the construction of the Project does not happen, the construction of other specific schemes has been included, in the LTAM using information from their forecast construction programmes as detailed in the Transport Assessment (Application Document 7.9).

5.3.25 In the with Lower Thames Crossing construction scenario, the Project's forecast construction demand and proposed traffic management measures across the programme have been included in the Project's transport model forecasts which have been used in the air quality assessment of the construction traffic impacts. More details of the approach and the assumptions made are set out in the Transport Assessment (Application Document 7.9) and the Outline Traffic Management Plan for Construction (Application Document 7.14).

5.3.26 The construction traffic data for each year, therefore, includes the activities within each year that will impact on traffic flows and this data has been used to determine the construction phase impacts on air quality.

5.3.27 Further detail on the construction traffic flows and the nature of traffic management measures across the approximately six years can be found in the Transport Assessment (Application Document 7.9) and the Outline Traffic Management Plan for Construction (Application Document 7.14).

5.3.28 The traffic impacts associated with construction vary across the network in each year of the construction phase. The Affected Route Network (ARN) for the construction phase was therefore limited to the areas where the construction traffic triggered the criteria in paragraph 5.3.30 for a period of greater than two years in accordance with DMRB LA 105 (Highways England, 2019). This is due to the fact that periods of two years or less are so short term that, in terms of duration, they would not have a significant effect on air quality.

5.3.29 Given the temporary nature of construction activities which have been included in the assessment, and the temporary duration of the impacts, it is unlikely a significant effect would be triggered unless the number of properties affected was above the upper significance guideline bands shown in Table 5.6.

5.3.30 The ARN is based on the criteria defined in DMRB LA 105 (Highways England, 2019) which includes the following:

a. Road alignment will change by 5m or more.

b. Daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) or more.

c. Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more.

d. Change in speed band (a range of categories for which outputs from the Project's transport model are grouped into to describe their emissions).

e. Any of the criteria above triggered for more than two years.

5.3.31 Roads were excluded from the assessment where they did not meet any of these criteria, or where they met the criteria, but only for a duration of two years or less.

5.3.32 In addition, DMRB LA 105 (Highways England, 2019) states that the construction traffic assessment should be proportionate. Therefore, only areas where there was likely to be a deterioration in air quality were included in the construction assessment. Areas where there would be improvements in emissions due to for example a reduction in traffic volumes (such as the A229) were not included as they would not affect the judgement as to whether the construction impacts would be likely to result in a significant adverse effect. Roads where a change in speed band was forecast were included regardless of whether there was an increase or decrease in flows on the road.

5.3.33 Human health and ecological receptors were modelled in those areas that were within 200m of the construction ARN where increases in traffic and/or changes in speed would result in an increase in emissions.

5.3.34 Defra Pollution Climate Mapping (PCM) links were also identified within the construction ARN to determine whether there was any risk of delay to achieving compliance with the Limit Values due to construction. Given the potential impact of delaying achievement of compliance, the assessment also identified whether the change in traffic flows associated with the construction phase triggered the ARN criteria for less than two-years, on a precautionary basis.

5.3.35 The extent of the construction phase assessment study area is presented in Figure 5.2: Construction Traffic Study Area (Application Document 6.2). All the roads modelled were within the Traffic Reliability Area of the Project's transport model.

Operational phase

5.3.36 The operational study area is determined by the change in traffic associated with the opening year of the Project, as predicted from the Project's transport model. To determine which roads, meet the DMRB ARN criteria (as described in paragraph 5.3.30 but excluding the criteria in bullet point 'e' of this paragraph), traffic flows from the Do-Minimum scenario (i.e., without the Project) were compared to the Do-Something scenario (i.e., with the Project). The operational air quality study area then includes receptors within 200m of this ARN and is presented in Figure 5.3: Operational Study Area (Application Document 6.2). All the roads modelled were within the Traffic Reliability Area of the Project's transport model.

5.3.37 Concentrations of NO_2 and PM_{10} were predicted at receptors present in worst-case locations for air quality in accordance with DMRB LA 105 (Highways England, 2019) (i.e., those receptors likely to have the highest predicted pollutant concentrations and largest changes in air quality as a result of the Project). The PM_{10} predictions were also used to predict $PM_{2.5}$ concentrations at these receptors, as described in paragraph 5.3.70.

Impact assessment methodology

5.3.38 The assessment follows the general approach described in Chapter 4: EIA Methodology. This section provides topic-specific information regarding the methodology used for establishing the baseline conditions, and the methods used for the construction and operational phase assessments.

Method of establishing existing baseline

Existing baseline

5.3.39 The existing baseline in relation to air quality was established based on desk-based studies, monitoring and modelling.

Desk-based studies

5.3.40 A desk-based review of the following data sources was undertaken to determine the baseline conditions across the Project study area:

a. Defra UK-AIR website (Defra, 2021a)

b. Local authority websites (LAQM and Annual Status Report documents)

c. London Air website (London Air Quality Network, 2021)

d. Kent Air website (Kent and Medway Air Quality Monitoring Network, 2021)

e. Essex Air website (Essex Air, 2021)

f. National Highways air quality monitoring

g. Connect Plus air quality monitoring

h. Air Pollution Information System (APIS) (Centre for Ecology and Hydrology, 2022)

i. Defra Pollution Climate Mapping (PCM) modelling

5.3.41 Monitoring data was obtained from local authorities within the assessment study area. Data was also collected from NO_2 diffusion tubes and automatic monitoring sites as presented in Section 5.4 below and Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3).

5.3.42 National Highways has historically undertaken NO_2 diffusion tube monitoring for the following road schemes in the study area:

a. A2 Bean

b. M20 junctions 3 to 5

c. M25 junction 30

d. A2 Ebbsfleet

e. A12 M25 to Chelmsford

f. M25 junctions 23 to 27

g. M25 junction 25 improvement

h. M25 junction 28 improvement

i. M2 junction 5 improvement

j. Dartford (mainly covering M25 junctions 1a to 3)

5.3.43 The monitoring by National Highways for these schemes was carried out over different periods between August 2013 and December 2017. The data was adjusted to 2016 (corresponding with the transport model base year) using the methodology described in Appendix 5.1: Air Quality Methodology (Application Document 6.3). The data needed to be adjusted to the base year for use in the model verification.

5.3.44 Connect Plus (who work on behalf of National Highways to manage and operate the M25) have been carrying out NO_2 diffusion tube monitoring from around 50 sites around the M25 since 2013. Many of these sites fall within the assessment study area, and the data collected from them includes the 2016 base year.

5.3.45 The locations of the Local Authority, National Highways and Connect Plus monitoring sites are presented in Figure 5.4: Air Quality Monitoring Sites and 2016 Annual Mean Data (Application Document 6.2).

Monitoring

5.3.46 An additional survey was undertaken to address gaps in air quality monitoring data near roads likely to be affected by the Project. A total of 94 NO_2 diffusion tubes were installed in the assessment study area, covering various periods from January 2018 to December 2019, as described in Appendix 5.1: Air Quality Methodology (Application Document 6.3). Some monitoring sites were installed and decommissioned later in the survey than others in response to the air quality risk (i.e., areas of possible exceedance of Air Quality Strategy (AQS) objectives, see Table 5.4), which was reviewed throughout the survey. The locations of the Project monitoring sites in the assessment study area are shown in Figure 5.4: Air Quality Monitoring Sites and 2016 Annual Mean Data (Application Document 6.2).

5.3.47 All of the sites were adjusted to 2016 base year following the procedure outlined in Appendix 5.1: Air Quality Methodology (Application Document 6.3).

Modelling

5.3.48 Dispersion modelling was undertaken to predict base year 2016 annual mean concentrations of NO_2 and PM_{10} at human health receptors for construction and operation. Although not explicitly modelled, the impact of the Project against the $PM_{2.5}$ thresholds were also assessed using the modelled PM_{10} annual mean concentrations.

5.3.49 A description of how the receptors were selected is provided in paragraphs 5.3.111 to 5.3.116. The base year predictions are presented in Table 1.1 of Appendix 5.3: Air Quality Construction Phase Results (Application Document 6.3) and Table 1.1 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3).

5.3.50 The dispersion model was also used to predict nitrogen deposition in ecological designated habitats in the base year. Paragraphs 5.3.117 to 5.3.126 describe how the ecological receptors were selected and the predictions are shown in Table 2.1 and Table 2.2 of Appendix 5.3: Air Quality Construction Phase Results (Application Document 6.3) and Table 2.1 and Table 2.2 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3).

Future baseline ('Do-Minimum' scenario)

5.3.51 Dispersion modelling was used to predict future baseline annual mean NO_2 and PM_{10} concentrations at construction human heath receptors for years between 2025 and 2030. The modelling results for the receptors modelled for each of the construction years are presented in Table 1.1 to Table 1.6 of Appendix 5.3: Air Quality Construction Phase Results (Application Document 6.3).

5.3.52 To forecast the future air quality conditions likely without the Project at operational human health receptors, dispersion modelling was used to predict annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations in the Project's opening year Do-Minimum scenario. These future baseline receptor concentrations are presented in Table 1.1 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3).

5.3.53 Opening year Do-Minimum nitrogen deposition has been predicted at ecological receptors using dispersion modelling, and the results are shown in Table 2.1 and Table 2.2 of Appendix 5.3: Air Quality Construction Phase Results (Application Document 6.3) and Table 2.1 and Table 2.2 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3).

Method of assessment – construction

Construction dust

5.3.54 Construction is anticipated to start in 2025 with the new road and tunnel expected to open in 2030. A detailed construction description is included in Appendix 2.1 Construction Supporting Information (Application Document 6.3). Construction would include activities that are expected to generate dust such as the following:

a. Topsoil removal

b. Earthworks including cutting and filling

c. Construction of retaining walls, bridges, and viaducts

d. Pavement construction and resurfacing

e. Road widening works

f. Demolition works

g. Temporary stockpiling

h. Construction of twin bored tunnels using tunnel boring machines

5.3.55 The construction phase therefore has the potential to affect local air quality through the generation and deposition of construction dust, particularly where there are receptors close to the activities described in paragraph 5.3.54.

5.3.56 DMRB LA 105 (Highways England, 2019) requires the construction dust risk potential of the Project to be determined (either 'large' or 'small'), in accordance with the criteria presented in Table 5.2.

Table 5.2 Construction dust risk potential

Risk	Examples of the type of project
Large	Large smart motorway projects, bypasses and major motorway junction improvements.
Small	Junction congestion relief project i.e., small junction improvements, signalling changes. Short smart motorway projects.

5.3.57 DMRB LA 105 (Highways England, 2019) also requires the sensitivity of the receiving environment to construction dust to be determined in accordance with Table 5.3.

Table 5.3 Receiving environment sensitivity to construction dust

Construction dust risk potential	Distance from construction activities		
	0 – 50m	50 – 100m	100 – 200m
Large	High	High	Low
Small	High	Low	Low

Construction road traffic and traffic management

5.3.58 The method used to determine the construction study area is presented in paragraphs 5.3.22 to 5.3.35.

5.3.59 The following traffic scenarios were considered in the construction assessment:

a. Do-Minimum – the without the Project construction scenario for each year between 2025 and 2030 (see paragraph 5.3.24)

b. Construction phase – the construction phase traffic data includes traffic management and construction traffic for each year between 2025 and 2030 (see paragraph 5.3.25).

5.3.60 The air quality modelling for the assessment of construction traffic is consistent with that described in the 'Method of assessment – operation' section of this chapter. The construction assessment is based on the traffic data for each year of construction (between 2025 and 2030) and therefore the emission factors and background pollution maps used are specific to the construction year being assessed.

5.3.61 Outputs of construction transport modelling data from the LTAM (described in the Transport Assessment (Application Document 7.9) and the Combined Modelling and Appraisal Report (Application Document 7.7)) have been used for this assessment to predict the construction phase traffic impacts. The traffic data used is described in paragraphs 5.3.22 to 5.3.35.

Method of assessment – operation

5.3.62 The standards contained in DMRB LA 105 (Highways England, 2019) require the air quality assessment to do the following:

a. Identify, describe and assess the likely significant effects of the Project resulting from impacts on air quality at human and ecological receptors.

b. Identify, describe and assess the risk of the Project affecting the UK's reported ability to comply with the Air Quality Directive (Directive 2008/50/EC) in the shortest time possible.

5.3.63 The AQS objectives and Limit Values relevant to this assessment are shown in Table 5.4 and are expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, within a specified timescale. AQS objectives and Limit Values are mostly identical in relation to the concentrations of pollutants and the averaging periods that are applied, but there are differences in how they should be interpreted and assessed. Local authorities are required to demonstrate best efforts to achieve the AQS objectives, whereas the UK Government is legally required to achieve the Limit Values in the shortest time possible. The legislation associated with the adoption of the AQS objectives and Limit Values is provided in Table 1.1 of Appendix 5.5 Air Quality Legislation and Policy (Application Document 6.3).

Table 5.4 Air Quality Strategy objectives and Limit Values

Pollutant	Air Quality Strategy objectives		Limit Values	
	Concentration and averaging period	**Compliance date**	**Concentration and averaging period**	**Compliance date**
NO_2	200µg/m^3 (1-hour mean, not to be exceeded more than 18 times per year)	31 Dec 2005	200µg/m^3 (1-hour mean, not to be exceeded more than 18 times per year)	01 Jan 2010
	40µg/m^3 (annual mean)	31 Dec 2005	40µg/m^3 (annual mean)	01 Jan 2010
PM_{10}	50µg/m^3 (24-hour mean, not to be exceeded more than 35 times per year)	31 Dec 2010	50µg/m^3 (24-hour mean, not to be exceeded more than 35 times per year)	01 Jan 2005
	40µg/m^3 (annual mean)	31 Dec 2004	40µg/m^3 (annual mean)	01 Jan 2005
$PM_{2.5}$	25µg/m^3 (annual mean)	2020	20µg/m^3 (annual mean)	01 Jan 2020
NO_x*	30µg/m^3 (annual mean)	31 Dec 2000	30µg/m^3 (annual mean)	19 July 2001

* NO_x critical level for the protection of vegetation and ecosystems. The NO_x Limit Value only applies to locations more than 20 km from towns with more than 250,000 inhabitants or more than 5 km from other built-up areas, industrial installations or motorways.

5.3.65 Compliance with Limits Values is reported by Defra at a zonal/agglomeration level. Zones/agglomerations are only reported as compliant when the assessment undertaken by Defra demonstrates that the zone achieves the Limit Values. This approach is designed to report the maximum concentration within the zone and determine the date by which the entire zone would comply with the Limit Value. Defra's PCM model is used to determine whether the pollution from roads exceeds the Limit Values. The predictions within the PCM model are based on a 4m distance from the road, regardless of the distance from the road where there is a qualifying feature (area of exposure within 15m of the PCM link e.g., area of public access (footpath), house, garden etc).

5.3.66 The assessment of AQS objectives is undertaken by local authorities. Local authorities determine the areas that exceed the AQS objectives and are therefore required to be designated as AQMAs. These areas can range from an individual property to the whole of the authority's administrative area.

5.3.67 Table 5.5 shows the key differences in relation to the locations where the Limit Values and AQS objectives apply. These differences are important when determining whether the Project complies with the NPSNN.

Table 5.5 Assessment differences between AQS objectives and Limit Values

Relevant exposure/locations	AQS objectives	Limit Values
Relevant exposure in relation to assessment of air quality threshold	The AQS objectives only apply where members of the public are likely to be regularly present for the averaging period of the objective. For example, annual mean AQS objectives only apply at locations such as residential properties and not in areas where exposure occurs over shorter timescales (e.g., gardens and footpaths).	Defra assessment of compliance with the Air Quality Directive (Directive 2008/50/EC) is that the annual mean Limit Values apply anywhere with public access regardless of the averaging period, and specifically next to PCM links (e.g., a footpath would be included for the assessment of the annual mean Limit Value).
Locations where air quality legislation applies	Anywhere that there is relevant public exposure	Only areas identified by Defra in its PCM model.
Locations excluded from where air quality legislation applies	Inside buildings, vehicles and natural or man-made structures, e.g., within tunnels. Areas where members of public don’t have access, e.g., commercial premises, workplaces	• Within 25m of junctions • Greater than 15m from the running lane • Public access across a carriageway, e.g., foot bridges/tunnels • Inside buildings, vehicles and natural or man-made structures, e.g., within tunnels. • Areas where members of public do not have access, e.g., commercial premises, workplaces

Air quality dispersion modelling

5.3.69 The Atmospheric Dispersion Modelling System ADMS-Urban (version 5.0) was used to predict NO_2 and PM_{10} concentrations at sensitive human and ecological receptors in the study area. It should be noted that DMRB LA 105 (Highways England, 2019) states that PM_{10} modelling of the opening year should only be necessary where an exceedance of PM_{10} AQS objectives is predicted in the base year. Given the length of new road that has been modelled for this Project, opening year PM_{10} concentrations have been predicted in this case, as it is not possible to use base year PM_{10} concentrations to characterise future PM_{10} concentrations next to the new A122 road (as it does not exist in the base year).

5.3.70 $PM_{2.5}$ concentrations were not modelled as this is not a requirement of DMRB LA 105 (Highways England, 2019). However, to address comments from the Planning Inspectorate, Gravesham Borough Council and Thurrock Council, the modelled PM_{10} results have been used (as they contain the $PM_{2.5}$ fraction) to demonstrate that there will be no risk of $PM_{2.5}$ exceeding statutory thresholds (see paragraphs 5.6.111 to 5.6.112).

5.3.71 The operational phase assessment considered the following scenarios:

a. Base year (2016) – predicted baseline air quality environment, used to characterise baseline and to carry out model verification.

b. Do-Minimum (2030) – predicted future air quality environment in the Project's opening year without the Project.

c. Do-Something (2030) – predicted future air quality environment in the Project's opening year with the Project.

5.3.72 A future year of 2030 has been selected for modelling as this represents the earliest anticipated opening year of the Project. Background pollutant concentrations and emissions from newer vehicles (alternative fuelled and Euro 6/VI) are expected to improve air quality over time as older more polluting vehicles are replaced in the vehicle fleet. Therefore, 2030 represents the worst-case in terms of air quality impacts.

5.3.73 The dispersion model was built by digitising links from the transport model to the Ordnance Survey (OS) MasterMap Integrated Transport Network and assigning road widths based on OS MasterMap Highways Network data and aerial imagery.

5.3.74 The following inputs and tools informed the air quality modelling assessment, each of which is explained in the following paragraphs:

a. Traffic data

b. Tunnel module

c. Speed band emission factors

d. NO_x to NO_2 conversion

e. Meteorological data

f. Receptors (human and ecological)

g. Background pollutant concentrations

h. Future assumptions on concentrations based on monitored trends

Traffic data

5.3.75 Traffic data used in the assessment was obtained from the LTAM, which is a transport model developed by National Highways that uses Simulation and Assignment of Traffic to Urban Road Networks (SATURN) software. The traffic data used is that from the core scenario of the LTAM (the most likely traffic forecast flows) and has been converted into the format required for the air quality assessment. Further information on the transport modelling is outlined in Appendix B: Transport Model Package and Appendix C: Transport Forecasting Package of the Combined Modelling and Appraisal Report (Application Document 7.7).

5.3.76 The data used in the assessment comprises total vehicle flows, percentage of HDVs and speeds for the four periods set out below. These periods were chosen as they were the most representative of the traffic conditions for the different periods of the day. Modelling periods ensures that congestion and higher emissions are captured in the air quality modelling compared to modelling daily average traffic conditions. The periods used in the air quality modelling to account for different traffic conditions through the day were:

a. AM peak period (06:00 to 09:00)

b. Inter-peak (IP) period (09:00 to 15:00)

c. PM peak period (15:00 to 18:00)

d. Off-peak (OP) period (18:00 to 06:00)

5.3.77 The data was based on AADT and categorised into speed bands in accordance with DMRB LA 105 (Highways England, 2019).

Tunnel module

5.3.78 The study area includes the Holmesdale and Bell Common tunnels on the M25, the Dartford Crossing tunnels, and the new tunnels associated with the Project. The ADMS tunnels module was used to calculate the dispersion of pollutants from the tunnel portals. The parameters for each tunnel were obtained from National Highways, including the tunnel portal sizes. The tunnels would be ventilated using longitudinal nozzle or jet fan systems in the direction of traffic flow. Although the Dartford Crossing tunnels have a ventilation stack, they are used only when a fire is detected and therefore the emissions from this stack were not included in the air quality model.

Speed band emission factors

5.3.79 Road traffic emission factors for NO_x and PM_{10} were derived from the speed band emission factors published by National Highways. The speed band emission factors were generated from the Emissions Factors Toolkit (EFT) v11 (released November 2021) (Defra, 2021b). EFT provides emission factors for 2018 to 2050, and the developers of the tool (Bureau Veritas) provided National Highways with a version to allow speed band emissions to be calculated for 2016 based on EFT v11.

5.3.80 It should be noted that, for particulates, the emission factors incorporate exhaust emissions, as well as non-exhaust emissions from brake and tyre wear and road abrasion.

5.3.81 Emissions were defined according to the speed band category of the road and the road type and location. The emissions were represented in the dispersion model using time varying emission factors.

NO_x to NO_2 conversion

5.3.82 Road traffic NO_x concentrations were predicted by the dispersion model, and these needed to be converted to NO_2 for comparison with AQS objectives and Limit Values.

5.3.83 In accordance with Local Air Quality Management Technical Guidance (TG22) (LAQM.TG (22)) (Defra, 2022), all modelled road-based concentrations of NO_x were converted to annual mean NO_2 using the 'NO_x to NO_2' calculator (Defra, 2020). It should be noted that the latest Defra 'NO_x to NO_2 calculator (Version 8.1, released August 2020) only allows conversions to be calculated for 2018 to 2030. The method therefore to generate the 2016 concentrations was agreed between National Highways and the developer of the tool (Ricardo-AEA) to allow conversions to be calculated for the 2016 base year (i.e., from the Version 8.1 calculator). This required year 2016 primary NO_2 values available from the National Atmospheric Emissions Inventory to be input into the NO_x to NO_2 calculator.

5.3.84 The traffic mix (e.g., whether urban road or motorway) and local authority used for the conversion from NO_x to NO_2 were selected depending on the modelled receptor and monitoring site location.

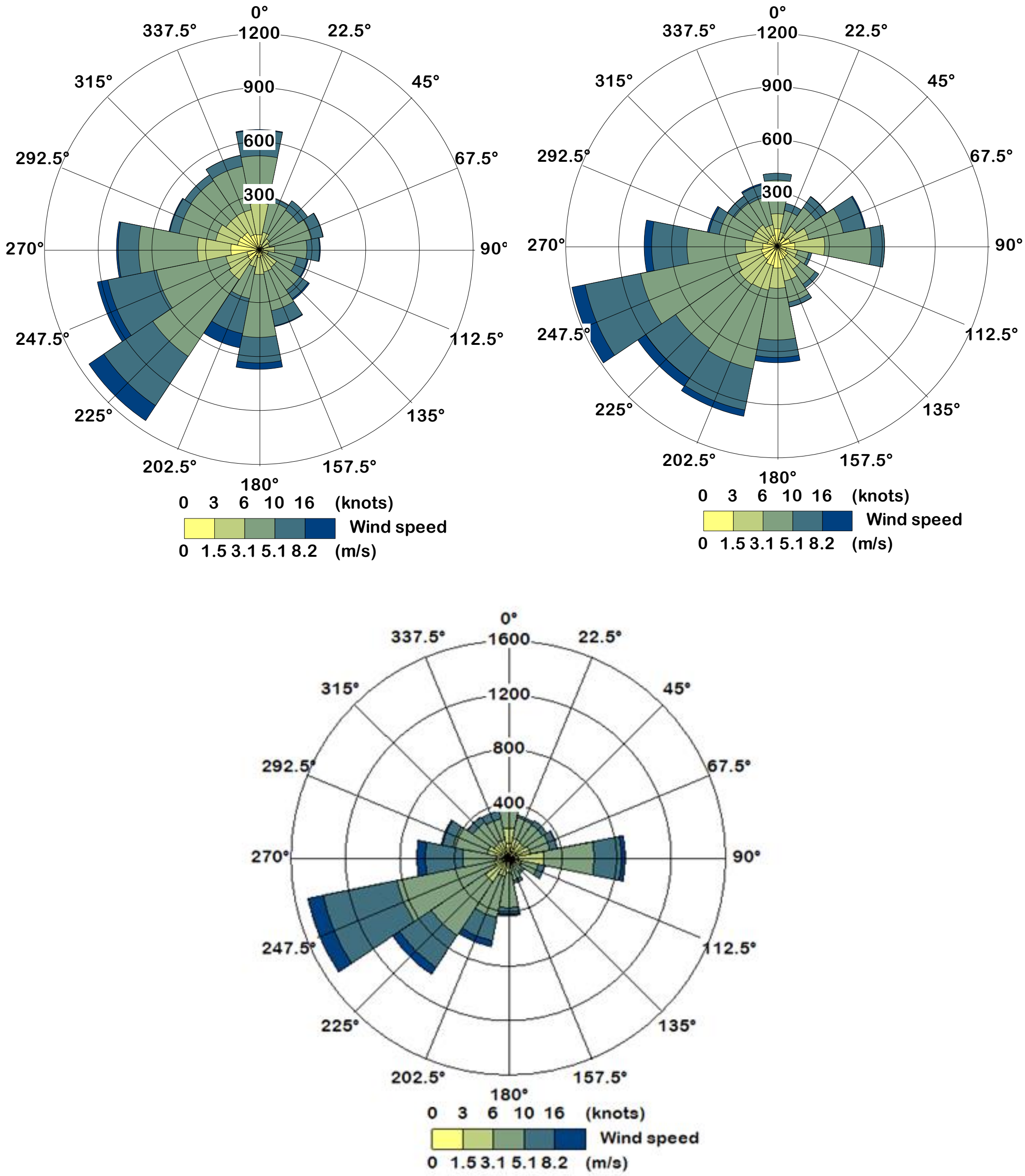
Meteorological data

5.3.85 The study area covers hundreds of kilometres of road network, so the operational model was split into meteorological zones to ensure the meteorology included in the model was representative of conditions for different regions of the study area.

5.3.86 Meteorological data recorded at Stansted Airport during 2016 was used for modelling roads north of M25 junction 28, all of which are within 30km of this station. Meteorological data from Gravesend-Broadness weather station was used for the area south of M25 junction 28. This weather station is located within 5km of the Order Limits and the majority of roads within the study area are located within 30km of this station. It should be noted that the meteorological zones were split around M25 junction 28, which is a rural environment, to allow the influence of the change in meteorology to be kept minimal due to the limited number of receptors at the boundary of the meteorological zone. Meteorological data from London City Airport weather station was used for operational receptors on the A102 and A13 located towards the centre of London (those within 10km of London City Airport).

5.3.87 Meteorological data for the year 2016 was used, corresponding with the base year of the transport model, and enabling verification of modelled outputs with 2016 monitoring data. The wind roses for Stansted Airport, Gravesend-Broadness and London City Airport weather stations are presented in Plate 5.1. While the predominant wind direction is from the south-west for all stations and is associated with the greatest wind speeds, there are small differences in the wind roses. The weather stations at Stansted Airport and Gravesend-Broadness have more variability in wind direction relative to London City Airport, where an easterly wind direction is more common. It should be noted that Gravesend-Broadness weather station is located within 5km of the Order Limits and is the closest station to the vast majority of roads in the ARN (around 80% of the roads in the operational study area), where the greatest traffic and air quality impacts are predicted. Stansted Airport and London City Airport are located on the periphery of the ARN but have been used as they are the most representative of those parts of the ARN.

Plate 5.1 2016 wind rose for Stansted Airport (left), Gravesend-Broadness (right) and London City Airport (bottom)



5.3.88 A surface roughness value of 0.5m and minimum Monin-Obukhov length of 10m was used throughout the model (except for receptors within 10km of London City Airport, where a surface roughness and minimum Monin-Obukhov length of 1m and 100m were respectively used). These parameters, which are determined by land use, influence wind patterns and atmospheric turbulence and, therefore, affect pollution dispersion. These values were selected as they were judged to be most representative of the predominant land use dispersion characteristics across the study area.

5.3.89 For the construction phase assessment, meteorological data recorded at the Gravesend-Broadness weather station (2016) was used for the modelling as the study area did not extend far enough north to require the use of the Stansted Airport data. Data from London City Airport (2016) was also utilised for the construction phase assessment although its use was limited to small area on the A406/M11 where a Defra PCM link overlapped with an isolated section of the ARN and therefore the compliance risk required assessment.

Background pollutant concentrations

5.3.90 Total air pollutant concentrations comprise a background and a local road component, both of which are considered for the air quality assessment. The background component is determined by regional, national, and international emissions, and often represents a significant proportion of the total pollutant concentration. The local component of the background is affected by emissions from sources such as roads and chimney stacks, which are less well mixed locally, and add to the background concentration.

5.3.91 Background NO_2 and PM_{10}/$PM_{2.5}$ concentrations vary spatially throughout the UK and are forecast to improve in future years. For the purposes of this assessment, the background concentrations were obtained from the UK-AIR website Defra (2021b). The latest background maps that have a reference year of 2018 were used. These maps were adjusted back to 2016 based on factors from automatic monitoring and were compared and adjusted against monitoring data obtained from background monitoring sites as described in Appendix 5.1: Air Quality Methodology (Application Document 6.3).

5.3.92 Background nitrogen (N) deposition data was obtained from the APIS database (Centre for Ecology and Hydrology, 2022) to predict N deposition at ecological designated habitats and represents a three-year average deposition rate to moorland (short vegetation) or forest (tall vegetation) over the period 2017 to 2019. The background rate was selected according to whether the ecological receptor modelled was associated with short or tall vegetation.

Future assumptions on concentrations based on monitoring trends

5.3.93 Vehicle emission factors assume that air quality improves in future years, as older vehicles are replaced with modern cleaner vehicles. However, UK monitored roadside NO_2 concentrations have generally not declined as would be expected. This trend is thought to be related to the increased use of modern diesel vehicles, which emit more NO_x in the real world than expected; they also have higher primary NO_2 emissions than petrol vehicles.

5.3.94 To address this uncertainty and to ensure that future pollutant concentrations generated by the air quality model are not overly optimistic, DMRB LA 105 (Highways England, 2019) provides an approach to uplift modelled future NO_2 concentrations. The approach requires a gap analysis to be carried out. In the gap analysis, adjustment factors are applied to uplift the modelled results to account for the gap between measured roadside NO_2 concentrations and the concentrations predicted in the future when using Defra air quality modelling tools.

5.3.95 The DMRB LA 105 (Highways England, 2019) approach involves adjusting modelled NO_2 for both the opening year (2030) Do-Minimum and the Do-Something scenarios. This adjustment uses the base year (2016) NO_2 and an alternative scenario (termed the projected base year), which is the base year traffic data with opening year emissions and background air quality. National Highways provided a gap analysis tool (Long Term Trend, LTTv1.1) to assist with the calculation.

5.3.96 DMRB LA 105 (Highways England, 2019) requires the gap analysis tool to be compared to monitored local air quality trends to ensure that the resulting predictions are neither too conservative nor too optimistic regarding future concentrations. This comparison is presented in Plate 3.1 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3) and is based on NO_2 monitored from automatic stations in the study area. The analysis suggests that the gap analysis tool is representative of historic long-term trends in local air quality.

5.3.97 Additionally, concentrations generated at receptors in the construction phase assessment were adjusted based on the gap analysis, using the specific construction year that was modelled.

Assessment of short-term NO_2 and PM_{10} concentrations

5.3.98 LAQM.TG (22) (Defra, 2022) advises that exceedances of the 1-hour mean NO_2 AQS objective are unlikely to occur where the annual mean is less than 60µg/m^3. Therefore, exceedances of 60µg/m^3 as an annual mean are used as an indicator of potential exceedances of the 1-hour mean NO_2 AQS objective.

The prediction of daily mean concentrations of PM_{10} is available as an output option within the ADMS roads dispersion model for comparison against the short-term air quality objective. However, as the model output for annual mean concentrations is considered more accurate than the modelling of the daily mean, an empirical relationship has been used to determine daily mean PM_{10} concentrations. In accordance with LAQM.TG (22) (Defra, 2022), the following formula was used: No. of 24-hour mean exceedances = -18.5 + 0.00145 x annual mean^3 + (206 / annual mean)

5.3.99 Based on this formula, an exceedance of the 24-hour mean PM_{10} AQS objective is unlikely to occur where the annual mean PM_{10} concentration is less than 32µg/m^3.

Designated habitats

5.3.100 Road traffic can contribute to N deposition as a result of emissions of NO_x and ammonia (NH_3). Vehicles generate NH_3 due to the technologies used to control emissions of other pollutants such as NO_x. Increases in N deposition can lead to adverse effects on ecological receptors. Critical loads for N deposition are habitat dependent and represent the exposure below which there should be no significant harmful effects on sensitive elements of the ecosystem (according to current knowledge).

5.3.101 There is currently no approved emission factors or Government tool for the assessment of NH_3 emissions from road traffic. However, as it is recognised that NH_3 can be a significant contributor to N deposition, National Highways developed a tool (which has been peer reviewed by the Institute of Air Quality

Management) to calculate N deposition associated with the road NH_3 component.

5.3.102 The tool calculates road NH_3 concentrations using the modelled road NO_x concentrations, which are factored against NH_3/NO_x ratios specific to Light Duty Vehicles (LDVs) and HDVs. The NH_3/NO_x ratio varies depending on the year being assessed as well as the dominant road type. The tool has been developed by reviewing the latest emissions literature and incorporating National Highways vehicle emission testing to develop the relationship between emissions of NO_x and NH_3 from the various vehicle types (e.g., diesel cars, petrol cars, Heavy Goods Vehicles). The ratios can then be applied to the modelled road NO_x to derive an NH_3 concentration.

5.3.103 Since the NH_3/NO_x ratios vary between LDVs and HDVs, the air quality models were rerun with only the HDV emissions. This enabled the contribution of LDVs and HDVs to road NO_x to be derived (total road NO_x could be subtracted from HDV NO_x to calculate LDV NO_x). The road NH_3 concentration was then converted to N deposition by a tool supplied by National Highways which incorporates the deposition velocities for NH_3 depending on whether the habitat type was short or tall vegetation.

5.3.104 DMRB LA 105 (Highways England, 2019) requires an assessment of N deposition impacts on internationally, nationally, and locally designated habitats of ecological conservation importance within 200m of the ARN. Designated habitats can include Ramsar sites, Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSIs), Local Nature Reserves (LNRs), Local Wildlife Sites (LWSs), nature improvement areas, ancient woodland, and veteran trees.

5.3.105 Before the modelled NO_x concentration is converted to N deposition (which includes the NH_3 element), any changes in NO_x between the Do-Minimum and Do-Something scenarios which were 1% or less of the NO_x critical level (i.e., $\leq 0.3\mu g/m^3$) are imperceptible, and as such were not converted to N deposition for use in the judgement of N deposition impacts. This can be explained by the fact that the NO_x concentrations form the basis of the calculations of N deposition, and so where changes in NO_x concentrations are imperceptible, any changes in N deposition resulting from the imperceptible change should also be classed as imperceptible regardless of the percentage change against the critical load. This is consistent with the assessment of human health, where 1% of the AQS objective is considered to be imperceptible according LA 105 guidance (see paragraph 5.3.134). It should be noted, for designated habitats, 1% of the critical level (i.e., $0.3\mu g/m^3$) will be a much smaller modelled value than 1% of the NO_2 AQS objective ($0.4\mu g/m^3$ of NO_2 is equivalent to approximately $0.8\mu g/m^3$ of NO_x), and as such is also considered precautionary when assessing designated habitats.

5.3.106 The assessment of N deposition comprises the following key stages:

a. Obtaining background N deposition rates from the APIS database for the 5km-by-5km grid square(s) corresponding with the designated habitat receptor and habitat type, whether moorland (short vegetation) or forest (tall vegetation).

b. Calculating annual mean road NO_2 concentrations at the designated habitat receptor for the base year, Do-Minimum and Do-Something scenarios.

c. Converting road NO_2 concentrations to road N deposition (1µg/m3 of NO_2 = 0.14kgN/ha/yr for grassland type habitats and 1µg/m3 of NO_2 = 0.29kgN/ha/yr for forests and similar habitats).

d. Converting road NO_x concentrations into NH3 associated N deposition using the National Highways ammonia N deposition tool (v1).

e. Adding the road N deposition from NO_2 and NH3 to the APIS background N deposition and comparing with the lower critical load (LCL) for the habitat in question.

Determining significance of effects

5.3.107 As described in Chapter 4: EIA Methodology, the significance of environmental effects was determined by taking into account the value (sensitivity) of the receptor and the magnitude of the impact. The following paragraphs set out the value (sensitivity) and impact magnitude criteria used in this assessment, based on DMRB LA 105 (Highways England, 2019).

5.3.108 For air quality, the generic significance matrix as provided in Chapter 4: EIA Methodology does not apply. Instead, the method for determining significance for air quality is based on DMRB LA 105 (Highways England, 2019), as set out in this chapter.

5.3.109 The assessment of significance undertaken in this chapter is used as the basis for identifying effects which are considered significant in the context of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (EIA Regulations).

Defining value/sensitivity of resources and/or receptors

Human health receptors

5.3.110 Receptors were selected at locations where AQS objectives apply (i.e., where members of the public are likely to be present). The AQS objectives are health-based thresholds and all human health receptors are assumed to be of high sensitivity.

5.3.111 Worst-case receptor locations were selected where total pollutant concentrations were expected to be greatest (typically closest receptors to roads and junctions) and where the largest change in air quality was anticipated based on the Project traffic impacts. The receptors considered included residential uses, educational facilities, hospitals, care homes and hotels (note that only short-term AQS objectives apply at hotels). It should be noted that as described in Table 5.5, the AQS objectives do not apply to offices or other places of work where members of the public do not have regular access.

5.3.112 All receptors considered to be at risk of exceeding NO_2 AQS objectives were included in the model, based on the baseline conditions (monitored and modelled) and by considering the traffic flows and impacts associated with the Project and the location of receptors relative to roads. These receptors were also reviewed using the Do-Minimum and Do-Something modelling results to ensure all receptors at risk have been included in the opening year assessment. Receptors were also added at residential gardens on Arlington Crescent, Waltham Cross, in the operational model, where there was a risk of exceedances of the 1-hour NO_2 AQS objective (based on predicted annual mean NO_2 concentrations). Human health receptors were modelled at the height of human exposure at ground floor (1.5m) and in some cases first floor height (4.5m), which was usually for modelling residential properties above commercial premises.

5.3.113 Future receptors were included in the model based on approved/permitted planning applications identified within the study area. These were typically developments where residential properties were proposed. Where exact locations of future properties were unknown, the closest boundary of the site to the neighbouring affected road was modelled as a worst case.

5.3.114 A total of 765 human health receptors were selected for the operational assessment at worst-case locations across the model study area, as shown in Figure 5.6: Operational Phase Receptors and Results (Application Document 6.2). It should be noted that the human receptors used in the assessment are not numerically sequential and so the receptor numeric ID may exceed the number of receptors in some cases. This is true of all receptors considered in the assessment for both construction and operation.

5.3.115 For the construction phase traffic and traffic management assessment, human health receptors were also chosen within 200m of those roads where the DMRB traffic change criteria (paragraph 5.3.30) were met for a period of more than two years due to the construction activities in accordance with DMRB LA 105 (Highways England, 2019). These receptors were chosen in the same way as the operational receptors.

5.3.116 A total of 217 human health receptors were selected for the construction assessment at worst-case locations across the model study area, as shown in Figure 5.5: Construction Traffic Receptors and Results (Application Document 6.2).

Ecological receptors

5.3.117 Ecological receptors were selected at designated habitats sensitive to the effects of N deposition (i.e., at locations where critical loads for N deposition apply, which excludes designated sites for geology, for example). All ecological receptors selected were assumed to be of high sensitivity.

5.3.118 N deposition has been modelled in designated habitats within 200m of the operational ARN, comprising Ramsar sites, SPAs, SACs, SSSIs, LNRs, Roadside Nature Reserves (RNRs), LWSs, nature improvement areas, ancient woodland, and veteran trees. It should be noted that site designations can sometimes overlap, and so for example a receptor representing an ancient woodland may also represent an LWS; in this case, one receptor point would cover two designated habitats. Furthermore, in some cases multiple receptor points can represent one designated habitat, for example where the designated habitat is on two sides of an affected road.

5.3.119 The habitats were modelled as worst-case receptor points at the closest point between the road and the designated habitat. Where the N deposition exceeded the LCL, and where the Project increase in N deposition was predicted to exceed 0.4kg N ha^{-1} yr^{-1} at the worst-case receptors (which is the threshold used to consider potential significant effects on site integrity in accordance with DMRB LA 105 (Highways England, 2019)), further points were added in the form of transects (i.e. line of receptors at 10m intervals extending into the habitat, as required by DMRB LA 105 (Highways England, 2019)). However, where impacts were 0.4 N ha^{-1} yr^{-1} or less or N deposition was below the LCL at the worst-case receptors, significant effects could be discounted, and no additional points were included in the model given that impacts will decrease with distance from the road.

5.3.120 North Downs Woodlands SAC was modelled as a receptor transect to inform the Habitats Regulations Assessment (Application Document 6.5). Epping Forest SAC is close to Bell Common Tunnel (M25) and would be affected by how pollutants disperse away from the tunnel portals. This SAC was therefore modelled as a grid of receptor points extending 200m from the tunnel portals into the habitat, to enable the area of maximum impact to be considered.

5.3.121 The ecological receptors included in the assessment are shown in Figure 5.6: Operational Phase Receptors and Results (Application Document 6.2).

5.3.122 For the construction phase assessment, the operational phase worst-case ecological receptor points were modelled at designated habitats which were within 200m of both the construction phase ARN and operational ARN. Additional worst-case ecological receptors were added at those designated habitats within the construction ARN which were not part of the operational ARN.

5.3.123 There was one Ramsar site within 200m of the construction ARN, the Thames Estuary and Marshes Ramsar site, which was included in the assessment for reporting in the Habitats Regulations Assessment (Application Document 6.5).

5.3.124 A number of designated habitats were modelled during the construction phase. The sites were located next to roads that were predicted to experience an increase in N deposition as a result of changes in traffic or speed band above the thresholds stated in DMRB LA 105 (Highways England, 2019) for a period of greater than two years. These are presented in Figure 5.5: Construction Traffic Receptors and Results (Application Document 6.2).

5.3.125 The judgement of likely significant effects was undertaken by the Project competent expert for biodiversity as required in DMRB LA 105 (Highways England, 2019) and reported in Section 8.6 of Chapter 8: Terrestrial Biodiversity.

Qualifying features for the compliance risk assessment

5.3.126 In line with DMRB LA 105 (Highways England, 2019), the assessment has determined whether the Project affects the UK's reported ability to comply with the Air Quality Directive (Directive 2008/50/EC) in the shortest timescale possible.

5.3.127 The compliance risk assessment is limited to links modelled by Defra in its PCM model (this is the basis that Defra uses to report zonal compliance with the Air Quality Directive (Directive 2008/50/EC)), which are within the Project ARN. The qualifying features along these PCM links were included in the assessment. It should be noted that these qualifying features are not consistent with how human health receptors are identified with respect to AQS objectives, as described in Table 5.5.

5.3.128 Unlike AQS objectives, the annual mean NO_2 Limit Value is relevant to all areas of public access (e.g., footpaths) and sensitive receptors (e.g., residential properties and schools) that are within 15m of the running lane (excludes hard shoulder). Footpaths perpendicular to the road (e.g., crossings over a motorway) and areas within 25m of junctions are excluded from the compliance risk assessment.

5.3.129 A total of 85 qualifying features were modelled in the operational assessment as shown in Figure 5.7: PCM Links in Construction and Operational Study Area (Application Document 6.2). These features were located next to 39 individual PCM links.

5.3.130 Following DMRB LA 105 (Highways England, 2019), a 4m point from the running lane (in the same location as the qualifying feature) has also been included for comparison against the PCM model predictions.

5.3.131 A total of 50 qualifying features located next to 14 individual PCM links were modelled across the six construction phase years. As compliance was assessed on a year-by-year basis, the number of features which were assessed varied year on year through the construction phase depending on the extent of the yearly compliance risk assessment study area.

Defining impact magnitude and effect significance

5.3.132 DMRB LA 105 (Highways England, 2019) provides the standard to determine the significance of project impacts for the purpose of paragraph 5.12 of the NPSNN. To determine whether paragraph 5.13 of the NPSNN is triggered, a compliance risk assessment must be completed.

5.3.133 The significance assessment involves an assessment of the following:

a. The effects on human health

b. The effects on designated habitats

c. The outcomes of the compliance risk assessment

5.3.134 The methodology for determining the significance of human health effects is discussed in this section, and the methodology for determining the significance of effects on designated habitats is discussed in Section 8.6 of Chapter 8: Terrestrial Biodiversity (Application Document 6.1). The compliance risk assessment methodology is discussed in paragraphs 5.3.138 to 5.3.147. Sensitive receptors for human health that have a reasonable risk of exceeding AQS objectives were assessed in both the Do-Minimum and Do-Something scenario, as described in paragraph 5.3.112. The difference in pollutant concentration between the Do-Minimum and Do-Something scenarios is used to describe the 'magnitude' of change in accordance with Table 5.6. Where the change between Do-Minimum and Do-Something NO_2 concentrations is less than 1% of the air quality threshold, then the change at these receptors is considered to be imperceptible, and these receptors are scoped out of the judgement of significance.

5.3.135 The total number of receptors in each magnitude band (which exceed AQS objectives) are aggregated and compared to the guideline number of receptors defined in DMRB LA 105 (Highways England, 2019), constituting a significant effect as shown in Table 5.6. The guideline bands have been developed to help determine likely significant air quality effects.

Table 5.6 Guideline to number of properties constituting a significant air quality effect at human health receptors (Highways England, 2019)

Magnitude of change in annual mean NO_2 or PM_{10} (µg/m^3)	**Total number of receptors with:**	
	Worsening of an air quality at sensitive receptor above the air quality threshold or the creation of a new exceedance	**Improvement of an air quality at sensitive receptor above the air quality threshold or the removal of an existing exceedance**
Large (>4)	1 to 10	1 to 10
Medium (>2)	10 to 30	10 to 30
Small (>0.4)	30 to 60	30 to 60

5.3.136 Where the number of receptors falls below the lower guideline bands used to inform significance, then a project is deemed unlikely to have a significant effect (e.g., 20 small magnitude worsenings would be unlikely to be classed as significant). If the number of receptors affected is greater than the upper guideline bands (60 small, 30 medium and 10 large), then a project is more likely to have a significant effect on air quality. Projects which affect receptors between the lower and upper guideline bands require justification to determine whether the effect is considered to be significant, taking into account the following:

a. The absolute concentration at each receptor, i.e., is the modelled concentration 40µg/m^3 or 60µg/m^3?

b. How many receptors are there in each of the magnitude of change criteria, i.e., does the project create more worsening than improvements?

c. The magnitude of change in concentration at each receptor, e.g., 0.6µg/m^3 vs 1.8µg/m^3

5.3.137 If the assessment concluded that a project could trigger a significant air quality effect, then a Project Air Quality Action Plan (PAQAP) would be required, detailing measures to mitigate the potential effects of the project. Should any mitigation measures be identified, the project including the measures would be reassessed to determine whether there is a significant effect following mitigation. If no measures are feasible the conclusion of the assessment would be that the Project leads to a significant effect on air quality.

Compliance risk assessment

5.3.138 DMRB LA 105 (Highways England, 2019) provides the standard that should be followed to determine whether the Project complies with paragraph 5.13 of the NPSNN. This also informs the significance assessment.

5.3.139 The Secretary of State for Environment, Food and Rural Affairs has responsibility for meeting the Limit Values (as presented in Table 5.4) in England, and Defra coordinate assessment and air quality plans for the UK. The UK currently fails to comply with the annual mean NO_2 Limit Value across some zones, but all zones comply with Limit Values for PM_{10} and $PM_{2.5}$.

5.3.140 The most recent published PCM data (2018 reference year) has been used for the compliance risk assessment.

5.3.141 The Project's air quality model is used to predict annual mean NO_2 at qualifying features next to each PCM link as well as at the 4m validation point. It should be noted that the compliance risk assessment is based on the Defra air quality modelling methodology only, as per the Defra PCM model, and so is informed by modelling results that directly from the verified air quality model using the Defra tools.

5.3.142 The 4m validation point is used to determine whether the Project air quality predictions align with the PCM outputs for the opening year of the Project. If there are significant differences between the two modelled values at the 4m point (defined as greater than 10%, where there are modelled exceedances in either dataset), the inputs into the Project air quality model would need to be investigated to ensure that the predictions are robust.

5.3.143 Where the predictions are considered to be robust, the Project air quality model should be used instead of the PCM model to inform the compliance risk assessment. This is as a result of the Project's air quality model being much more detailed than the PCM model, which is verified at a local rather than national level.

5.3.144 The following information was used to determine the compliance risk in accordance with the flow chart in Figure 2.79 of DMRB LA 105 (Highways England, 2019):

a. The modelled annual mean NO_2 concentrations in the Do-Minimum and Do-Something scenarios

b. The change in annual mean NO_2

c. The corresponding PCM road census ID

d. The modelled NO_2 concentration from either the PCM model or local authority local air quality plan for the opening year

5.3.145 The assessment would conclude that there is no compliance risk where one of the following is the case:

a. There are no exceedances of the Limit Value of 40µg/m^3 on any of the PCM links.

b. The Project results in a change in annual mean NO_2 less than or equal to 0.4µg/m^3 where exceedances are predicted.

c. Where model concentrations are above 40µg/m^3 and have a change greater than 0.4µg/m^3, the Project does not materially impact on measures within local air quality or national plans for the achievement of compliance (i.e., the Project would not cause a measure within the national or local plan to become non-deliverable and thereby does not have the potential to impact on the achievement of compliance in the shortest timescale possible).

5.3.146 A PAQAP describing the proposed mitigation measures would be required if the assessment identified a risk to the UK's reported ability to comply with the Air Quality Directive (Directive 2008/50/EC) in the shortest timescale possible where:

a. The Project causes a compliant zone to become non-compliant or delays compliance, i.e., creates a new maximum in any non-compliant zone (as this would be contrary to paragraph 5.13 of the NPSNN).

b. The Project materially impacts the delivery of measures set out in local authority local air quality plans.

c. Maximum modelled NO_2 concentrations are higher with the Project compared to the Do-Minimum scenario across all PCM links (where there are exceedances).

5.3.147 If the assessment identifies impacts that cannot be mitigated through the PAQAP, the compliance risk assessment would be used as part of the judgement as to whether the Project impacts are significant and/or affect compliance with the Air Quality Directive (Directive 2008/50/EC) on air quality. The judgement would be informed by whether the Project would materially impact on plans or require new measures to improve achievement of compliance, either local authority plans produced as directed by Defra (not local air quality action plans) or the zonal action plan.

Assumptions and limitations

5.3.148 General assumptions used throughout the ES, and limitations affecting the assessments are set out in Chapter 4: EIA Methodology. Relevant assumptions and any other limitations encountered during the air quality assessment are as described below. Acknowledging the assumptions and limitations identified below and in Chapter 4: EIA Methodology, the ES is considered robust and in line with relevant legislation, policy, and guidance.

5.3.149 Traffic datasets are produced as outputs from the Project’s transport model, the LTAM which includes data on traffic flows and speeds. The environmental assessments and Transport Analysis Guidance (TAG) worksheets completed are based on traffic datasets CM45 (Core Do Minimum) and CS67 (Core Do Something). These traffic datasets are different to those used in the traffic and transport assessments, which are based on datasets CM49 and CS72 that were updated to include the correct value of time in the variable demand model for low income commuting trips. A review of traffic datasets CM49 and CS72 concluded that the difference between the two sets of traffic flows were minimal. The assessment is therefore considered to be robust for air quality as the changes in flows would not change the conclusions of the assessment.

5.3.150 The construction modelling undertaken using the Project's transport model provides an extensive quantitative assessment of the forecast impact of construction works on the road network, using the same traffic baseline and forecasting work that has informed the operational modelling.

5.3.151 The DCO application has been developed on the basis of a 2030 opening year. This assumes consent is granted in 2024. Following the DCO Grant there would be preparatory works, referred to in the draft DCO as preliminary works taking place in 2024. The main construction period for the Lower Thames Crossing would start in early 2025, with the road being open for traffic in late 2030. Construction may take approximately six years, but as with all large projects there is a level of uncertainty over the construction programme, which will be refined once contractors are appointed and as the detailed design is developed. The 2030 opening year has been selected as the basis for the assessments and is representative of the reasonable worst-case scenario. This has been used consistently across the environmental assessments, transport assessments and the economic appraisal of the Project.

5.3.152 It should be noted that an operational phase opening year of 2030 is expected to provide a worst-case assessment of the Project air quality effects due to anticipated air quality improvements in future years (e.g., due to a year-on-year increase in alternative fuelled and Euro 6/VI vehicles).

Air quality modelling

5.3.153 The air quality modelling predictions are based on the most reasonable, robust, and representative methodologies, but there are uncertainties associated with the predictions, for example due to uncertainties in emission and background air quality predictions. Modelling uncertainties have been addressed as far as practicable in the assessment and are not considered to adversely affect the adequacy of assessment. These are described below.

5.3.154 The latest Defra air quality assessment tools and guidance, and National Highways assessment tools and guidance, have been used for the assessment.

5.3.155 The background air quality maps provided by Defra have been compared and adjusted against background monitoring data as described in Appendix 5.1: Air Quality Methodology (Application Document 6.3), to ensure the background concentrations included in the assessment are representative of the study area.

5.3.156 The air quality dispersion model outputs have been compared and verified against 241 roadside air quality monitoring sites. The model verification process was carried out in line with LAQM.TG (22) (Defra, 2022), which involves comparing modelled and monitored pollutant concentrations and, when required, adjusting the model output to account for systematic bias. Verification was carried out for both the construction and operational assessment. The modelled area was split into different road corridors and geographic regions where there was found to be similar model performance against monitoring data. This process is known as zonal verification, and the model was split into 19 verification zones.

5.3.157 Following the verification process, an overall Root Mean Square Error value of 5.8µg/m^3 was derived for the Project air quality model, which is well within the Defra (2022) recommended Root Mean Square Error value of 10µg/m^3. The model verification for this Project is presented in Appendix 5.1: Air Quality Methodology (Application Document 6.3).

5.3.158 Uncertainty in future vehicle emission factors and roadside NO_2 concentrations has been considered by carrying out a gap analysis, as described in paragraphs 5.3.93 to 5.3.97. This process provides a less optimistic prediction of future air quality compared to the Defra modelling tools.

Nitrogen deposition compensation sites

5.3.159 The DCO application documents identify the locations of habitat creation sites proposed as compensation for the effects of nitrogen deposition. The design and management regimes for these locations will be developed as part of the detailed design, in accordance with the control plan documents including the Outline Landscape and Ecology Management Plan (OLEMP) (Application Document 6.7), Design Principles (Application Document 7.5) and the Environmental Masterplan (ES Figure 2.4: Application Document 6.2).

5.4 Baseline conditions

Existing baseline

5.4.1 The baseline conditions for air quality are mainly focused on the AQS objectives and Limit Values, since these are the key considerations in understanding the risk of the Project triggering significant air quality effects. As previously discussed, and referenced in Table 5.4, AQS objectives and Limit Values relevant to this assessment are expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, within a specified timescale.

Air Quality Management Areas (AQMAs)

5.4.2 The combined construction and operational assessment study area covers 29 local authorities.

5.4.3 There are 41 AQMAs (areas indicative of exceedances of AQS objectives) across the construction and operational study area, as presented in Figure 5.2: Construction Traffic Study Area (Application Document 6.2) and Figure 5.3: Operational Study Area (Application Document 6.2). Many of these AQMAs were declared around 2005 when air quality was likely to have been poorer than currently. Table 5.7 summarises these AQMAs by the AQS objective that the AQMA has been declared for.

5.4.4 All but two (which have been declared for PM_{10} AQS objective exceedances) of the AQMAs are declared for annual mean NO_2. Where AQMAs are declared for exceedances of the PM_{10} AQS objectives, this is generally for the 24-hour AQS objective, except for the Northfleet Industrial Area AQMA (Gravesham), which is declared for an exceedance of the annual mean PM_{10} AQS objective as a result of particulates from industrial sources. The Gravesham automatic monitor ZG3 measures PM_{10} next to the section of the ARN (High Street) that intersects this AQMA. In 2016, the station monitored an annual mean PM_{10} concentration of 18µg/m^3, which is well below the objective.

5.4.5 A full list of the AQMAs in the study area, including the area they cover and the pollutants for which they are declared, is presented in Table 1.1 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3).

Table 5.7 Study area AQMAs by pollutant and AQS objective declared

Pollutant and AQS objective declaration	Number of AQMAs within study area
Annual mean NO_2 only	29
Annual mean PM_{10} only	1
24-hour mean PM_{10} only	1
Annual mean NO_2 and 24-hour mean PM_{10}	8
Annual and 1-hour mean NO_2 and 24-hour mean PM_{10}	1
Annual mean NO_2, annual mean PM_{10} and 24-hour mean PM_{10}	1

5.4.6 It should be noted that the Havering AQMA and Gravesham A2 AQMA fall within the Order Limits for the Project and have been declared for exceedances of the annual mean NO_2 AQS objective. Havering AQMA has also been declared for exceedances of the 24-hour mean PM_{10} AQS objective.

5.4.7 Although there are AQMAs declared for exceedances of the PM_{10} AQS objectives, there are no modelled or monitored exceedances of PM_{10} AQS objectives in the study area in the base year scenario. It should be noted that some of these AQMAs are declared across multiple roads and in some cases are borough-wide designations. This means that there are not necessarily exceedances of AQS objectives in the parts of the study area that are within these AQMAs. Although there are 39 AQMAs declared for exceedances of the annual mean NO_2 AQS objective that intersect the ARN, the base year model and monitoring results indicate that there are no exceedances next to the roads assessed in 18 of these AQMAs.

5.4.8 It should also be noted that AQMAs are not predictions of where there will be future exceedances of the AQS objectives but are designated due to current exceedances identified by the relevant local authority. Therefore, with future improvements in air quality (particularly for AQMAs designated due to road traffic, because vehicle emissions will improve over time), it is anticipated that there will be fewer areas where the NO_2 AQS objective is exceeded across the study area by the Project's opening year.

Local authority monitoring

5.4.9 The local authority monitoring data described in this section has been obtained from local authority 2020 Air Quality Annual Status Reports produced for Defra, which report annual mean data for 2019 and earlier. Although air quality monitoring data is available for 2020 and 2021 at some monitoring sites, this has not been included here as it is expected to have been heavily influenced by the COVID-19 pandemic where traffic flows decreased in response to restrictions including lockdowns and encouragement of home working. As such 2020 and 2021 air quality monitoring data is likely to be representative of air quality under specific conditions and constraints which are not representative of a 'normal' baseline.

NO_2 diffusion tubes

5.4.10 There are 227 local authority diffusion tube sites within the assessment study area, the site details and data for which are presented in Table 2.1 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3). The locations of these sites are shown in Figure 5.4: Air Quality Monitoring Sites and 2016 Annual Mean Data (Application Document 6.2), which are also coloured according to the monitored annual mean NO_2 concentration.

5.4.11 The diffusion tube data show that there are 30 sites where the annual mean NO_2 AQS objective was exceeded in 2019. The monitoring sites are located within 10 local authorities, and 10 of these sites are located in Dartford and Thurrock. A total of 23 of the 30 sites with exceedances of the annual mean NO_2 AQS objective are located within the AQMAs shown in Table 1.1 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3).

5.4.12 In the base year (2016), the diffusion tube data show that there are 57 sites that exceeded the annual mean NO_2 AQS objective, 41 of which are within AQMAs shown in Table 1.1 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3). These sites extend over 12 local authority boundaries. Half of the sites that exceed the AQS objective are located in Dartford, Gravesham and Thurrock, including the A2 and A282 Dartford Crossing.

5.4.13 There are eight sites located within 200m of the Project route (including the improved sections of A2 and M25), four of which are located within Gravesham A2 AQMA. These sites provide an indication of the monitored concentrations in relation to AQS objectives close to the Project route. Table 5.8 shows the monitored annual mean NO_2 concentrations from these sites between 2016 and 2019. GR110 is located west of the M2/A2/Lower Thames Crossing junction and GR138, GR141 and GR142 are east of the M2/A2/Lower Thames Crossing junction. The other four monitoring sites are located in Thurrock, near to the proposed A13/A1089/A122 Lower Thames Crossing junction. Exceedances of the annual mean NO_2 AQS objective have been monitored from GR110 and GR142, while concentrations elsewhere are below the objective. However, it should be noted that GR142 is not representative of human exposure, as the closest human receptor representative of long-term exposure to NO_2 is LTC616, which is located 500m north of the diffusion tube location.

Table 5.8 NO_2 concentrations (µg/m^3) recorded at diffusion tubes within 200m of Project route

LA ID	Local authority	X OS grid ref (m)	Y OS grid ref (m)	Site type	Annual mean NO_2 concentration (µg/m3)			
					2016	2017	2018	2019
GR110	Gravesham	566149	170436	Roadside	34.5	40.4	35.3	38.7
GR138	Gravesham	570584	169550	Other	--	29.2*†	28.8	30.2
GR141	Gravesham	569588	169603	Roadside	--	36.7*	29.3	27.1
GR142	Gravesham	567500	169836	Roadside	--	65.6*	55.0	59.8
SCR LTC	Thurrock	562380	181156	Urban background	--	--	32.4	30.1

LA ID	Local authority	X OS grid ref (m)	Y OS grid ref (m)	Site type	Annual mean NO_2 concentration (µg/m3)			
					2016	2017	2018	2019
BSA LTC	Thurrock	563483	181069	Roadside	--	--	24.0	25.9
BSB LTC	Thurrock	563572	180770	Roadside	--	--	30.2	28.3
HR LTC	Thurrock	563782	180155	Roadside	--	--	27.3	29.0

-- No data

*Exceedance of annual mean NO_2 AQS objective emphasised in **bold**.*

LA = local authority

Data captures above 95% unless stated

** GR138, GR141, GR142 data capture less than 75% in 2017.*

† Annual mean NO_2 at GR138 annualised for 2017 by Gravesham Borough Council.

Source: Gravesham Borough Council. 2017, 2018, 2019, 2020 Air Quality Annual Status Report, Thurrock Council. 2019,2020/21 Air Quality Annual Status Report

5.4.14 Gravesham Borough Council also monitors background NO_2 from a diffusion tube (GR69) located approximately 0.5km west of the Project. This tube recorded an annual mean NO_2 concentration of 20.7µg/m^3 in 2019, which is well below the annual mean NO_2 AQS objective and likely to be representative of background air quality near the Project, south of the River Thames.

Automatic monitoring

5.4.15 Annual mean NO_2 concentrations and the number of exceedances of the 1-hour mean threshold of 200µg/m^3 (not to be exceeded more than 18 times per year), recorded by the roadside continuous automatic monitoring stations within the assessment study area are shown in Table 2.2 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3). The location and concentration of NO_2 monitored from these sites is shown on Figure 5.4: Air Quality Monitoring Sites and 2016 Annual Mean Data (Application Document 6.2). There are 10 continuous NO_2 monitoring stations within the study area.

5.4.16 Table 2.2 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3) shows that two sites recorded exceedances of the annual mean NO_2 AQS objective in 2019. Exceedances were recorded at Dartford 3 (A2 Bean Interchange) and GR8 (Woolwich Flyover), where an annual mean NO_2 concentration of 46.0µg/m^3 and 52.0µg/m^3 was monitored, respectively. No exceedances of the 1-hour NO_2 AQS objective were recorded at any of the stations.

5.4.17 In the base year (2016), four sites recorded exceedances of the annual mean NO_2 AQS objective: Dartford 3 (A2 Bean Interchange), Dartford 1 (St Clements), RD1 (Eastwood Road / High Street) and GR8 (Woolwich Flyover). The highest annual mean NO_2 concentration was 64µg/m^3, recorded at GR8. Exceedances of the 1-hour NO_2 AQS objective were also monitored in 2016 at Dartford 3, Dartford 1 and GR8.

5.4.18 Annual mean PM_{10} concentrations and the number of days above the daily mean threshold of 50µg/m^3 (not to be exceeded more than 35 times per year), recorded at the continuous automatic monitoring sites across the study area are shown in Table 2.3 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3). There are eight continuous monitoring stations within the assessment study area which monitor PM_{10}.

5.4.19 Monitored PM_{10} concentrations were well below the annual mean AQS objective at all stations between 2015 and 2019. The highest annual mean PM_{10} concentration monitored in 2019 was 28µg/m^3, recorded at the Dartford 3 station. In the base year 2016, the highest annual mean PM_{10} concentration was 30µg/m^3, recorded at GR8. No exceedances of the 24-hour PM_{10} AQS objective were recorded at any of the stations between 2015 and 2019.

5.4.20 Annual mean $PM_{2.5}$ concentrations, recorded at the continuous automatic monitoring sites across the study area are shown in Table 2.4 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3). There are two continuous monitoring stations within the assessment study area which monitor $PM_{2.5.}$ These sites are Havering HV1 and Greenwich GR8.

5.4.21 The highest annual mean $PM_{2.5}$ concentration monitored at HV1 between 2015 and 2019 was 12µg/m^3, which was monitored in 2016 and 2017. The highest annual mean $PM_{2.5}$ concentration monitored at GR8 between 2015 and 2019 was 13µg/m^3, which was monitored in 2016 and 2017. These concentrations are well below the annual mean $PM_{2.5}$ AQS objective value.

National Highways and Connect Plus monitoring

5.4.22 A review of National Highways Scheme and Connect Plus monitoring data revealed that there are 153 diffusion sites located in the assessment study area, and these are shown and colour coded by monitored NO_2 concentration in Figure 5.4: Air Quality Monitoring Sites and 2016 Annual Mean Data (Application Document 6.2). Details of the monitoring sites and the concentrations recorded are presented in Table 4.1 and Table 6.1 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3). It should be noted that these tubes have historically been deployed in areas of air quality risk (i.e., where AQS objectives/Limit Values could be exceeded), and so tend to represent areas where high concentrations would be expected.

5.4.23 Based on the 2016 data, 44 of the sites exceeded the annual mean AQS objective, and 27 of these are within AQMAs described in Table 1.1 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3). A total of 18 of the 44 exceedances are recorded in Dartford, Thurrock and Gravesham AQMAs.

Project-specific monitoring

5.4.24 Project-specific monitoring was installed to address gaps in baseline data and provide detailed baseline data in areas of air quality risk. The diffusion tube monitoring data for the Project is presented in Table 5.1 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3), and the locations of the monitoring sites are shown in Figure 5.4: Air Quality Monitoring Sites and 2016 Annual Mean Data (Application Document 6.2), which are also colour coded by monitored NO_2 concentration. There are 94 sites within the study area.

5.4.25 Annual mean NO_2 concentrations for 2016 are less than the annual mean NO_2 AQS objective at all sites within 200m of the Project route, other than LTC52 on Squires Close (36m east of the M2), where a concentration of 40.6µg/m^3 was recorded. The annual mean NO_2 AQS objective is exceeded at 28 monitoring sites, which are predominantly located along the A282 Dartford Crossing, A2 (between M25 junction 2 and M2 junction 1) and A228 (between M20 junction 4 and M2 junction 2).

5.4.26 It should be noted that, although monitoring does record exceedances of the AQS objectives, it is not always representative of relevant exposure, given that the majority of sites are located on street furniture such as lampposts at kerbside locations. However, the monitoring results are used to verify the air quality model which is then used to determine air quality at locations of relevant exposure (i.e., human health and ecological receptors).

Designated habitats

5.4.27 Within the assessment study area there are 527 designated habitats and 208 veteran trees. Critical loads have been established based on the habitat with the lowest critical load in each site. Table 7.1 of Appendix 5.2: Air Quality Baseline Conditions (Application Document 6.3) shows designated habitats within the assessment study area together with their lower critical load (LCL) for nitrogen deposition. The latest background rates of nitrogen deposition have been obtained from APIS (Centre for Ecology and Hydrology, 2021).

5.4.28 Table 5.9 presents a summary of the number of designated habitats for each habitat type and the number of habitats where background N deposition exceeds the LCL in the base year scenario. Background N deposition exceeds the LCL for all veteran trees and the majority of designated habitats. Of the 527 designated habitats, 46 of them are exposed to background N deposition which is below the LCL. It should be noted that the number of designated habitats is less than the number of ecological receptors, as some designated habitats include multiple receptors (e.g., if they are affected by more than one road). The full set of ecological air quality results are shown in Table 2.1 and Table 2.2 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3).

Table 5.9 Designated habitats and baseline conditions

Designated habitat type	Number of designated habitats	Number where background N deposition exceeds the LCL in base year (2016)
Ancient woodland	256	256
Local Wildlife Site	212	176
Special Sites of Scientific Interest	32	24
Local Nature Reserve	8	7
Roadside Nature Reserve	14	14
Nature Improvement Area	1	1

Designated habitat type	Number of designated habitats	Number where background N deposition exceeds the LCL in base year (2016)
Veteran trees	208	208
Special Areas of Conservation	2	2
RAMSAR	1	0
National Nature Reserve	1	1
It may be possible that some habitats will have more than one designation (e.g., a habitat designated as SSSI could also be designated as ancient woodland and so would be listed twice in the table).		

Base year (2016) air quality modelling results – construction phase

5.4.29 The base year air quality modelling results for human health receptors in the construction phase are presented in Table 1.1 of Appendix 5.3: Air Quality Construction Phase Results (Application Document 6.3).

NO_2

5.4.30 Analysis of the modelled outputs for the base year (2016) in the construction phase assessment study area indicates that, 18 of the modelled human health receptors exceed the annual mean NO_2 AQS objective in the base year (excluding future receptors and receptors where only short-term objectives apply). These are primarily located along the A2, A282, A1306 and the M2 junction 1. The maximum modelled annual mean NO_2 concentration was 44.9µg/m^3 at receptor LTC035. This receptor is located within 11m of the A1306, Thurrock and is shown in Figure 5.5: Construction Traffic Receptors and Results (Application Document 6.2).

PM_{10} and $PM_{2.5}$

5.4.31 Analysis of PM_{10} concentrations in the base year (2016) at the construction phase receptors shows that the maximum modelled annual mean PM_{10} concentration was predicted at LTC055 and was 23.4µg/m^3, which is below the annual mean AQS objective. This receptor is located within approximately 15m of the A282 Dartford Crossing southern approach and is shown on Figure 5.5: Construction Traffic Receptors and Results (Application Document 6.2). There are no receptors which are expected to exceed the 24-hour mean AQS objective for PM_{10}, as the annual mean concentration is less than 32µg/m^3.

5.4.32 Given annual mean PM_{10} concentrations are lower than 25µg/m^3, there is no risk of the annual mean $PM_{2.5}$ AQS objective being exceeded.

Base year (2016) air quality modelling results – operational phase

5.4.33 The base year air quality modelling results for human health receptors in the operational phase are presented in Table 1.1 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3).

NO_2

5.4.34 The results of the operational modelling indicate that 178 receptors exceed the annual mean NO_2 AQS objective in the base year (excluding future receptors and receptors where only short-term objectives apply). These exceedances are predominantly located on the A127 Arterial Road, the A282 Dartford Crossing, the A1306 (Thurrock), the A228 (between M20 junction 4 and M2 junction 2), the A2/M2 between M25 junction 2 and M2 junction 3, the A2 London Road (Strood) and the A102 in London.

5.4.35 The maximum annual mean NO_2 concentration was 73.8µg/m^3, predicted at receptor LTC196 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), which is well above the annual mean AQS objective. This receptor is located on Arlington Crescent, Waltham Cross, within 50m of the Holmesdale Tunnel eastbound portal (M25).

PM_{10} and $PM_{2.5}$

5.4.36 The maximum annual mean PM_{10} concentration was 28.5µg/m^3, predicted at LTC776 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), which is below the annual mean AQS objective. This receptor is located adjacent to the Sun in the Sands Roundabout in Greenwich, and within 9m of the A102. As annual mean PM_{10} concentrations are predicted to be less than 32µg/m^3 at all receptors, there are not expected to be exceedances of the 24-hour mean AQS objective. Receptor LTC776 also has the highest predicted annual mean $PM_{2.5}$ concentration, which is 21.2µg/m^3, and so below the annual mean AQS objective. There are therefore no exceedances of PM_{10} and $PM_{2.5}$ AQS objectives predicted at human health receptors in the base year.

Pollution Climate Mapping (PCM) model

5.4.37 Defra uses the PCM model to assess compliance against the Air Quality Directive (Directive 2008/50/EC), as described in Section 5.3 of this chapter. Table 5.10 presents the maximum annual mean NO_2 concentration predicted by the Defra PCM model for compliance zones that intersect the construction and operational study area (in 2018, which is the most up to date PCM model base year). It should be noted that these concentrations are the maximum predicted in the zone, and not the maximum concentrations on PCM links which reside within the study area. The PCM links and zones within the construction and operational study area are presented on Figure 5.7: PCM Links in Construction and Operational Study Area (Application Document 6.2).

5.4.38 The maximum PCM concentration is predicted to exceed the Limit Value in all zones which intersect the construction and operational study area. The maximum annual mean NO_2 concentration on PCM links which intersect the study area is predicted on a PCM link corresponding with the A102 (Census ID: 802074532) in the Greater London Urban Area zone and was 62.9µg/m^3 in 2018, which exceeds the Limit Value. Exceedances are also predicted on seven PCM links in the operational study area corresponding with one link on the A12, one link on the A13, two links on the A102 (Greater London Urban Area), one link on the A127 (Southend Urban Area zone) and two links on the A229 (South East zone).

5.4.39 Of all the PCM links that overlap the construction phase compliance risk study area, there is only one which exceeds the Limit Value in 2018. This is on the A406/M11 in Redbridge (Census ID: 801070206) which resides in the Greater London Urban Area and was 51.8µg/m^3 in 2018.

Table 5.10 Predicted maximum zonal annual mean NO_2 concentration in zones/agglomerations which intersect the construction and operational study area (2018)

Zone/agglomeration	Maximum annual mean NO_2 (µg/m^3) (2018)	Compliance status
Eastern	56.8	Non-compliant
South East	59.1	Non-compliant
Greater London Urban Area	89.3	Non-compliant
Southend Urban Area	47.7	Non-compliant
Based on 2020 NO_2 projections data (2018 reference year)		

5.4.40 PM_{10} and $PM_{2.5}$ concentrations predicted by the PCM model are below the Limit Value for all zones which intersect the construction and operational study area. In 2018, the maximum PM_{10} and $PM_{2.5}$ concentrations are predicted as being 28.6µg/m^3 and 16.9µg/m^3, respectively, in the Greater London Urban Area. Given that these concentrations are below the Limit Value in 2018 and decrease in the future, no further discussion is provided on baseline PCM PM_{10} and $PM_{2.5}$ concentrations in future years.

Baseline summary

5.4.41 The Order Limits for the Project fall within two AQMAs. These are Gravesham AQMA, declared for exceedances of the annual mean NO_2 AQS objective and, Havering AQMA, for exceedances of the annual mean NO_2 and 24-hour PM_{10} AQS objectives. However, where these AQMAs intersect the Order Limits, exceedances of the annual mean NO_2 AQS objective were only modelled or monitored on the A2 (Gravesham A2 AQMA) in the base year scenario. Havering AQMA has been declared as a borough wide AQMA for exceedances of the AQS objectives, however in the areas where the AQMA overlaps the Order Limits there are no modelled or monitored exceedances of the AQS objectives.

5.4.42 Air quality monitoring data from local authorities, National Highways and the Project-specific survey indicate that NO_2 concentrations exceed the annual mean NO_2 AQS objective at many roadside locations throughout the study area. There are no exceedances within the Order Limits, other than on the A2 Watling Street, close to the Project tie in. The areas of exceedances within the study area are mainly located next to the A282 Dartford Crossing, the A2/M2 between M25 junction 2 and M2 junction 2, the A228 between M20 junction 4 and M2 junction 2, the A127 Southend Arterial Road (Havering and Brentwood), the A1306 (Thurrock) and the A206/A226 (Dartford). The annual mean concentrations are also in excess of 60µg/m^3 at several diffusion tube sites, which suggests that the 1-hour NO_2 AQS objective may also be exceeded in these roadside locations, although not all will be representative of relevant human exposure. Exceedances of the 1-hour NO_2 AQS objective were monitored in 2016 from the automatic stations at A2 Bean Interchange (Dartford), St Clements (Dartford), and Woolwich Flyover (Greenwich), although no exceedances were recorded in the more recent monitoring data.

5.4.43 The base year NO_2 predictions at human health receptors are also consistent with the monitoring data, with exceedances of the annual mean AQS objective predicted at many receptors. Annual mean NO_2 concentrations are predicted to be in excess of 60µg/m^3 at some properties and gardens on Arlington Crescent, Waltham Cross, as a result of emissions from the M25 and neighbouring Holmesdale tunnel portal, and at some properties close to Sun in the Sands Roundabout in Greenwich due to emissions from the A102, A2 and A207. This suggests that the 1-hour NO_2 AQS objective may also be exceeded at these locations.

5.4.44 No exceedances of PM_{10} or $PM_{2.5}$ AQS objectives have either been monitored or predicted at human health receptors across the study area.

5.4.45 There are 527 designated habitats and 208 veteran trees within the operational phase study area. Background N deposition exceeds the LCL for all veteran trees and most designated habitats. Only 46 of the 527 designated habitats are exposed to background N deposition that is below the LCL.

5.4.46 The PCM model predicts there are exceedances of the NO_2 Limit Value on several PCM links which intersect roads in the construction and operational study area (in 2018). These roads are located within the Greater London Urban Area, South East and Southend Urban Area zones. However, as described below, future air quality improvements (which are accounted for in the PCM model) mean that there are no exceedances of the Limit Value predicted on PCM links that intersect the study area in the years corresponding with the construction (2025) and operational (2030) phases of the Project.

Future baseline (‘Without Scheme’ scenario)

5.4.47 The future baseline identifies anticipated changes to the existing baseline over time in the absence of the Project and is used as a basis against which to predict the potential impacts of the Project. A description of how the future baseline has been considered within the assessment is provided in Chapter 4: EIA methodology.

5.4.48 Background pollutant concentrations and emissions from newer vehicles (alternative fuelled and Euro 6/VI) are expected to improve air quality over time, as older, more-polluting vehicles are replaced in the vehicle fleet. Decarbonisation of the vehicle fleet in response to Government policy such as the Transport Decarbonation Plan (Department for Transport, 2021), and the Net Zero Highways Plan (National Highways, 2021) are expected to deliver future air quality improvements.

Future PCM forecast – construction phase

5.4.49 Table 5.11 presents the maximum annual mean NO_2 concentration forecast by the Defra PCM model for compliance zones that intersect the construction phase study area in each year of construction. It should be noted that these concentrations are the maximum in the zone, and not the maximum concentrations on PCM links which reside within the study area. The PCM links and zones within the construction and operational study area are presented on Figure 5.7: PCM Links in Construction and Operational Study Area (Application Document 6.2).

5.4.50 The Eastern and South East zone are expected to be compliant in 2025. The Greater London Urban Area zone is expected to be compliant by 2030. There are no PCM links included in the construction phase compliance risk assessment which are in exceedance of the annual mean NO_2 Limit Value of 40µg/m^3.

Table 5.11 Predicted maximum zonal annual mean NO_2 concentration in zones/agglomerations which intersect the construction phase compliance risk study area during any year of the construction phase (Do-Minimum 2025 – 2030)

	Maximum annual mean NO_2 (µg/m3) (Do-Minimum)					
Zone/agglomeration	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Eastern	34.9	33.1	31.4	29.8	28.2	27.0
South East	37.3	35.2	33.5	31.8	30.5	29.5
Greater London Urban Area	47.9	46.0	44.2	42.4	40.6	38.9
Based on 2020 NO_2 projections data (2018 reference year)						

5.4.51 The construction phase compliance risk study area varies year on year. Therefore, the PCM link with the highest concentration within the construction phase study area varies in location and concentration through construction. For example, the A406/M11 in Redbridge (Census ID: 801070206) met the DMRB traffic change criteria for assessment in 2027 and 2028 only and is the highest PCM link concentration in both the 2027 and 2028 construction phase compliance assessment study areas. Table 5.12 summarises the location and maximum concentration for PCM links within the construction phase compliance assessment study area in each year of construction.

Table 5.12 Maximum Do-Minimum annual mean concentration on a PCM link within compliance assessment study area in each year of the construction phase (Do-Minimum 2025 – 2030)

Year	Census ID	Road name and zone/agglomeration	Do-Minimum annual mean concentration (µg/m3)
2025	802048310	A226, South East	23.6
2026	802006036	M20, South East	21.6
2027	801070206	A406/M11, Greater London Urban Area	30.4
2028	801070206	A406/M11, Greater London Urban Area	28.8
2029	802006036	M20, South East	18.4
2030	802006036	M20, South East	17.6

Future PCM forecast – operational phase

5.4.52 Table 5.13 presents the maximum annual mean NO_2 concentration forecast by the Defra PCM model for compliance zones that intersect the operational assessment study area, for the 2030 Do-Minimum (without the Project) scenario.

5.4.53 The maximum PCM NO_2 concentration is predicted in the Greater London Urban Area zone in 2030 Do-Minimum (without the Project) scenario. All zones are predicted to be compliant with the Limit Value.

5.4.54 There are no PCM links included in the operational phase compliance risk assessment that are in exceedance of the annual mean NO_2 Limit Value of 40µg/m^3. The maximum annual mean NO_2 concentration in the study area is predicted on a PCM link corresponding with the A102 (Census ID: 802074532) in the Greater London Urban Area zone and is 38.9µg/m^3 in 2030.

Table 5.13 Predicted maximum zonal annual mean NO_2 concentration in zones/agglomerations which intersect the operational study area (Do-Minimum 2030)

Zone/agglomeration	Maximum annual mean NO_2 (µg/m3) (Do-Minimum 2030)	Compliance status
Eastern	27.0	Compliant
South East	29.5	Compliant
Greater London Urban Area	38.9	Compliant
Southend Urban Area	24.4	Compliant
Based on 2020 NO_2 projections data (2018 reference year)		

5.5 Project design and mitigation

5.5.1 Environmental considerations have influenced the Project throughout the design development process, from early route options assessment through to refinement of the Project design. An iterative process has facilitated design updates and improvements, informed by environmental assessment and input from the Project engineering teams, stakeholders and public consultation.

5.5.2 The Project, as applied for, includes a range of environmental commitments. Commitments of relevance to air quality are set out in this section under the following categories:

a. Embedded mitigation: measures that form part of the engineering design, developed through the iterative design process summarised above.

b. Good practice: standard approaches and actions commonly used on infrastructure development projects to avoid or reduce potential environmental impacts, typically applicable across the whole Project.

c. Essential mitigation: any additional Project-specific measures needed to avoid, reduce, or offset potential impacts that could otherwise result in effects considered to be significant in the context of the EIA Regulations. Essential mitigation has been identified by environmental topic specialists, taking into account the embedded and good practice mitigation.

5.5.3 Embedded mitigation is included within the Design Principles (Application Document 7.5) or as features presented on Figure 2.4: Environmental Masterplan (Application Document 6.2). Design Principles relevant to mitigation of effects on air quality are described below, each with an alpha-numerical reference code (e.g., REAC Ref. AQ0XX). Good practice and essential mitigation are included in the Register of Environmental Actions and Commitments (REAC). The REAC forms part of Appendix 2.2: Code of Construction Practice (CoCP) (Application Document 6.3). Relevant good practice and essential mitigation to reduce air quality effects are identified below.

5.5.4 The Design Principles, Environmental Masterplan, CoCP and REAC, all form part of the Project control plan. The control plan is the framework for mitigating, monitoring and controlling the effects of the Project. It is made up of a series of 'control documents' which present the mitigation measures identified in the application that must be implemented during design, construction and operation to reduce the adverse effects of the Project. Further explanation of the control plan and the documents which it comprises is provided in the Introduction to the Application (Application Document 1.3).

5.5.5 Enhancement measures have been directly incorporated into the Project as part of the application of 'good design' principles. Enhancements are measures that are considered to be over and above any measures to avoid, reduce or remediate adverse impacts of the Project. Relevant beneficial effects arising as a consequence of this good design process are provided below.

Embedded mitigation

Construction phase

5.5.6 No construction phase embedded mitigation is presented for air quality.

Operational phase

5.5.7 No operational phase embedded mitigation is presented for air quality.

Good practice

Construction phase

5.5.8 Construction phase good practice measures for air quality are outlined in the REAC (Application Document 6.3, Appendix 2.2). The REAC includes measures to reduce the air quality effects associated with construction dust as well as emissions from non-road mobile machinery (NRMM) and construction vehicles, and these measures are also listed below for completeness:

Vehicle and plant emissions (REAC Ref. AQ001)

a. All on-road heavy vehicles would comply with the standards set within the London Low Emission Zone (LEZ) across all sites within Order Limits for the relevant class of vehicle.

b. All NRMM net power 37kW to 560kW would comply with the engine emission standards set by London's Low Emission Zone for NRMM across all sites within Order Limits. From 1 September 2020, NRMM used on any site would therefore be required to meet emission standard Stage IIIB as a minimum. From 1 January 2025, NRMM used on any site would be required to meet emission standard Stage IV as a minimum.

c. Ensure all vehicle engines, mobile and fixed plant stationed on site are not left running or idling unnecessarily.

d. Use low emission vehicles and plant fitted with catalysts, diesel particulate filters or similar devices, where reasonably practicable.

e. Use ultra-low sulphur fuels in plant and vehicles, where reasonably practicable.

f. Keep vehicles and plant well maintained, with routine servicing to be completed in accordance with the manufacturer's recommendations and records maintained for the work undertaken.

Demolition (REAC Ref. AQ002)

5.5.9 Implement good practice measures to reduce dust during demolition works such as:

a. Soft strip inside buildings before demolition (i.e., retain external walls and windows where safe, to provide a screen against dust).

b. Use water suppression for dust control during demolition operations.

c. Avoid explosive blasting, using appropriate manual or mechanical alternatives.

d. Bag and remove any biological debris or damp down such material before demolition.

Earthworks and construction (REAC Ref. AQ003)

5.5.10 Implement good practice controls to reduce dust during works such as:

a. Cover with topsoil and re-vegetate earthworks and exposed areas including soil stockpiles to stabilise surfaces.

b. Use a cover such as hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil.

c. Ensure that the specification of the seeding mix used to re-vegetate stockpiles is such that no undesirable or non-target species are introduced to the seedbank.

d. Remove the cover systematically during work to reduce exposure of areas that are not being worked on.

e. Avoid scabbling of concrete from structures by compressed air powered machines, where reasonably practicable.

f. Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless required for a particular process, in which case ensure that appropriate additional control measures are in place to prevent escape.

g. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored with suitable emission control systems to prevent escape.

h. For small supplies of fine powder materials, ensure bags are sealed after use and stored appropriately to prevent dust.

Dust from trackout (REAC Ref. AQ004)

a. Use of water-assisted dust sweepers on the access and local roads to remove any material tracked out of the site.

b. Avoid dry sweeping of large areas.

c. Ensure vehicles entering and leaving worksites are securely covered to prevent escape of materials during transport.

d. Inspect haul routes for integrity, instigate necessary repairs and record in site logbook.

e. Access gates to be sited at least 10m from receptors, e.g., residential properties, where reasonably practicable.

f. Apply dust suppressants to locations where large volumes of vehicles enter and exit the construction site.

Dust management good practice (REAC Ref. AQ005)

a. Undertake onsite and offsite inspections to monitor dust.

b. Plan site layout so that machinery, stockpiles, mounds and dust causing activities are located away from receptors, as far as this is reasonably practicable.

c. Erect suitable solid screens or barriers around dusty activities or the site boundary.

d. Avoid site runoff of water or mud, having, having regard for the drainage maintenance requirements set out in RDWE002.

e. Remove waste materials that have a potential to produce dust from site as soon as reasonably practicable.

f. Cover, seed or fence stockpiles to prevent wind whipping.

g. Cutting/grinding/sawing equipment to use water as dust suppressant or suitable local extract ventilation.

h. Ensure an adequate water supply on the site for effective dust/particulate matter suppression, using recycled water where reasonably practicable.

i. Use enclosed chutes, conveyors and covered skips to reduce escape of dust.

j. Reduce drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment to a practical minimum and use fine water sprays on such equipment where appropriate.

k. Ensure equipment is readily available on site to clean up spillages as soon as reasonably practicable after the spill is identified.

l. Reuse and recycle waste to reduce dust from waste materials.

Air Quality monitoring during construction (REAC Ref. AQ006)

a. The Contractors shall determine the level of any dust and particulate monitoring carried out on project construction sites by means of a risk-based approach. This will identify the type of monitoring that is required on each worksite by looking at the details of the specific packages of work within the site boundaries and the location of receptors around the site. Should monitoring be required, the monitoring locations will be approved by the Secretary of State (SoS) in consultation with the relevant local authorities.

Baseline dust monitoring (REAC Ref. AQ007)

a. Should dust monitoring be required in accordance with the requirements of AQ006, it would begin at least three months prior to the commencement of the construction works to allow a suitable pre-construction baseline to be established unless otherwise agreed by National Highways following consultation with the relevant local authorities.

Actions in case of air quality monitoring exceedance (REAC Ref. AQ008)

a. If required during construction, continuous particulate monitoring for PM_{10}, $PM_{2.5}$ and TSP (total suspended particles) will be carried out using appropriate survey instruments at locations approved under REAC item AQ006, in consultation with the relevant local authority. Instruments will be set up at relevant sites to operate an alert system when a predetermined site action level approved by the Secretary of State in consultation with the relevant local authorities, is reached. If the alarm is triggered, the following actions will be taken:

   i. The Contractor, or a delegated representative, shall at the earliest reasonable opportunity, investigate activities on the site to ascertain whether any visible dust is emanating from the site or activities are occurring that are not in line with dust control procedures.

   ii. Actions taken to resolve the situation will be recorded in a site logbook and the relevant local authorities notified of the event and actions by telephone or email, as soon as is reasonably practicable, after or during the dust event.

iii. If no source of the dust event is identified, other project sites and local authorities or Automatic Urban and Rural Network monitoring sites will be contacted to establish whether there is an increase in particulate concentrations in the wider area.

iv. If the cause of the alert is not related to site operations, the outcome of any investigation will be recorded in a site logbook which would be made available to the relevant local authorities on request.

v. Dust monitoring will continue until that part of the construction works has been completed, or earlier, if the site is deemed to be low risk in consultation with National Highways and the relevant local authorities.

Operational phase

5.5.11 No operational phase good practice measures are required and therefore presented for air quality.

Essential mitigation

5.5.12 An iterative appraisal of the Project design taking into account the design principles and good practice was undertaken to identify any potentially significant effects that would require essential mitigation.

5.5.13 Taking into account the implementation of good practice measures of the REAC and the predicted changes in air quality during construction and operation, no potential for likely significant effects was identified for human health and compliance with Limit Values, and as such, no essential mitigation measures are required for these effects. However, it should be noted that measures to reduce the operational impact of the Project on the A228 have been investigated where there are predicted exceedances of the annual mean NO_2 AQS objective and worsenings in annual mean NO_2 concentrations as a result of the Project. The section of the A228 affected resides in the administrative area of Medway Council, and the potential measures the Project could introduce to reduce the air quality impact along this corridor have been discussed with Medway Council, as outlined in Table 5.1. Numerous measures have been investigated including introducing a Clean Air Zone, applying lower speed limits, HGV bans, traffic calming, use of air quality barriers and improving alternative routes such the A229 and A2/M2 to make those routes more attractive and reduce traffic flows on the A228. The measures identified were, however, considered to be ineffective or undeliverable. Further work is ongoing to explore the feasibility of introducing measures to reduce the air quality impact of the Project on the A2 London Road, Strood (located in the administrative area of Medway Council), where there are also predicted exceedances of the annual mean NO_2 AQS objective and small worsenings in annual mean NO_2 as a result of the Project. It is considered unlikely at this stage that there will be any viable mitigation measures that will reduce the reported impacts. However, it should be noted that that this does not alter the conclusion that for impacts on human health the Project is not considered to have a significant effect.

5.5.14 Mitigation has been considered as a result of the operational impacts on biodiversity. As referred to previously in the methodology section of the chapter, it is a requirement of DMRB LA 105 (Highways England, 2019) to produce a PAQAP (Application Document 6.3, Appendix 5.6). The PAQAP is presented in Appendix 5.6 (Application Document 6.3) and provides the assessment of measures that have been considered that have potential to reduce the impacts of the Project on the sites affected. Measures considered included barriers, speed limits and speed enforcement. The viability of the measures were also assessed as although they could theoretically reduce the Project's impacts, measures are not always viable. For example, whilst barriers may reduce pollutants behind the barrier, they have the potential to give rise to adverse impacts on the site that they are trying to protect.

Enhancement

5.5.15 In addition to the 'good design' principal enhancement measures, there are no specific enhancement measures included in the Project for air quality.

5.6 Assessment of likely significant effects

5.6.1 This section presents the assessment of likely significant effects on air quality resulting from the construction and operational phases of the Project. This is based on the design of the Project and takes into account the mitigation as presented in Section 5.5 of this chapter.

5.6.2 The significance of effects has been determined following DMRB LA 105 (Highways England, 2019), as described in Section 5.3 above, based on the air quality effects of the Project on human health, designated habitats and compliance with the Air Quality Directive (Directive 2008/50/EC).

Construction phase

Construction dust

5.6.3 Given the size of the Project and the location of receptors, the overall dust risk potential is rated 'large' (based on DMRB LA 105 (Highways England, 2019) classification) according to Table 5.2, and the receiving environment sensitivity is 'high' up to 100m from construction activities according to Table 5.3. It should be noted, however, that the risk of adverse dust effects occurring at any given receptor will vary widely along the Project route depending on the nature of construction activities occurring near the receptor and the distance of the receptor from those activities.

5.6.4 Good practice mitigation measures reflecting the overall construction dust risk have been proposed to reduce the dust effects at receptors, as outlined in Section 5.5.

5.6.5 As noted in DMRB LA 105 (Highways England, 2019), when appropriately mitigated, construction dust impacts on human and ecological receptors are not expected to trigger a significant air quality effect. During construction of the Project, air quality will be monitored where required to make sure significant construction dust effects do not occur.

Construction plant

5.6.6 Exhaust emissions of pollutants including NO_2 and PM_{10} would occur from onsite plant (NRMM). Emissions from NRMM would be temporary and minimised through the application of mitigation measures, including meeting the emissions standard requirements of the London Low Emission Zone for NRMM across all construction compounds and activities, as described in Section 5.5. Therefore, through adopting these procedures, given individual plant would operate for relatively short periods of time in any given area and considering the low background pollutant concentrations, these emissions are unlikely to trigger exceedances of AQS objectives and a significant air quality effect.

Use of the River

5.6.7 The conclusion of the assessment of Project vessel movements on the River Thames was that there would be no significant effects because the number of additional vessel movements anticipated is very small in relation to the baseline, and because air quality meets AQS objectives close to the Port of Tilbury and River Thames.

5.6.8 The baseline data used in this assessment include information relating to existing vessel movements on the river Thames and air quality in the vicinity of the Port of Tilbury and Tilbury2.

5.6.9 The Port of Tilbury handled an average of 3,260 vessels per year between 2016 and 2019 (which would generate at least 6,520 two-way vessel movements). Furthermore, the Tilbury 2 terminal opened in 2020, enabling the Port of Tilbury to increase its capacity, which will further increase the number of baseline movements. There are also over 900 vessel transits per month in some sections of the authorised channel within the Order Limits.

5.6.10 There are no AQMAs declared in Thurrock and Gravesham as a result of shipping emissions and so emissions associated with the Port of Tilbury and Tilbury2 are not considered to be causing exceedances of AQS objectives. Thurrock automatic monitoring stations TK1 and TK4 which are located within 500m of the Port of Tilbury/Thames monitored no exceedances of short term or long term AQS objectives for NO_2, PM_{10} or SO_2 between 2015 and 2019.

5.6.11 It is anticipated that there would be a maximum of 126 two-way vessel movements per year associated with the transport of material via the Port of Tilbury and Tilbury2 during the construction phase. A limited number of Project vessels will also be used for limited periods (likely to be less than 10 in total) for activities such as surveying. This number of vessels and movements is considered to be very small in relation to the number of baseline movements and given the fact that there are no exceedances of AQS objectives associated with the existing use of the river, the small temporary increase in construction river transport is considered to be negligible in terms of impacts on local air quality.

Construction road traffic and traffic management

5.6.12 The construction phase assessment uses the traffic data provided for each construction year.

Impacts on human health receptors

5.6.13 A total of 217 human health receptors were modelled for the construction phase traffic and traffic management assessment.

5.6.14 One receptor is predicted to exceed the annual mean NO_2 AQS objective of 40µg/m³ throughout the 2025 – 2030 construction period. This is receptor LTC289_H, located by Junction 30 of the M25/A282. This receptor is a hotel and unlikely to be a building with permanent residence given it is part of a large hotel chain. As a result, the annual mean AQS objective should not apply at this receptor. The maximum modelled annual mean NO_2 concentration in the Do-Minimum and Do-Something scenario in any construction year is predicted in 2025, 45.9µg/m³ and 45.7µg/m³ respectively. As the annual mean is below 60µg/m³ it is not likely to represent a risk of exceeding the one-hour AQS objective which would apply at the hotel. Additionally, the quantified change in concentration is considered to be imperceptible in each of the construction phase assessment years.

5.6.15 There are no receptors where the increase in pollutant concentration causes a new exceedance of any of the relevant long term AQS objectives for NO_2, PM_{10} or $PM_{2.5}$.

5.6.16 In the largest increase in annual mean NO_2 as a result of construction is predicted at receptor LTC_Con_015 in 2027: the Do-Minimum annual mean NO_2 is predicted to be 23.3µg/m³ and increase by 1.3µg/m³ as a result of the ongoing construction of the Project. This receptor is located on West Road in South Ockendon, where there is an increase in traffic due to re-routing as a result of nearby traffic management measures on B186 North Road during the construction phase. The increase in NO_2 is due to an increase of approximately 3,400 vehicles per day during 2027, and due to reductions in speed during the PM peak.

5.6.17 The largest increase in annual mean PM_{10} is predicted at the same receptor (LTC_Con_015) and is an increase of 0.4µg/m³.

5.6.18 The change in PM_{10} at all receptors is imperceptible in all construction phase years.

5.6.19 The maximum PM_{10} concentration predicted in any of the construction phase years across the modelled human health receptors is 22.4µg/m³, which is predicted at receptor LTC055 in both the Do-Minimum and Do-Something 2025 scenarios. This is a receptor located close to the A282 on the southern approach to the Dartford Crossing.

5.6.20 There are therefore no receptors which are expected to exceed the annual mean PM_{10} AQS objective. Since annual mean concentrations are below 32µg/m³ at all receptors, there are expected to be no exceedances of the 24-hour mean AQS objective for PM_{10}.

5.6.21 $PM_{2.5}$ has not been modelled as a separate pollutant but is considered through the results of the PM_{10} modelling, as $PM_{2.5}$ is a component of PM_{10}. There are no receptors where predicted annual mean PM_{10} concentrations are in excess of 25µg/m^3 in the Project opening year. The annual mean AQS objective for $PM_{2.5}$ is 25µg/m^3.

5.6.22 It is therefore concluded that the impacts during the construction phase will not lead to a significant effect on local air quality on human health receptors.

Compliance

5.6.23 During the 2025 – 2030 construction phase, there are no qualifying features where the total concentration exceeds the annual mean Limit Value for NO_2 and where the increase in concentration is greater 0.4µg/m^3 (i.e., a perceptible change). The conclusion of the compliance risk assessment is that there is no risk to the reported date of compliance with the Limit Value for NO_2.

5.6.24 The maximum modelled concentration at a qualifying feature adjacent to a PCM link is predicted at Con_PCM_007 (a footpath) which is located next to the A1089 (PCM link census ID: 802016644) in Tilbury. The annual mean NO_2 concentration modelled at this feature is 34.4µg/m^3 in the 2025 Project construction scenario which is below the Limit Value of 40µg/m^3. The change at this feature is 1.8µg/m which is the joint largest increase in concentration at a qualifying feature in any of the construction phase year.

5.6.25 In relation to PM_{10} and $PM_{2.5}$, there are no qualifying features where the total concentration exceeded the annual mean Limit Value for PM_{10} or $PM_{2.5}$. The maximum particulate concentrations across all of the construction phase scenarios are predicted at PCM_78 which is predicted to experience the annual mean particulate concentrations of 25.0µg/m^3 (PM_{10}) and 19.7µg/m^3 ($PM_{2.5}$). These concentrations are below the Limit Values of 40µg/m^3 and 20µg/m^3 for PM_{10} and $PM_{2.5}$ respectively. The conclusion of the compliance risk assessment is that there is no risk to the reported date of compliance with the Limit Value for PM_{10} and $PM_{2.5}$.

5.6.26 It should be noted that the $PM_{2.5}$ predictions are worst case as PM_{10} modelled road component have been added to the $PM_{2.5}$ backgrounds and therefore the concentrations presented are an overprediction.

5.6.27 The full set of modelled results for qualifying features is shown in Tables 3.1 – 3.6 of Appendix 5.3: Air Quality Construction Phase Results (Application Document 6.3).

Designated habitats

5.6.28 Ecological receptors were included in the air quality model for the construction ARN. Project changes in N deposition during construction would be temporary and would vary throughout the construction phase as a result of the dynamic nature of the construction activities and associated traffic effects. Changes in N deposition over the construction phase are not likely to affect ecological site integrity, as N deposition effects are cumulative. The modelled results were provided to the competent expert for Biodiversity to determine whether the change in N deposition would result in a significant effect where there were cumulative impacts during both construction and operation.

5.6.29 The competent expert concluded that the construction impact in isolation would not result in a significant effect on designated habitats as a result of N deposition. The cumulative impacts of both construction and operation have been considered and where a significant effect has been identified this has been reported in the operational phase impacts. Further details can be found in ES Chapter 8: Terrestrial Biodiversity (Application Document 6.1).

Operational phase

5.6.30 Given the size of the study area, the description of the operational air quality impacts has been split into two parts:

a. Receptors that inform the judgement of significance – Discussion of the results at receptors which are predicted to exceed AQS objectives in either the Do-Minimum or Do-Something scenario, and also have greater than imperceptible changes in annual mean NO_2 (changes greater than 1% of the annual mean AQS objective, i.e., >0.4µg/m3). These receptors are used to inform whether the Project leads to a significant effect. As set out in Section 5.3, all receptors judged to be at risk of exceeding AQS objectives have been included in the model.

b. Remainder of receptors across the study area – Discussion of the results at receptors split into different geographical areas, known as discussion areas. This section provides an overview of the Project's impacts over the study area regardless of whether there are exceedances of the AQS objectives. The discussion of results in each area predominantly focuses on receptors with the highest concentrations and concentrations changes from the Project.

5.6.31 Some receptors within the Order Limits would be subject to demolition as a result of the Project, and while these have been included in the model (denoted with receptor ID '_D'), they are not included in the discussion of results since they would not exist with the Project in operation. Results for all the receptors modelled are shown in Table 1.1 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3) and Figure 5.6: Operational Phase Receptors and Results (Application Document 6.2).

5.6.32 The changes in NO_2 and PM_{10} predicted at receptors are attributable to Project-related changes in traffic flows and the addition of new road infrastructure. It is therefore important to understand how the Project would affect traffic flows on the road network, to understand the likely air quality effects. The description of traffic flows provided in this section focuses on changes in AADT flow in specific locations.

5.6.33 The concentrations predicted in each scenario and the concentration change associated with the Project are influenced by a variety of factors, including traffic flows and congestion on adjacent roads, the distance between road and receptors, and the wind direction relative to the location of roads and receptors (e.g., for a south to north orientated road, during westerly winds, concentrations would be higher on the eastern side of the road compared to the west).

5.6.34 The distance between road and receptor can have a large influence on the concentrations and the change in concentration caused by the Project, which should be noted when comparing results at individual receptors. Receptors further from a road would generally need a larger traffic flow/change in traffic flow to result in the same concentration/concentration change as receptors closer to a road, because of dispersion effects. This explains why it can be possible to predict a larger change in air quality at one receptor compared to another, despite the Project causing a smaller change in traffic on the adjacent road.

Receptors that inform judgement of significance

5.6.35 In accordance with DMRB LA 105 (Highways England, 2019), and as described in paragraphs 5.3.133 to 5.3.137, only receptors where there are exceedances of the annual mean NO_2 AQS objective and perceptible changes in annual mean NO_2 (>0.4µg/m^3) are considered in the judgement as to whether the Project leads to a significant effect. There are receptors predicted to meet these criteria in the following four areas:

a. A282 Dartford Crossing

b. A2 London Road, Strood

c. M25 Holmesdale Tunnel

d. A228 (between M20 junction 4 and M2 junction 2)

5.6.36 Table 5.14 presents all the receptors in the four areas described above with the predicted change and the impact magnitude based on the descriptors in DMRB LA 105 (Highways England, 2019).

Table 5.14 Receptors which exceed the annual mean NO_2 AQS objective with a perceptible Project change in NO_2 (2030)

Receptor	Annual mean NO_2 (µg/m3)			Impact magnitude
	Do-Minimum 2030	Do-Something 2030	Predicted change	
A282 Dartford Crossing				
LTC477	40.2	36.7	-3.5	Medium decrease
LTC073	42.4	40.9	-1.5	Small decrease
LTC554	41.2	39.9	-1.3	Small decrease
LTC833	40.1	38.9	-1.2	Small decrease
A2 London Road, Strood				
LTC687	40.8	41.9	+1.1	Small increase
LTC689	41.3	42.4	+1.1	Small increase
LTC691	42.3	43.4	+1.1	Small increase
LTC696	43.3	44.5	+1.2	Small increase

Receptor	Annual mean NO_2 (µg/m3)			Impact magnitude
	Do-Minimum 2030	Do-Something 2030	Predicted change	
M25 Holmesdale Tunnel				
LTC196	59.0	57.9	-1.1	Small decrease
LTC530	52.1	51.2	-0.9	Small decrease
LTC531	45.9	45.2	-0.7	Small decrease
LTC532	44.4	43.8	-0.6	Small decrease
LTC533	43.8	43.3	-0.5	Small decrease
LTC534	44.1	43.6	-0.5	Small decrease
LTC535	44.6	44.1	-0.5	Small decrease
A228 (between M20 junction 4 and M2 junction 2)				
LTC011	40.5	44.7	+4.2	Large increase
LTC026	43.0	45.7	+2.7	Medium increase
LTC450	40.7	43.8	+3.1	Medium increase
LTC451	41.2	43.8	+2.6	Medium increase
LTC456	39.9	42.3	+2.4	Medium increase
LTC111	44.3	43.2	-1.1	Small decrease
LTC443	43.8	42.7	-1.1	Small decrease
LTC444	43.9	42.7	-1.2	Small decrease
LTC445	44.0	42.8	-1.2	Small decrease
LTC446	44.2	42.9	-1.3	Small decrease

A282 Dartford Crossing

5.6.37 There are four receptors predicted to exceed the annual mean NO_2 AQS objective along the A282 Dartford Crossing corridor in the Do-Minimum scenario. Exceedances are predicted at receptors LTC073, LTC554 and LTC833 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) as they are located within 20m of A225 Princes Road and within 20 to 30m of the Princes Road Interchange. The adjacent sections of the A225 Princes Road and Princes Road Interchange have an approximate traffic flow of 35,000 AADT and 35,900 AADT in the Do-Minimum scenario. An exceedance is also predicted at receptor LTC477 as it is located within 30m of the A282, and the adjacent section of this road has a traffic flow of approximately 178,800 AADT in the Do-Minimum scenario. The highest annual mean NO_2 concentration predicted in the Do-Minimum scenario is 42.4 µg/m^3 and is predicted at receptor LTC073.

5.6.38 The Project is forecast to result in an approximate reduction in traffic flow of 5,300 AADT at Princes Road interchange, which leads to a reduction in annual mean NO_2 of 1.2 to 1.5µg/m^3 (small improvement) at receptors LTC073, LTC554 and LTC833. The exceedance of the annual mean AQS objective is removed from two of these receptors as a result of the improvement. There is a forecast decrease in traffic flow of approximately 26,200 AADT on the section of A282 adjacent to receptor LTC477, which leads to a reduction in annual mean NO_2 of 3.5µg/m^3 (medium improvement) and removes the exceedance.

5.6.39 An exceedance of the annual mean NO_2 AQS objective and a reduction in annual mean NO_2 of 1.2 µg/m^3 (small improvement) is predicted at receptor LTC289_H, which is located by Junction 30 of the M25/A282. However, this receptor is a hotel and unlikely to be a building with permanent residence given it is part of a large hotel chain. As a result, the annual mean AQS objective would not apply at this receptor and it has not been reported in Table 5.14 or included in the significance assessment.

A2 London Road, Strood

5.6.40 Exceedances of the annual mean NO_2 AQS objective are predicted in the Do-Minimum scenario at four receptors next to the A2 London Road, Strood. Exceedances of the annual mean NO_2 AQS objective are predicted here due to receptors being located very close to the A2 (within 3m). The section of the A2 next to these receptors is forecast to have an approximate traffic flow of 18,100 AADT in the Do-Minimum scenario. The highest annual mean NO_2 concentration predicted in the Do-Minimum scenario is 43.3µg/m^3, which is predicted at LTC696 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2).

5.6.41 There is a forecast increase in traffic flow on the A2 London Road of approximately 1,100 AADT next to these receptors. This increase in traffic leads to an increase in annual mean NO_2 of 1.1 to 1.2µg/m^3 (small worsening) at the four receptors which exceed the objective. No additional receptors are predicted to exceed the objective on the A2 London Road in the Do-Something scenario.

M25 Holmesdale Tunnel

5.6.42 Seven receptors adjacent to the M25 between junction 25 and junction 26 are predicted to exceed the annual mean NO_2 AQS objective in the Do-Minimum scenario. These receptors are located on Arlington Crescent, and exceedances are predicted here as they are located within 8 to 20m of the M25, and within 40 to 100m of the Holmesdale Tunnel east portal. The adjacent section of the M25 is predicted to have a traffic flow of approximately 155,700 AADT in the Do-Minimum scenario. Receptor LTC196 is the closest receptor to the M25 and tunnel portal and is predicted to have the highest annual mean NO_2 concentration in the Do-Minimum scenario, with a concentration of 59.0µg/m^3. Although this concentration is well in excess of the annual mean objective, it is unlikely that NO_2 at this receptor would exceed the 1-hour AQS objective since the annual mean is below 60µg/m^3 (as described in paragraph 5.3.98).

5.6.43 The Project is forecast to lead to an approximate increase in traffic flow of 4,000 AADT on the adjacent section of M25, but there is a change in speed band from high speed to free flow in the IP traffic period, which leads to a reduction in per vehicle emissions. The change in speed band leads to an overall reduction in annual mean NO_2 at the seven receptors which exceed the annual mean AQS objective, ranging from 0.5 to 1.1µg/m^3 (small improvement).

5.6.44 The model predicts that there is a risk of exceedances of the 1-hour NO_2 AQS objective in some of the gardens of the residential properties on Arlington Crescent which exceed the annual mean AQS objective. There are five gardens (LTC429_G to LTC433_G, Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) where the annual mean NO_2 concentration is predicted to exceed 60µg/m^3 in the Do-Minimum scenario, and these experience a decrease in annual mean NO_2 ranging from 0.9 to 1.6µg/m^3 (small improvement) as a result of the Project. It should be noted that the annual mean NO_2 AQS objective does not apply to gardens.

A228 (between M20 junction 4 and M2 junction 2)

5.6.45 There are 10 receptors next to the A228 which are predicted to exceed the annual mean NO_2 AQS objective in either the Do-Minimum or Do-Something scenario. Receptor LTC111 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) is predicted to experience the highest annual mean NO_2 concentration in the Do-Minimum scenario, with a predicted concentration of 44.3µg/m^3. This receptor is located within 20m of the A228 Castle Way, which is the section with the highest traffic flows along the A228 corridor (between M20 and M2).

5.6.46 The Project is forecast to lead to an increase in traffic on the A228 (between Leybourne Way and M2 junction 2) ranging from approximately 1,100 to 3,200 AADT. A large proportion of the increase is associated with HDVs, which increase by up to 1,600 AADT. This increase in traffic leads to an increase in annual mean NO_2 of 2.4 to 3.1µg/m^3 (medium worsening) at four receptors which exceed the objective on Rochester Road/Sundridge Hill. It should be noted that three of these four receptors already exceed the objective in the Do-Minimum scenario. An increase in annual mean NO_2 of 4.2µg/m^3 (large worsening) is predicted at receptor LTC011 on Rochester Road, which also already exceeds the objective in the Do-Minimum scenario.

5.6.47 A decrease in HDV flows of 1,600 per day is forecast on the A228 Castle Way (between Leybourne Way and M20 junction 4), and this leads to a decrease in annual mean NO_2 of 1.1 to 1.3µg/m^3 (small improvement) at five receptors which exceed the objective in the Do-Minimum scenario. This reduction in HDVs occurs due to these vehicles being forecast to travel north from the Leybourne Way junction to the M2 instead of traveling south to the M20.

Remainder of receptors across the study area

M25 junction 25 to junction 28

5.6.48 There are seven receptors located on Arlington Crescent and adjacent to the M25 between junction 25 and junction 26, which are predicted to exceed the annual mean NO_2 AQS objective in the Do-Minimum scenario and have been used to inform the judgement of significance (Table 5.14) as discussed in paragraph 5.6.42 to 5.6.44.

5.6.49 For other receptors not located on Arlington Crescent, as presented in Table 5.15, the highest Do-Minimum annual mean NO_2 concentration is predicted at receptor LTC123 and is 36.1µg/m^3. This receptor is located on Holmesdale, close to the Holmesdale tunnel west portal and within 30m of the M25 between junction 25 and junction 26.

Table 5.15 M25 junction 25 to junction 28 receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC170	Close to M25 southbound on-slip from junction 28, approximately 60m from M25.	25.9	26.3	+0.4	Increase of approximately 13,100 AADT and 1,300 HDV.
LTC162	Between M25 junctions 26 and 27, approximately 25m from M25.	27.0	27.3	+0.3	Increase of approximately 4,800 AADT and 900 HDV.
LTC409	Close to portal of Bell Common Tunnel, approximately 40m from M25.	25.0	25.2	+0.2	Increase of approximately 4,800 AADT and 900 HDV.
LTC400	Between M25 junctions 28 and 27, approximately 30m from M25.	22.4	22.7	+0.3	Increase of approximately 10,300 AADT and 1,200 HDV.
LTC123	Holmesdale, close to west portal of the Holmesdale Tunnel, within 30m of M25	36.1	35.6	-0.5	Increase in AADT of approximately 4,000 AADT and 700 HDV. Speed band change in the IP period (high speed to free flow).
LTC406	Holmesdale, close to west portal of the Holmesdale Tunnel, within 30m of M25	35.8	35.3	-0.5	

5.6.50 The Project is forecast to lead to an increase in traffic on the M25 ranging from approximately 4,000 to 10,300 AADT between junction 25 and junction 28. With the exception of worst-case receptors close to Holmesdale tunnel, all receptors modelled in this discussion area are predicted to experience a change in annual mean NO_2 of 0.4µg/m^3 or less (i.e., ‘imperceptible’ magnitude of change). Such a small change can be explained by the distance between the M25 and the closest receptors, which are located at least 20m away.

5.6.51 The largest change in annual mean NO_2 in the discussion area is predicted at receptors LTC123 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) and LTC406 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), with decrease in NO_2 of 0.5µg/m^3 as a result of the Project. LTC123 and LTC406 are located within 30m of the M25, close to the Holmesdale Tunnel west portal and next to the M25 junction 25 off-slip. Although the Project leads to a predicted increase in traffic flow of 4,000 AADT adjacent to these receptors, there is a change in speed band of the adjacent section of M25 from high speed to free flow in the IP period, which leads to a decrease in emissions per vehicle, and an overall decrease in NO_2 concentrations.

M11 junction 6 to junction 8

5.6.52 Table 5.16 presents the annual mean NO_2 predictions for a selection of receptors within this discussion area and includes a brief description of why there would be a change in NO_2 concentration because of the Project.

Table 5.16 M11 junction 6 to junction 8 receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2029	Do-Something 2029	Predicted change	
LTC264	Between M11 junction 6 and junction 7, approximately 170m from the M11.	15.5	15.6	+0.1	Increase of approximately 1,700 AADT and 100 HDV.
LTC169	Between M11 junction 7 and junction 7a, approximately 40m from the M11.	16.6	16.6	0.0	Increase of approximately 1,600 AADT and 100 HDV.
LTC159	Between junction 7a and junction 8, approximately 30m from the M11.	21.2	21.3	+0.1	Increase of approximately 1,400 AADT and 100 HDV.

5.6.53 Receptor LTC159 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) is predicted to experience the highest annual mean NO_2 concentration in this discussion area, which is 21.2µg/m^3 in the Do-Minimum scenario, well below the annual mean AQS objective.

5.6.54 The Project is forecast to lead to an increase in traffic ranging between approximately 1,400 to 1,700 AADT on the M11 between junction 6 and junction 8. The largest change in annual mean NO_2 predicted at receptors in this discussion area is 0.1µg/m^3, which reflects the small forecast increase in traffic on the M11 as result of the Project and the fact that receptors are set far back from the motorway (30 to 160m away).

A12 junction 12 to junction 19

5.6.55 Table 5.17 presents the annual mean NO_2 predictions for a selection of receptors within this discussion area and includes a brief description of why there would be a change in NO_2 concentration because of the Project.

Table 5.17 A12 receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2029	Do-Something 2029	Predicted change	
LTC114	Between A12 junction 12 and junction 13, approximately 6m from A12	32.8	32.6	-0.2	Reduction of approximately 2,200 AADT and 200 HDV on A12.
LTC563	Next to A12 junction 17, approximately 50m from A12, and 15m from A12 exit slip road.	30.7	30.7	0.0	Reduction of approximately 1,100 AADT on A12.
LTC756	Located within 29m of A12 between junction 12 and 13, and within 6m of Roman Road.	26.6	26.2	-0.4	Reduction of approximately 2,200 AADT on A12 and 1400 AADT on Roman Road.

5.6.56 Receptor LTC114 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), which is located within 6m of the A12 adjacent to junction 13, is predicted to experience the highest NO_2 concentration in this discussion area. An annual mean NO_2 concentration of 32.8µg/m^3 is predicted at LTC114 in the Do-Minimum scenario, which is below the annual mean AQS objective.

5.6.57 The Project is forecast to lead to a change in traffic ranging from approximately +400 to -2,300 AADT, and +200 to -200 HDVs per day between junction 12 and junction 19. All receptors located along the A12 experience an imperceptible change in annual mean NO_2 as a result of the Project.

A127, A12 and surrounding roads

5.6.58 Table 5.18 presents the annual mean NO_2 predictions for a selection of receptors within this area and includes a brief description of why there would be a change in NO_2 concentration because of the Project.

Table 5.18 A127 and surrounding roads receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC792	Adjacent to Gallows Corner, approximately 15m from the junction circulatory in between A118 and A127.	31.4	31.6	+0.2	Increase of approximately 300 AADT on A118 and increase of approximately 1,600 AADT on A127.

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC747	Approximately 24m north of A12 Eastern Avenue East.	28.0	28.4	+0.4	Increase of approximately 1,000 AADT on A12/
LTC104	Folkes Lane, approximately 20m from A127 Arterial Road, west of M25 junction 29.	28.9	30.5	+1.6	Increase of approximately 10,500 AADT and 500 HDV on A127.
LTC072	Approximately 12m south of A127 Arterial Road, west of M25 junction 29.	28.0	29.4	+1.4	Increase of approximately 10,500 AADT and 500 HDV on A127.
LTC295	Front Lane, approximately 7m east of this road.	22.7	23.3	+0.6	Increase of approximately 1,700 AADT on Front Lane.
LTC023	Approximately 8m south of the A128 to A127 on-slip, east of M25 junction 29.	28.9	27.9	-1.0	Reduction of approximately 2,200 AADT and 600 HDV on adjacent slip road.
LTC654	Approximately 4m from A127 on-slip and 13m from A127 Southend Arterial Road, Rayleigh	28.5	28.6	+0.1	Reduction of approximately 60 AADT on adjacent slip road and increase of approximately 1,900 AADT on A127 mainline.

5.6.59 The receptor predicted to experience the highest annual mean NO_2 concentration in this discussion area is LTC792 (located on Gallows Corner, within 15m of the junction circulatory) (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2). An annual mean NO_2 concentration of 31.4µg/m^3 is predicted at LTC792 in the Do-Minimum scenario, which is below the annual mean AQS objective.

5.6.60 The maximum increase in annual mean NO_2 predicted is 1.6µg/m^3, which is predicted at receptor LTC104 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2). This receptor is located within 20m of the A127 Arterial Road, west of M25 junction 29, where there is a predicted increase in traffic flow of approximately 10,500 AADT as a result of the Project.

5.6.61 The maximum reduction in annual mean NO_2 predicted is -1.0µg/m^3, which is predicted at receptor LTC023 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), next to the A127, east of M25 junction 29. This receptor is located within 8m of the A127 on-slip road and within 18m of the A127, where there is a respective reduction in flow of 2,200 AADT and 1,700 AADT as a result of the Project.

M25 junction 28 to junction 30

5.6.62 Table 5.19 presents the annual mean NO_2 predictions for a selection of receptors within this discussion area and includes a brief description of why there would be a change in NO_2 concentration because of the Project.

Table 5.19 M25 junction 28 to junction 30 receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC184	M25 between junction 28 and junction 29. Approximately 35m from M25.	28.1	29.2	+1.1	Increase of approximately 15,100 AADT and 1,200 HDV on the M25.
LTC222	M25 between junction 28 and junction 29. Approximately 100m from M25.	21.0	21.3	+0.3	Increase of approximately 15,100 AADT and 1,200 HDV on the M25.
LTC293	M25 between junction 29 and junction 30. North of the junction with the A122. Approximately 40m from M25.	24.3	25.5	+1.2	Increase of approximately 36,400 AADT and 3,400 HDV on the M25.
LTC213	M25 between junction 29 and junction 30. South of the junction with the A122. Approximately 90m from M25.	22.6	22.2	-0.4	Reduction in AADT of 24,800 AADT and 10,100 HDV.

5.6.63 Annual mean NO_2 concentrations in this discussion area are predicted to be well below the annual mean AQS objective at all receptors. Receptor LTC184 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) is predicted to experience the highest annual mean NO_2 concentration, which is 28.1µg/m^3 in the Do-Minimum scenario.

5.6.64 The Project is forecast to lead to a traffic increase of approximately 15,100 AADT on the M25 between junction 28 and junction 29. The A122 joins the M25 between junction 29 and junction 30, and as a result, to the north, there is a forecast traffic increase of approximately 36,400 AADT. South of where the A122 joins the M25, there is a forecast reduction in traffic flow of approximately 24,800 AADT.

5.6.65 Receptors located north of where the A122 joins the M25 experience a deterioration in air quality, whereas receptors south experience an improvement, as a result of the Project. The largest increase in annual mean NO_2 is predicted at receptor LTC293 and is 1.2µg/m^3. The largest reduction in NO_2 is predicted at receptor LTC213 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) and is -0.4µg/m^3.

A282 Dartford Crossing

5.6.66 There are four receptors along the A282 Dartford Crossing which are predicted to exceed the annual mean NO_2 AQS objective in the Do-Minimum scenario and have been used to inform the judgement of significance (Table 5.20) as discussed in paragraphs 5.6.37 to 5.6.38.

5.6.67 For other receptors not above the AQS objective, as presented in Table 5.20, the highest annual mean NO_2 concentration is predicted at receptor LTC478 and is 39.9µg/m^3. This receptor is located on Hardwick Crescent within 10m of the A282. It should be noted that, although receptor LTC048 is located closer to the same section of the A282, it has a lower annual mean NO_2 concentration because it is located on the other side of the A282, and so is typically upwind of emissions from this road based on the prevailing wind direction.

5.6.68 The Project is forecast to result in a reduction in traffic flow of approximately 21,700 to 31,700 AADT on the A282, which leads to a reduction in NO_2. The greatest reduction in annual mean NO_2 is predicted at receptor LTC478 and is -3.4µg/m^3.

Table 5.20 A282 receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 (µg/m$_3$)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC098	Eliot Road, close to off-slip of M25 junction 1a, approximately 20m from A282.	33.7	31.5	-2.2	Reduction of approximately 31,700 AADT and 10,300 HDV on the A282.

Receptor	Location	Annual mean NO_2 ($\mu g/m_3$)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC048	Bow Arrow Lane, approximately 8m from A282 between junction 1a and junction 1b.	38.3	35.6	-2.7	Reduction of approximately 26,200 AADT and 10,100 HDV on the A282.
LTC478	Hardwick Crescent, approximately 10m from A282 between junction 1a and junction 1b.	39.9	36.5	-3.4	Reduction of approximately 26,200 AADT and 10,100 HDV on the A282.
LTC055	Queens Gardens, approximately 10m from the A282 south of M25 junction 2.	33.9	32.6	-1.3	Reduction of approximately 21,700 AADT and 10,100 HDV on the A282.

A13 and surrounding roads

5.6.69 Table 5.21 presents the annual mean NO_2 predictions for a selection of receptors within this discussion area and includes a brief description of why there would be a change in NO_2 concentration because of the Project.

Table 5.21 A13 and surrounding roads receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 ($\mu g/m^3$)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC103	Clockhouse Lane, A13 between the M25 and the Project route. Approximately 20m from A13.	31.0	30.1	-0.9	Reduction of approximately 16,700 AADT and 3,900 HDV on the A13.
LTC119	A13, east of Project route. Approximately 20m from the A13.	26.5	27.7	+1.2	Increase of approximately 21,000 AADT and 800 HDV on the A13.
LTC376	Approximately 1m from Stifford Clays Road.	21.5	22.8	+1.3	Located close to new junction constructed as part of the Project.

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC084	East of A13/A132 junction. Approximately 10m from the A13.	26.5	26.8	+0.3	Increase of approximately 8,300 AADT and 100 HDV on the A13.
LTC345	A176 Nether Mayne. Approximately 10m from the A176.	27.7	27.4	-0.3	Reduction of approximately 1,900 AADT.
LTC417	Approximately 8m from Buckingham Hill Road and 40m from A13.	32.0	33.7	+1.7	Increase of approximately 2,000 AADT on Buckingham Hill Road. Increase of approximately 21,000 AADT and 800 HDV on the A13.
LTC262	A1013 Stanford Road, east of A13/A1089/A122 Lower Thames Crossing junction	25.1	26.2	+1.1	Located close to new junction constructed as part of the Project.
LTC673_F	Approximately 20m from A13 alongside A13 junction with A406 and A1020.	36.7	36.7	0	Increase of approximately 400 AADT and decrease of 300 HDVs on A13.
LTC067	Approximately 15m from Brentwood Road.	22.6	23.5	+0.9	Increase of approximately 1,400 AADT.
LTC113	Approximately 20m from the A1089.	23.1	23.5	+0.4	Increase of approximately 9,200 AADT and 500 HDVs on the A1089.
LTC035	Approximately 10m from the A1306 Arterial Road North Stifford.	34.1	33.0	-1.1	Reduction of approximately 4,600 AADT and 400 HDV on the A1306.

5.6.70 The receptor predicted to experience the highest annual mean NO_2 concentration in this discussion area is LTC673_F (located west of the M25, within 20m of A13, close to the A13 junction with A406 and A1020) (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2). An annual mean NO_2 concentration of 36.7µg/m3 is predicted at LTC035 in the Do-Minimum scenario, which is below the annual mean AQS objective.

5.6.71 The receptor predicted to experience the largest change in annual mean NO_2 in this discussion area is LTC417 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), which is located to the east of the Project route, approximately 8m from Buckingham Hill Road and 40m from A13. There is a predicted increase in annual mean NO_2 of 1.7µg/m3 at this receptor as a result of the Project. This receptor is associated with a potential residential development and has been modelled at the closest point between the Application Site and Buckingham Hill/A13, which is likely to overestimate impacts at residential receptors.

5.6.72 Along the A13 between the M25 (junction 30) and the A13/A1089/A122 Lower Thames Crossing junction, traffic flows are forecast to decrease in the range of 15,400 to 18,800 AADT, resulting in an air quality improvement. The largest reduction in annual mean NO_2 predicted along this specific corridor is - 0.9µg/m^3, at LTC103 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2).

5.6.73 To the east of the A13/A1089/A122 Lower Thames Crossing junction, flows on the A13 are forecast to increase, with a maximum predicted increase of approximately 23,200 AADT, resulting in a deterioration in air quality. The largest increase in annual mean NO_2 predicted along this specific corridor is 1.7µg/m^3, at LTC417 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2).

5.6.74 On the A13 to the west of M25 junction 30, traffic flows are forecast to increase, with a maximum increase of 4,800 AADT predicted. However, the resultant changes in annual mean NO_2 are all expected to be imperceptible.

5.6.75 Taking into account all the receptor results in this discussion area, as presented in Table 1.1 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3) and Figure 5.6: Operational Phase Receptors and Results (Application Document 6.2), the forecast changes in annual mean NO_2 on roads surrounding the A13 are generally less than 0.4µg/m^3. The largest changes in annual mean NO_2 are forecast around new links at the A13/A1089/A122 Lower Thames Crossing junction.

A2 and surrounding roads

5.6.76 Table 5.22 presents the annual mean NO_2 predictions for receptors along the A2 and surrounding roads and includes a brief description of why there would be a change in NO_2 concentration because of the Project.

Table 5.22 A2 and surrounding roads receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC128	A2 between M25 and A2 Bean Interchange. Approximately 20m from the A2.	33.7	33.4	-0.3	Reduction of approximately 19,800 AADT and 6,800 HDV. Speed band changes to higher speed, giving higher emissions per vehicle in some periods.
LTC175	A2 Watling Street. Approximately 25m from the A2.	34.1	32.7	-1.4	Reduction of approximately 19,700 AADT and 6,900 HDV.
LTC657	A2 Watling Street, close to Valley Drive. Approximately 15m from the A2.	30.0	27.8	-2.2	Reduction of approximately 15,800 AADT and 6,400 HDV.
LTC186	A2 Watling Street, close to Hall Road junction. Approximately 50m from the A2.	28.8	28.4	-0.4	Reduction of approximately 16,300 AADT and 6,800 HDV.
LTC076	Brewers Road. Approximately 50m from the A2.	22.2	22.6	+0.4	New links constructed as part of the A2/Lower Thames Crossing junction and increase in flows.
LTC254	Church Hill Road, approximately 10m from the A2 (west of M25 junction 2).	38.0	38.2	+0.2	Increase of approximately 2,200 AADT.
LTC567	Gravel Hill Close, approximately 27m from the A2 (at A223 junction).	30.3	30.6	+0.3	Increase of approximately 700 AADT, and speed band change from light congestion to heavy congestion in PM period.

5.6.77 The receptor predicted to experience the highest annual mean NO_2 concentration in this discussion area is LTC254 (located within 10m of the A2 on Church Hill Road) (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2). An annual mean NO_2 concentration of 38.0µg/m^3 is predicted at LTC254 in the Do-Minimum scenario, which is below the annual mean AQS objective.

5.6.78 On the A2 between M25 junction 2 and the A223 junction, there is a predicted increase in traffic flow ranging from 2,200 to 700 AADT (note that, on this 700 AADT change section of A2 immediately east of the A223 junction, there is a speed band change from light congestion to heavy congestion in PM traffic period). These forecast traffic changes lead to an imperceptible change in annual mean NO_2 at receptors. The largest change is predicted at receptor LTC567 on Gravel Hill Close (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) and is 0.3µg/m^3.

5.6.79 On the A2 between the A2/Lower Thames Crossing junction and the M25 (junction 2), there is a forecast reduction in traffic flow ranging from approximately 15,200 to 22,800 AADT, resulting in an improvement in air quality. The largest improvement is predicted at LTC657 (A2 Watling Street) (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), where a reduction in annual mean NO_2 of 2.2µg/m^3 is predicted as a result of the Project.

M2 junction 1 to junction 7 and A2 Boughton Bypass/Dover Road

5.6.80 Table 5.23 presents the annual mean NO_2 predictions for a selection of receptors within this discussion area and includes a brief description of why there would be a change in NO_2 concentration because of the Project.

Table 5.23 M2 junctions 1 to junction 7 receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC122	Squires Close, within approximately 20m of the M2 between junctions 1 and 2.	34.9	37.2	+2.3	Increase of approximately 28,100 AADT and 3,800 HDV. Change in speed band from high speed to light congestion in PM period.
LTC204	Peterborough Gardens, within approximately 45m of the M2 between junction 1 and 2.	27.0	28.3	+1.3	Increase of approximately 28,100 AADT and 3,800 HDV. Change in speed band from high speed to light congestion in PM period.

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC143	Nashenden Lane, within 25m of M2 between junctions 2 and 3.	30.4	32.4	+2.0	Increase of approximately 24,200 AADT and 2,100 HDV.
LTC091	Maidstone Road, close to M2 junction 3 and within 18m of M2.	33.0	35.2	+2.2	Increase of approximately 24,200 AADT and 2,100 HDV.
LTC189	Redwood Glade, within approximately 40m of the M2 between junction 3 and junction 4.	19.3	19.5	+0.2	Increase of approximately 5,800 AADT.
LTC079	Rookery Close, within 20m of the M2 between junctions 5 and 6.	21.0	21.2	+0.2	Increase of approximately 2,600 AADT.
LTC257	A2 within approximately 6m of A2 Boughton Bypass	17.3	17.5	+0.2	Increase of approximately 1,500 AADT.
LTC789	B2068 within approximately 26m of A2 Dover Road	13.0	13.1	+0.1	Increase of approximately 1,200 AADT on A2.

5.6.81 Receptor LTC122 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), which is located on Squires Close within 20m of the M2, is predicted to experience the highest NO_2 concentration in this discussion area. An annual mean NO_2 concentration of 34.9µg/m^3 is predicted at LTC122 in the Do-Minimum scenario, which is below the annual mean AQS objective.

5.6.82 Between M2 junction 1 and junction 7 there is a forecast increase in traffic of between approximately 2,300 and 28,100 AADT as a result of the Project, which leads to an increase in NO_2 at receptors. The largest increase in NO_2 is predicted at receptor LTC122 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), where an increase of 2.3µg/m^3 is predicted as a result of the Project.

5.6.83 On the A2 Boughton Bypass/Dover Road between M2 junction 7 and Geddinge Lane there is a forecast increase in traffic of approximately 1,500 to 1,100 AADT and the predicted change in NO_2 is imperceptible at all receptors (e.g., at LTC257 and LTC789).

M20 junction 1 to junction 7

5.6.84 Table 5.24 presents the annual mean NO_2 predictions for a selection of receptors within this discussion area and includes a brief description of why there would be a change in NO_2 concentration because of the Project.

Table 5.24 M20 junction 1 to junction 7 receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC046	M20 between junctions 4 and 5 on eastbound side. Approximately 10m from the M20.	35.4	34.6	-0.8	Reduction of approximately 10,900 AADT and 1,600 HDV on this section of the M20.
LTC240	New Hythe Lane. Approximately 20m from the M20.	30.1	29.5	-0.6	Reduction of approximately 10,900 AADT and 1,600 HDV on this section of the M20.
LTC161	Lunsford Lane. Approximately 20m from the M20.	30.0	29.3	-0.7	Reduction of approximately 10,900 AADT and 1,600 HDV on this section of the M20.
LTC074	London Road (A20). Approximately 60m from the M20.	19.4	18.9	-0.5	Reduction of approximately 13,300 AADT and 3,600 HDV on this section of the M20.
LTC180	M20 between junctions 1 and 2. Approximately 50m from the M20.	17.3	16.9	-0.4	Reduction of approximately 13,400 AADT and 3,700 HDV on this section of the M20.

5.6.85 LTC046 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) is predicted to experience the highest annual mean NO_2 concentration in this discussion area. An annual mean NO_2 concentration of 35.4µg/m^3 is predicted in the Do-Minimum scenario, which is below the annual mean AQS objective.

5.6.86 The Project is forecast to lead to a reduction in traffic flow ranging from approximately 5,800 to 13,300 AADT between M20 junction 1 and junction 6. This reduction in traffic results in a reduction in annual mean NO_2 at receptors, and the largest reduction in NO_2 is also predicted at receptor LTC046 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), where a decrease of -0.8µg/m^3 is predicted as a result of the Project.

M26

5.6.87 Table 5.25 presents the annual mean NO_2 predictions for a selection of receptors within this discussion area and includes a brief description of why there would be a change in NO_2 concentration because of the Project.

Table 5.25 M26 receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC115	A224 London Road, within 20m of the M26.	18.2	18.1	-0.1	Reduction of approximately 1,700 AADT and 400 HDV on this section of the M26.
LTC157	Borough Green Road, within 35m of the M26.	16.2	16.1	-0.1	Reduction of approximately 1,700 AADT and 400 HDV on this section of the M26.
LTC116	Ford Lane, within 15m of the M26.	21.2	21.1	-0.1	Reduction of approximately 1,600 AADT and 400 HDV on this section of the M26.

5.6.88 LTC116 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) is predicted to experience the highest annual mean NO_2 concentration in this discussion area. An annual mean NO_2 concentration of 21.2µg/m^3 is predicted in the Do-Minimum scenario, which is below the annual mean AQS objective.

5.6.89 The Project is forecast to lead to a decrease in traffic flow on the M26 of approximately 1,600 to 1,700 AADT, resulting in imperceptible changes in NO_2 at receptors. The imperceptible changes reflect the relatively small change in traffic predicted on the M26 as a result of the Project, and the distance between the receptors and motorway which allows good dispersion. The greatest reduction in NO_2 is predicted at receptors along this section is 0.1µg/m^3.

A228 and A229

5.6.90 There are 10 receptors located on the A228 that are predicted to experience an exceedance of the annual mean AQS objective and are used to inform the judgement of significance Table 5.14 as discussed in paragraph 5.6.45 to paragraph 5.6.47.

5.6.91 The Project is forecast to lead to an increase in traffic on the A228 (between Leybourne Way and M2 junction 2) ranging from approximately 1,100 to 3,200 AADT. A decrease in HDV flows of approximately 1,600 per day is predicted on the A228 Castle Way (between Leybourne Way and M20 junction 4). Other receptors along the A228 are not predicted to exceed the annual mean NO_2 AQS objective, and Table 5.26 shows the results for a selection of these receptors, as well as receptors along the A229.

Table 5.26 A228 and A229 receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 ($\mu g/m^3$)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC045	A229 northbound. Approximately 10m from the A229.	26.2	27.3	+1.1	Increase of approximately 10,100 AADT and 1,100 HDV.
LTC066	A229 southbound. Approximately 15m from the A229.	26.7	27.6	+0.9	Increase of approximately 10,200 AADT and 1,100 HDV.
LTC136	Chatham Road, within approximately 27m of the A229 off-slip at junction with Cobtree roundabout.	26.0	26.4	+0.4	Increase of approximately 1,700 AADT and 200 HDV on A229 off-slip road.
LTC349	Sandling Road, within approximately 6m of the A229	21.0	21.1	+0.1	Increase of approximately 900 AADT and 200 HDV
LTC455	Pilgrims Way, approximately 12m from the A228.	36.8	38.9	+2.1	Increase of approximately 3,200 AADT and 1,600 HDV.
LTC022	Cantium Place, within approximately 10m of the A228 southbound.	36.9	38.5	+1.6	Increase of approximately 2,400 AADT and 1,600 HDV.
LTC150	Coombe Close, approximately 30m from the A228.	26.5	26.8	+0.3	Increase of approximately 1,700 AADT and 1,500 HDV.
LTC382	A228 Formby Way, within approximately 8m of the A228.	35.7	39.4	+3.7	Increase of approximately 2,600 AADT and 1,600 HDV. Change in speed band from free flow to light congestion in AM period, and from free flow to light congestion in IP period.

5.6.92 The highest annual mean NO_2 concentration along the A229 is predicted at receptor LTC066 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), which is shown in Table 5.26. An NO_2 concentration of 26.7µg/m^3 is predicted at this receptor in the Do-Minimum scenario, which is below the annual mean AQS objective.

5.6.93 The A229 is forecast to experience an increase in traffic flow ranging from approximately 10,100 to 11,400 AADT between M20 junction 6 and M2 junction 3, and an increase of less than 1,000 AADT (+200 HDVs per day) between Maidstone Fairmeadow Gyratory and M2 junction 3. The majority of worst-case receptors modelled in this discussion area experience a deterioration in air quality due to the increase in traffic flow. The largest increase in annual mean NO_2 at receptors along the A229 is predicted at receptor LTC045 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), with an increase of 1.1µg/m3 as a result of the Project.

5.6.94 While a larger increase in traffic is predicted on the A229 than on the A228, there are no predicted exceedances of the AQS objective along the A229, as receptors are set further back from the carriageway along the A229 compared with the A228.

M25 junction 2 to junction 6

5.6.95 Table 5.27 presents the annual mean NO_2 predictions for a selection of receptors within this discussion area and includes a brief description of why there would be a change in NO_2 concentration because of the Project.

Table 5.27 M25 junction 2 to junction 6 receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC144	Hawley Road, approximately 25m from M25 between junction 2 and junction 3.	31.7	31.4	-0.3	Reduction of approximately 5,500 AADT and 3,300 HDV.
LTC207	Wested Lane, approximately 130m from the M25 at junction 3.	19.9	20	+0.1	Increase of approximately 5,900 AADT and 200 HDV.
LTC191	Parkgate Road, approximately 60m from the M25 between junction 3 and junction 4.	19	19.1	+0.1	Increase of approximately 4,100 AADT and 100 HDV.
LTC154	Sundridge Road, approximately 30m from the M25.	20.6	20.7	+0.1	Increase of approximately 3,500 AADT and 100 HDV.

Receptor	Location	Annual mean NO_2 ($\mu g/m^3$)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC201	B269, approximately 75m from the M25.	18.7	18.8	+0.1	Increase of approximately 1,500 AADT and a reduction of approximately 200 HDV.

5.6.96 LTC144 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), which is located approximately 25m west of the M25 is predicted to experience the highest annual mean NO_2 concentration in this discussion area. An annual mean NO_2 concentration of 31.7µg/m3 is predicted at LTC144 in the Do-Minimum scenario, which is below the annual mean AQS objective.

5.6.97 There is a reduction in traffic flow of approximately 5,500 AADT as a result of the Project between M25 junction 2 and 3, as a result of the decrease in traffic joining the M25 from the M20 (at junction 3). This decrease in traffic leads to an imperceptible change in NO_2 at all receptors along this section of the M25. The largest decrease in annual mean NO_2 is predicted at LTC144 and is –0.3µg/m3.

5.6.98 The Project is forecast to increase traffic flows ranging from approximately 1,500 to 4,100 AADT between M25 junction 3 and junction 6. This increase in traffic is predicted to result in an increase in annual mean NO_2 at receptors, although these are all less than 0.4$\mu g/m^3$, and so imperceptible in magnitude.

A102

5.6.99 Only a small section of the A102 triggers the DMRB criteria, and the maximum concentration is predicted at receptor LTC777 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), where an annual mean NO_2 concentration of 52.3$\mu g/m^3$ is predicted in the Do-Minimum scenario, which is above the annual mean AQS objective. This is receptor located close to the Sun in the Sands Roundabout, within 12m of the A102 on-slip road.

5.6.100 The Project is forecast to lead to a decrease in traffic flow on the A102 of between 1,100 and 2,100 AADT, resulting in an imperceptible change in annual mean NO_2 at all receptors.

A122

5.6.101 Table 5.28 presents the annual mean NO_2 predictions for a selection of receptors within this discussion area and includes a brief description of why there would be a change in NO_2 concentration because of the Project.

Table 5.28 A122 receptor annual mean NO_2 (2030)

Receptor	Location	Annual mean NO_2 (µg/m^3)			Reason for change in concentration
		Do-Minimum 2030	Do-Something 2030	Predicted change	
LTC326	High House Lane, approximately 30m from the A122.	18.6	23.4	+4.8	New section of road would be constructed close to receptor, with predicted flows of 86,400 AADT and 11,800 HDV.
LTC018	Ockendon Road, approximately 50m from the A122.	27.4	28.4	+1.0	New section of road for Project road on-slip, with predicted flows of 26,500 AADT and 6,300 HDV.
LTC410	Muckingford Road, approximately 80m from the A122.	18.5	20.5	+2.0	New section of road would be constructed close to receptor, with predicted flows of 86,400 AADT and 11,800 HDV.
LTC247	Thong Lane, approximately 70m from the A122.	15.8	18.2	+2.4	New section of road would be constructed close to receptor, with predicted flows of 86,400 AADT and 11,800 HDV.
LTC263	Rochester Road, approximately 400m north from South Portal of tunnel.	16.2	17.2	+1.0	Closest receptor to the South Portal, with predicted flows of 86,400 AADT and 11,800 HDV.
LTC659	Baker Street, next to A13/A1089/ A122 Lower Thames Crossing junction. Within approximately 30m of the A122 eastbound slip road to A13.	26.6	30.3	+3.7	Predicted flows of 34,700 AADT and 3,200 HDV on adjacent the A122 eastbound slip road to A13.

5.6.102 LTC018 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) is predicted to experience the highest annual mean NO_2 concentration in this discussion area. An annual mean NO_2 concentration of 27.4µg/m^3 is predicted here in the Do-Minimum scenario, which is well below the annual mean AQS objective. This receptor is located on Ockendon Road, approximately 50m east of the A122.

5.6.103 The A122 would have an AADT flow of approximately 86,400 between the M2/A2/A122 Lower Thames Crossing junction and the A13/A1089/A122 Lower Thames Crossing junction. The Project would result in a deterioration in air quality at receptors next to the route.

5.6.104 Taking into account all the receptor results in this discussion area, as presented in Table 1.1 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3) and Figure 5.6: Operational Phase Receptors and Results (Application Document 6.2), the worsening in annual mean NO_2 concentrations at receptors range between 0.3 and 4.8µg/m^3. The largest increase in annual mean NO_2 attributable to the Project is predicted at receptor LTC326 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) with an increase of 4.8µg/m^3. This receptor is located on High House Lane, approximately 30m from the proposed southbound carriageway of the Project road.

5.6.105 The nearest receptor to the North Portal is located on Station Road, approximately 800m north of the portal, and the nearest receptor to the South Portal is located on Rochester Road, approximately 400m north of the portal. The distance between the Project tunnel portals and receptors allows tunnel emissions to be well dispersed before reaching receptors. Receptor LTC263 on Rochester Road (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) represents the nearest receptor to either portal; the annual mean NO_2 concentration here increases from 16.2 to 17.2µg/m^3 as a result of the Project.

5.6.106 No exceedances of the annual mean AQS objective are predicted at receptors along this corridor, largely as a result of the distance between receptors and the Project road and the fact that background concentrations are low in this area, given the rural/suburban nature of the surrounding land use.

Particulate matter (PM_{10} and $PM_{2.5}$)

5.6.107 The modelled annual mean PM_{10} results are shown in Table 1.1 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3).

5.6.108 The maximum PM_{10} concentration predicted in the opening year across all human health receptors is 26.7µg/m^3, which is predicted at receptor LTC026 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2) in the Do-Something scenario. This receptor is located on Pilgrims Way within 4m of the A228. There are therefore no receptors which are expected to exceed the annual mean PM_{10} AQS objective, and as annual mean concentrations are below 32µg/m^3 at all receptors, there are expected to be no exceedances of the 24-hour mean AQS objective for PM_{10}.

5.6.109 The largest modelled increase in PM_{10} due to the Project is 1.3µg/m^3, which is also predicted at receptor LTC026, and is adjacent to a section of the A228 where there is a predicted increase in traffic flow of 2,600 AADT (1,600 HDV) as a result of the Project.

5.6.110 The largest modelled decrease in PM_{10} due to the Project is -0.6µg/m^3 and is predicted at receptor LTC477 (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2), located next to the A282 Dartford Crossing where AADT flows decrease by approximately 26,200 as a result of the Project.

5.6.111 $PM_{2.5}$ has not been modelled as a separate pollutant but is considered through the results of the PM_{10} modelling, as $PM_{2.5}$ is a component of PM_{10}. There are a number of receptors where predicted annual mean PM_{10} concentrations are in excess of 25µg/m^3 in the Project opening year (e.g., LTC026) (Figure 5.6: Operational Phase Receptors and Results, Application Document 6.2). The annual mean AQS objective for $PM_{2.5}$ is 25µg/m^3.

5.6.112 Annual mean $PM_{2.5}$ concentrations have been predicted by adding the background $PM_{2.5}$ concentrations obtained from Defra background maps (see paragraph 5.3.91) to the predicted road traffic PM_{10} concentrations obtained from the dispersion model. This approach is conservative as it assumes all the road traffic PM_{10} will be $PM_{2.5}$. Following this approach, the maximum $PM_{2.5}$ concentration modelled is 20.1µg/m^3 and is predicted at LTC026 in the Do-Something scenario. These results therefore demonstrate that there would be no exceedances of the $PM_{2.5}$ AQS objective, as the concentrations are below 25µg/m^3 at all human health receptors.

Designated Habitats

5.6.113 Air quality impacts on designated habitats for ecology (due to changes in N deposition) are presented in Table 2.1 and Table 2.2 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3). As described in paragraph 5.4.28, background rates of N deposition exceed the LCL in the majority of designated habitats in the study area. Only habitats with changes in NO_x greater than 1% of the NO_x critical level were included in the N deposition calculations as described in paragraph 5.3.105. The change in NO_x concentrations at all the points modelled are presented in Table 2.1, Table 2.2, and Table 2.3 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3).

5.6.114 Table 5.29 presents the statutory designated habitats where the N deposition exceeds the LCL, and where the Project increase in N deposition is predicted to exceed 0.4kg N ha^{-1} yr^{-1} (which is the threshold used to consider potential significant effects on site integrity according to DMRB LA 105 (Highways England, 2019) advice). The table also shows the maximum impacts in a selection of non-statutory designated habitats, where the greatest impacts are predicted because of the Project. In total, there is one SAC, eight SSSIs, 103 non-statutory designated habitats and 94 veteran trees which exceeded the LCL and the 0.4kg N ha^{-1} yr^{-1} Project change threshold. The significance of effects resulting from the change in N deposition is considered in Section 8.6 of Chapter 8: Terrestrial Biodiversity. The likely significance of effects on European designated habitats (e.g., Epping Forest SAC) is considered in the Habitats Regulations Assessment (Application Document 6.5).

5.6.115 The changes in N deposition are predominantly determined by the traffic changes associated with the Project and by how close the designated habitat is to roads affected by the Project. Table 5.29 provides a description of how close the designated habitat is to the nearest affected road together with the associated change in traffic flow resulting from the Project. It should be noted that the changes in N deposition shown are the maximum changes predicted anywhere in the habitat.

Table 5.29 Modelled changes in nitrogen deposition in designated habitats

Receptor	Designated habitat	Location	N deposition (kg N ha^{-1} yr^{-1})			Reason for change
			Do-Minimum 2030	Do-Something 2030	Predicted change	
66_LWS	Rainbow Shaw LWS	Approximately 27m east of the A122 between the M2/A2/A122 Lower Thames Crossing junction and A13/A1089/A122 Lower Thames Crossing junction.	29.6	38.0	+8.4	New section of road constructed close to receptor, with predicted flows of 86,400 AADT and 11,800 HDV
156_SSSI	Titsey Woods SSSI	Approximately 3m north of M25 between junctions 5 and 6.	63.2	63.7	+0.5	Increase of approximately 1,500 AADT on the M25.
235_AW	A2/M2 Roundabout Ancient Woodland	Approximately 17m south of the M2 at junction 1.	42.9	46.1	+3.2	Increase of approximately 29,600 AADT and 3,900 HDV on the adjacent section of M2.
237_SSSI_AW	Great Crabbles Wood SSSI	Approximately 140m west of A289, north of M2 junction 1.	33.5	33.9	+0.4	Increase of approximately 3,700 AADT on adjacent section of A289.
238_AW	AW_Theme_ID_1486679 Ancient Woodland	Approximately 25m west of M2 between junctions 1 and 2.	42.0	44.0	+2.0	Increase of approximately 28,100 AADT and 3,800 HDV on the M2.
240_SSSI and 240_AW	Cobham Woods SSSI and Great Wood Ancient Woodland	Approximately 8m west of the M2 between junctions 1 and 2.	56.9	62.1	+5.2	Increase of approximately 28,100 AADT and 3,800 HDV on the M2.
249_AW	AW_Theme_ID_1486937 (Longhoes) Ancient Woodland	Approximately 42m west of the A228 between the M2 and the M20.	48.1	50.2	+2.1	Increase of approximately 3,200 AADT and 1,600

Receptor	Designated habitat	Location	N deposition (kg N ha^{-1} yr^{-1})			Reason for change
			Do-Minimum 2030	Do-Something 2030	Predicted change	
						HDV on adjacent section of the A228.
256_AW	Frith/Impton Woods	Approximately 6m east of the M2 junction 3 off-slip.	48.6	51.8	+3.2	Increase of approximately 5,900 AADT, and 700 HDV on the M2 off-slip.
280_SSSI_AW	Langdon Ridge SSSI	Approximately 2m west of B1007 High Road.	33.1	33.7	+0.6	Increase of approximately 1,200 AADT on adjacent section of the B1007.
348_SSSI	Halling to Trottiscliffe Escarpment SSSI	Approximately 7m west of the A228 between the M2 and the M20.	70.4	75.8	+5.4	Increase of approximately 3,000 AADT and 1,600 HDV on the A228.
350_SSSI	Wouldham to Detling Escarpment SSSI	Approximately 12m west of the A229, between M20 junction 6 and M2 junction 3.	42.3	43.8	+1.5	Increase of approximately 11,400 AADT and 1,900 HDV on the A229.
389_SSSI	Shorne and Ashenbank Woods SSSI	Approximately 20m north of the A2, east of M2/A2/A122 Lower Thames Crossing junction.	47.9	49.6	+1.7	Increase of approximately 40,800 AADT and 4,200 HDV on the A2 and adjacent new roads.
439_LWS	Bridge Wood LWS	Approximately 12m west of the A229, between M20 junction 6 and M2 junction 3.	49.2	52.7	+3.5	Increase of approximately 11,400 AADT and 1,900 HDV on the A229.
443_LWS	River Medway Between Cuxton and Temple Marsh LWS	Approximately 9m west of the M2 northbound, between junctions 2 and 3 on Medway Viaduct.	32.1	35.2	+3.1	Increase of approximately 24,200 AADT and 2,100 HDV on the M2.

Receptor	Designated habitat	Location	N deposition (kg N ha^{-1} yr^{-1})			Reason for change
			Do-Minimum 2030	Do-Something 2030	Predicted change	
449_LWS	Low Street Pit LWS	<5m east of the A122 between the M2/A2/A122 Lower Thames Crossing junction and A13/A1089/A122 Lower Thames Crossing junction.	17.0	33.4	+16.5	New section of road constructed close to receptor, with predicted flows of 86,400 AADT and 11,800 HDV
EPF_193	Epping Forest SAC and SSSI	Approximately 19m south of the M25 Bell Common Tunnel portal, between junction 26 and junction 27.	58.5	59.5	+1.0	Increase of approximately 4,800 AADT and 900 HDV on the adjacent section of M25.
641_AW	AW_Theme_ID_1486891 Ancient Woodland	Central reservation of M2 at junction 2.	72.8	81.0	+8.2	Increase of approximately 24,700 AADT and 2,100 HDV on the adjacent section of M2.
609a_SINC	Folkes Lane Woodland	Approximately 9m from M25 northbound, between junction 28 and junction 29.	44.4	48.3	+3.9	Increase of approximately 15,100 AADT and 1,200 HDV on the adjacent section of M25, which also becomes more congested in the AM, IP and PM period.
442_LWS	Temple Marsh LWS	Approximately 2m east of the A228 between the M2 and the M20.	69.9	74.3	+4.4	Increase of approximately 3,200 AADT and 1,600 HDV on the A228.

Compliance risk assessment – Operational Phase

5.6.116 No exceedances of the annual mean NO_2 Limit Value of 40µg/m^3 are predicted in the PCM model in the opening year of the Project (2030) as shown in Table 3.1 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3).

5.6.117 There is only one 4m point where an exceedance of the annual mean NO_2 Limit Value of 40µg/m^3 is predicted in the Do-Minimum model, and this is shown in Table 5.30 and in Figure 5.7: PCM Links in Construction and Operational Study Area (Application Document 6.2). The corresponding PCM link is the A102, Greenwich, and the Do-Minimum annual mean NO_2 concentration is 50.2% higher than the PCM prediction for this link.

5.6.118 The input data to the air quality model has been reviewed, as per the requirements of DMRB LA 105 (Highways England, 2019). The Project transport and air quality models have been appropriately validated in this area (e.g., air quality model has been adjusted against four air quality monitoring sites on the A102, as described in Appendix 5.1: Air Quality Methodology (Application Document 6.3)). The model prediction is, therefore, considered to be robust, and the local air quality model predictions have been used instead of the reported NO_2 concentrations from the PCM model to inform the compliance risk assessment.

Table 5.30 Comparison of PCM and Do-Minimum NO_2 concentrations at 4m point – operational phase (2030)

PCM census ID	Agglomeration zone	4m Point ID	Annual mean NO_2 (µg/m_3)		Percentage difference (Do-Minimum/PCM)
			PCM	Do-Minimum	
802074532	Greater London Urban Area	PCM_4m_2	29.9	44.9	50.2

5.6.119 Table 5.31 shows the compliance risk assessment outputs for the nearest qualifying feature (public footpath, located 11m from the running lane) to the PCM link described above. This feature is also shown in Figure 5.7: PCM Links in Construction and Operational Study Area (Application Document 6.2). The full set of modelled results for qualifying features is shown in Table 3.1 of Appendix 5.4: Air Quality Operational Phase Results (Application Document 6.3).

Table 5.31 Do-Minimum and Do-Something annual mean NO_2 at qualifying feature – operational phase (2030)

PCM census ID	Agglomeration zone	Qualifying feature receptor ID	Annual mean NO_2 (µg/m^3)		Change (µg/m^3)
			Do-Minimum	Do-Something	
802074532	Greater London Urban Area	PCM_2 (footpath)	41.2	41.0	-0.2

5.6.120 As can be seen from Table 5.31, annual mean NO_2 concentrations are also predicted to exceed the Limit Value at the nearest qualifying feature to the PCM link in the Do-Minimum scenario, but the change in annual mean NO_2 is predicted to be imperceptible. There are no other PCM qualifying features that exceed the Limit Value of 40µg/m^3 in either the Do-Minimum or Do-Something scenario throughout the study area. The conclusion of the compliance risk assessment is that there is no risk to the reported date of compliance with the Limit Value for NO_2.

5.6.121 The assessment has modelled annual mean NO_2 concentrations above 40µg/m^3 on the A228 where there is a predicted worsening in air quality and the road is not included in Defra's PCM model. DMRB LA 105 (Highways England, 2019) requires that the Overseeing Organisation be contacted where the local air quality assessment for human health predicts air quality concentrations above the air quality thresholds, that do not coincide with the PCM road network. Defra was subsequently contacted to determine whether the A228 should be included in the PCM model and, therefore, considered against Limit Values and subsequently included in the compliance risk assessment for the Project.

5.6.122 Defra has advised that the A228 should not be included in the PCM model, and therefore this road has not been included in the compliance risk assessment in accordance with this advice. It should however be noted that the exceedances at human receptors are based on the gap factored approach as described in paragraphs 5.3.93 to 5.3.97, which involves applying a gap factor to uplift the annual mean NO_2 predictions obtained using the Defra air quality modelling methodology (Defra background pollution maps and vehicle emission factors). The compliance risk assessment is however based on the same assumptions that Defra use in its air quality modelling when reporting against compliance (as per the Defra PCM model), and so is informed by modelling results that are taken directly from the Defra tools. The annual mean NO_2 concentrations at human receptors are predicted to be less than 25µg/m^3 when assessed using the Defra methodology, and so would be well below the annual mean Limit Value.

5.6.123 Annual mean PM_{10} concentrations are predicted to be well below 40 µg/m^3 at all human health receptors and there are no exceedances of the PM_{10} Limit Value of 40 µg/m^3 predicted by the PCM model in the Project opening year. There is therefore no risk of the Project affecting the reported date of compliance with the Limit Value for PM_{10}.

5.6.124 The PCM receptors used for the NO_2 compliance assessment were also used to determine whether there was a risk that the $PM_{2.5}$ annual mean Limit Value of 20µg/m^3 could be exceeded (using road traffic PM_{10} plus background $PM_{2.5}$). There were two PCM receptors where the PM_{10} based $PM_{2.5}$ concentration was predicted to exceed 20µg/m^3 (PCM_2, which is adjacent to A102, Greenwich and PCM_78, which is adjacent to A2 London Road, Strood). To determine whether the $PM_{2.5}$ Limit Value is likely to be exceeded at these receptors, the road traffic PM_{10} component was factored into road traffic $PM_{2.5}$ based on a conversion ratio of 0.64 (Department for Transport, 2022) and added to the background $PM_{2.5}$ concentration. The resulting $PM_{2.5}$ concentrations are shown for receptors PCM_2 and PCM_78 in Table 5.32. A $PM_{2.5}$ concentration of 19.5µg/m^3 (PCM_2) and 17.5µg/m^3 (PCM_78) was predicted in the Do-

Something scenario, which is below the Limit Value, and demonstrates there would be no risk to the reported date of compliance with the Limit Value for $PM_{2.5}$. At PCM_2 which has the highest predicted annual mean close to 20µg/m³ there is an imperceptible improvement (i.e., <0.2µg/m³, less than 1% of the annual mean Limit Value). This further demonstrates that the assessment has indicated no risk in relation to compliance with the $PM_{2.5}$ Limit Value.

Table 5.32 Do-Minimum and Do-Something annual mean $PM_{2.5}$ at qualifying feature – operational phase (2030)

PCM census ID	Agglomeration zone	Qualifying feature receptor ID	Annual mean $PM_{2.5}$ (µg/m³)		Change (µg/m³)
			Do-Minimum	Do-Something	
802074532	Greater London Urban Area	PCM_2 (footpath)	19.6	19.5	-0.1
802026105	South East	PCM_78 (footpath)	17.2	17.5	+0.3

Assessment of likely significant effects

5.6.125 In accordance with the standards in DMRB LA 105 (Highways England, 2019) and as described in Section 5.3, the significance of local air quality effects has been evaluated to determine compliance with the NPSNN. The judgement of the significance of effects on air quality is informed by the following:

a. The effects on human health

b. The effects on designated habitats

c. The outcomes of the compliance risk assessment

Construction

5.6.126 No receptors are predicted to exceed the AQS objective for annual mean NO_2 during construction as a result of the Project. Therefore, in accordance with DMRB LA 105 (Highways England, 2019) the impacts on human health are not considered to be significant.

5.6.127 No receptors are predicted to exceed the AQS objectives for annual mean and 24-hour mean PM_{10} or annual mean $PM_{2.5}$.

5.6.128 The changes in N deposition in designated habitats associated with construction will be temporary and in isolation are not considered to result in a significant effect. Where the cumulative impacts during construction and operation are considered to be significant these are reported in the operational effects.

5.6.129 During construction, there is no risk to the reported date for compliance with Limit Values.

Operational

Human health

5.6.130 As presented in Table 5.14, there are 25 receptors across the study area which are predicted to exceed the annual mean AQS objective for NO_2 in either the Do-Minimum or Do-Something scenario and experience a perceptible increase or decrease in NO_2 as a result of the Project (i.e., > 0.4µg/m^3). There are no exceedances of AQS objectives predicted for PM_{10} and $PM_{2.5}$.

5.6.131 Table 5.33 presents the number of receptors in each magnitude guideline band that experience a worsening or improvement in annual mean NO_2 as a result of the Project (where an exceedance of AQS objective is predicted). It should be noted that the number of receptors shown for each change magnitude are aggregated in the table (e.g., a large magnitude of change at one receptor would also be counted as a medium and small magnitude of change). The overall judgement is informed both by the number of receptors predicted to experience a worsening and the number of receptors predicted to experience an improvement in air quality as a result of the Project.

Table 5.33 Local air quality receptors informing Project significance

Magnitude of change in annual average NO_2 or PM_{10} (µg/m$_3$)	**Number of receptors with:**	
	Worsening of air quality objective already above objective or creation of a new exceedance	**Improvement of an air quality objective already above objective or the removal of an existing exceedance**
Large (>4)	1	0
Medium (>2)	5 (4 medium only)	1
Small (>0.4)	9 (4 small only)	16 (15 small only)
Total change	9	16

5.6.132 There are a total of nine receptors which experience a worsening in NO_2 concentrations, and 16 receptors which experience an improvement in NO_2 concentrations where the annual mean NO_2 AQS objective is exceeded.

5.6.133 When judging whether the Project leads to a significant effect, the change in concentration and the total number of receptors are considered against the guideline bands in DMRB LA 105 (Highways England, 2019) as described in paragraphs 5.3.132 to 5.3.137.

5.6.134 There is one receptor with a large worsening, four receptors with a medium worsening and four receptors with a small worsening in predicted annual mean NO_2. These receptors are located on the A228 and A2 London Road, Strood and experience an annual mean NO_2 concentration ranging from 41.9µg/m^3 to 45.7µg/m^3 in the Do-Something scenario. Given these concentrations, there is unlikely to be exceedances of the 1-hour mean NO_2 AQS objective as a result of the Project (as all the annual mean concentrations are below 60µg/m^3, see paragraph 5.3.98). The number of receptors predicted to experience a small and medium worsening in annual mean NO_2 are both well below the medium and small guideline bands (30 for small and 10 for medium). The changes in NO_2 at these receptors are in the middle of the small and medium magnitude bands, e.g., the medium magnitude band ranges from 2 to 4µg/m³ and the medium worsenings on the A228 are close to 3µg/m³. There is one receptor where a 4.2µg/m^3 increase in annual mean NO_2 is predicted. This increase in NO_2 is at the low end of the magnitude range corresponding with the large magnitude category. The guideline bands for large changes in terms of number of receptors are 1 to 10 and therefore this receptor is at the bottom of the guideline band.

5.6.135 It should be noted that the NO_2 concentrations and impacts predicted at receptors along the A228 are likely to be overpredicted in the assessment. When comparing the model results versus monitoring data along the A228, the model underpredicts concentrations, and underpredicts most at monitoring sites closest to the roadside (i.e., close to the kerb where there are no receptors). This has been adjusted for to some extent through model verification, but following verification, the model tends to overpredict concentrations at monitoring sites further back from the road where receptors are present. Furthermore, the long-term trend gap analysis factors used to account for uncertainty in future trends in annual mean NO_2 (paragraphs 5.3.93 to 5.3.97) are likely to lead to an overprediction of concentrations in the opening year, due to the length of time between the base year (2016) and opening year (2030).

5.6.136 The Project leads to a small magnitude of improvement at 16 receptors (four near the Dartford Crossing, five on A228 Castle Street and seven near M25 Holmesdale Tunnel). The exceedances of the annual mean AQS objective are removed at three of these receptors in the Do-Something scenario as a result of this improvement.

5.6.137 Taking into account the discussion above, the Project is not expected to lead to a significant air quality effect on human health as:

a. There are no exceedances of AQS objectives predicted for $PM_{2.5}$ or PM_{10} with or without the Project.

b. Where the Project leads to a worsening in annual mean NO_2, the total concentrations predicted are close to 40µg/m^3, which suggests there are unlikely to be exceedances of the 1-hour mean NO_2 AQS objective.

c. Where the Project leads to a small or medium worsening in annual mean NO_2, the magnitude of change in NO_2 is in the mid-range of the magnitude band.

d. The number of receptors experiencing a small or medium worsening in annual mean NO_2 is well below the lower range of the corresponding guideline band in DMRB LA 105 (Highways England, 2019).

e. Although the Project leads to a large worsening at one receptor, the change is just within the large magnitude range and is at the bottom of the large magnitude guideline band in DMRB LA 105 (Highways England, 2019). Furthermore, the impact and concentrations are likely to be overpredicted at this receptor as well as other receptors on the A228 as explained in paragraph 5.6.135.

5.6.138 Whilst the Project does not lead to a significant effect, work has been undertaken to determine whether there are measures that could be put in place to reduce the Project impacts in areas where there are predicted worsenings in air quality above the AQS objectives as described in paragraph 5.5.13. This does not alter the conclusion that for impacts on human health the Project is not considered to have a significant effect.

Designated habitats

5.6.139 The significance of the effects of the changes in N deposition on ecology are discussed in Section 8.6 of Chapter 8: Terrestrial Biodiversity and in the Habitats Regulations Assessment (Application Document 6.5). The changes in N deposition were considered to be significant by the competent expert for biodiversity at 36 designated habitat sites presented in Table 5.34 and shown on Figure 2 of Appendix 8.14 (Application Document 6.3).

Table 5.34 Designated Habitats Assessed as Significant

Receptor	Designated habitat	Site Type
121_AW_LWS	ANDREWS WOOD (AW_Theme_ID 1499246) AW	AW
238_AW	AW_Theme_ID_1486679 (Object ID 9096) AW	AW
235_AW	AW_Theme_ID_1486820 (A2/M2 ROUNDABOUT) AW	AW
233_SSSI_LWS_AW 660_AW	AW_Theme_ID_1486860 (Shorne Woods) AW	AW
640_AW	AW_Theme_ID_1486867 (Head Barn Wood) AW	AW
236_AW	AW_Theme_ID_1486883 (Object ID 9151) AW	AW
641_AW	AW_Theme_ID_1486891 (Between M2 carriageways) AW	AW
249_AW	AW_Theme_ID_1486937 (Longhoes) AW	AW
251_AW 282_AW	AW_Theme_ID_1498717 (OBJECT ID 11749) AW	AW
252_AW	AW_Theme_ID_1498718 AW	AW
76_AW_LWS	AW_Theme_ID1420012 AW	AW
660_AW	AW_Theme_ID1486951 AW	AW
174_AW	AW_Theme_ID1494010 AW	AW
119_AW	AW_Theme_ID1499144 AW	AW
119_AW	AW_Theme_ID1499145 AW	AW
195_AW	AW_Theme_ID_1501634 (OBJECT ID 12881) AW	AW
72_AW_LWS	Barber's Wood AW	AW
181_AW	Bridge Woods AW	AW
254_LWS_AW 439_LWS	Bridge Woods, Burham LWS	LWS
240_SSSI	Cobham Woods SSSI	SSSI

Receptor	Designated habitat	Site Type
78_LWS_AW	Codham Hall Wood AW	AW
78_LWS_AW 381_LWS	Codham Hall Woods LWS	LWS
194_AW 197_AW 256_AW 258_AW 303_AW 327_AW 373a_AW 373b_AW 258b_AW	Frith/Impton Woods AW	AW
47_LWS	Frith Woods Etc., Kits Coty LWS	LWS
240_AW	Great Wood AW	AW
348_SSSI 392_SSSI	Halling To Trottiscliffe Escarpment SSSI	SSSI
193_AW 261_AW	Impton/Podkin Wood AW	AW
239_AW	Merrals Shaw (AW_Theme_ID 1486881) AW	AW
198_AW 199_AW 201_AW	Middlefield Shaw AW (AW_Theme_ID_1501447,1500825,1500821)	AW
521_LWS 521b_LWS 775_LWS	Ockendon Railsides SINC	SINC
262_AW 367_LWS_AW	Peartree Wood AW	AW
206_AW_LWS	REED'S SHAW (AW_Theme_ID 1498441) AW	AW
232_SSSI 233_SSSI_LWS_AW 248_SSSI 264_SSSI 349_SSSI 389_SSSI	Shorne And Ashenbank Woods SSSI	SSSI
234_AW	Shorne/Brewers Woods AW	AW

5.6.140 As a result of the significant effects and in accordance with Figure 2.98 in LA 105, there is a requirement to develop a PAQAP (Application Document 6.3, Appendix 5.6), which is presented in Appendix 5.6: Project Air Quality Action Plan (Application Document 6.3).

5.6.141 A number of mitigation measures have been investigated, and speed enforcement on a section of the M2 between Junction 3 and 4 was considered to be viable. This mitigation measure removes the significant effects at seven designated sites. The total designated sites therefore that were assessed to have a significant effect that could not be mitigated were 29. The results of this assessment are included in the PAQAP (Application Document 6.3, Appendix 5.6).

Compliance risk assessment

5.6.142 The outcome of the compliance risk assessment modelled one PCM link (corresponding with the A102, Greenwich), that was above the annual mean NO_2 Limit Value of 40μg/m^3, and the nearest qualifying feature (PCM_2) had a modelled annual mean NO_2 concentration which was also in excess of 40μg/m^3 (in Do-Minimum and Do-Something scenarios). However, the Project associated change in annual mean NO_2 at the qualifying feature was predicted to be imperceptible. Furthermore, no exceedances of the Limit Value were predicted for PM_{10} or $PM_{2.5}$ and as such, the Project would not affect the reported date of compliance with Limit Values.

Overall judgement of significance

5.6.143 Considering the three components that inform the judgement of significance for air quality, it has been concluded by the competent expert that the Project does not lead to a significant air quality effect when considering human health and compliance risk but does lead to a significant air quality effect on designated habitats for ecology. The PAQAP (Application Document 6.3, Appendix 5.6) has been developed as presented in Appendix 5.6: Project Air Quality Action Plan (Application Document 6.3), however the considered measures do not eliminate the significance of effect on all the biodiversity sites and it has been concluded that the Project leads to a significant air quality effect.

5.7 Cumulative effects

Intra-project effects

5.7.1 Cumulative effects of the Project can occur as a result of interrelationships between different environmental topics, which are referred to as 'intra-project effects'. For air quality, interrelationships are identified with, Chapter 8: Terrestrial Biodiversity and Chapter 13: Population and Human Health and are summarised below:

a. Terrestrial biodiversity – degradation of sensitive habitats or species close to construction works as a result of deposition of dust, and as a result of Project related changes in traffic and emissions leading to a change in nutrient nitrogen deposition.

b. Population and human health – the air quality assessment has been considered in light of the potential implications it has for the assessment of effects on residential amenity carried out in Chapter 13: Population and Human Health. Air quality effects are also considered in the assessment on human health in the Health and Equalities Impact Assessment (Application Document 7.10) and reported in summary within Chapter 13: Population and Human Health.

5.7.2 The above interrelationships have been considered as part of the assessments reported in the respective topic chapters.

Inter-project effects

5.7.3 In addition to intra-project effects, cumulative effects can also occur due to the Project in combination with other proposed developments. These are known as 'inter-project' effects and are considered separately in Chapter 16: Cumulative Effects Assessment.

5.7.4 It should also be noted that the traffic data used in the assessment of air quality already accounts for traffic generated by other planned or near certain or more than likely developments (see the Combined Modelling and Appraisal Report Appendix C: the Transport Forecasting Package (Application Document 7.7) for more information). In accordance with the Planning Inspectorate's (2019) Advice Note Seventeen: Cumulative Effects Assessment, no additional cumulative assessment of these aspects is required.

5.8 Monitoring

5.8.1 The REAC, which forms part of the CoCP (Application Document 6.3), documents the monitoring that would be required during the construction phase. The requirements for air quality monitoring are outlined in REAC Ref. AQ006.

5.8.2 The Project does not require mitigation for operational air quality effects for human health or compliance with Limit Values. Whilst there are significant effects on the biodiversity sites and speed enforcement on the M2 has been assessed, it is not appropriate to undertake nitrogen deposition monitoring. Monitoring will not aid in determining whether the mitigation is effective as there is no ability to monitor conditions with and without the Project. Given that the impacts are as a result of the change in N deposition rather than for example absolute concentrations against AQS objectives, monitoring would only provide information related to the conditions at the time the monitoring was undertaken. In addition, as the speed enforcement would not be time limited, monitoring would not be needed to determine when the measure is removed.

5.9 Summary

5.9.1 This chapter provided an assessment of the potential air quality effects of the Project during construction and operation following DMRB LA 105 standards (Highways England, 2019), and these effects are summarised below. Table 5.35 provides a summary of all predicted impacts in this chapter, taking into account the Project design and mitigation set out in Section 5.5.

Construction phase

5.9.2 Properties located within 200m of construction activities have the potential to be adversely affected by construction dust. However, these effects would be temporary in nature and suitably controlled using good practice measures and so are not considered to be significant.

5.9.3 Construction phase traffic and associated traffic management is not considered to result in significant air quality effects at human health receptors. Additionally, the impacts associated with construction traffic would not affect the UK's ability to comply with the Air Quality Directive (Directive 2008/50/EC) in the shortest possible timescales.

Operational phase

5.9.4 A reduction in NO_2 and PM_{10} is predicted at receptors between the base year (2016) and opening year (2030) Do-Minimum scenario, as there are expected to be improvements in vehicle emissions over this period (e.g., due to uptake of electric and alternative fuelled vehicles). The assumptions regarding future air quality improvements are supported by trends in local air quality monitoring data, which show an overall downward trend in NO_2 across recent years.

5.9.5 The air quality modelling results show that the operation of the Project would result in both improvements and deteriorations in local air quality as a result of Project-associated changes in traffic flows.

5.9.6 There are 25 human health receptors where an exceedance of the annual mean NO_2 AQS objective and a perceptible change in NO_2 (i.e. >0.4µg/m^3) are predicted in the Project opening year, and these are confined to worst-case receptors on the A282 Dartford Crossing (one medium and three small NO_2 improvements), M25 between junction 25 and junction 26 near Holmesdale Tunnel (seven small NO_2 improvements), A2 London Road (four small NO_2 worsenings) and A228 between M20 junction 4 and M2 junction 2 (five small NO_2 improvements and one large, four medium worsenings). The air quality effects of the Project on human health are not considered to be significant as:

a. There are no exceedances of AQS objectives predicted for $PM_{2.5}$ or PM_{10} with or without the Project.

b. Where the Project leads to a worsening in annual mean NO_2, the total concentrations predicted are close to 40µg/m^3, which suggests there are unlikely to be exceedances of the 1-hour mean NO_2 AQS objective.

c. Where the Project leads to a small or medium worsening in annual mean NO_2, the magnitude of change in NO_2 is in the mid-range of the magnitude band.

d. The number of receptors experiencing a small or medium worsening in annual mean NO_2 is well below the lower range of the corresponding guideline band in DMRB LA 105 (Highways England, 2019).

e. Although the Project leads to a large worsening at one receptor, the change is just within the large magnitude range and is at the bottom of the large magnitude guideline band in DMRB LA 105 (Highways England, 2019). Furthermore, the impact and concentrations are likely to be overpredicted at this receptor as well as other receptors on the A228 as explained in paragraph 5.6.135.

5.9.7 The Project is not expected to affect the UK's ability to comply with the Air Quality Directive (Directive 2008/50/EC) in the shortest possible timescales.

5.9.8 The Project is considered to have a significant effect on 29 designated habitats for ecology because of an increase in N deposition, as outlined in Chapter 8: Terrestrial Biodiversity.

Table 5.35 Air quality impact table

Impact description	Importance	Level of Impact	Effect	Significance
Construction				
Temporary change in the concentration of nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) at human receptors, as a result of the change in vehicle flows and emissions associated with construction vehicles and traffic management.	Local to regional	Imperceptible changes in air quality where annual mean NO_2 AQS objective exceeded. No risk to the reported date of compliance with the Air Quality Directive (Directive 2008/50/EC).	N/A	Not significant
Temporary change in nitrogen deposition in designated habitats, as a result of the change in vehicle flows and emissions associated with construction vehicles and traffic management.	Local to regional	In isolation construction does not cause a significant effect on designated habitats due to its temporary impacts. Where the cumulative effects of construction and operation cause a significant effect, these are reported in the operation.	N/A	Not significant
Temporary dust soiling, and increase in concentrations of NO_2, PM_{10} and $PM_{2.5}$ at human receptors as a result of construction dust emissions and emissions from NRMM.	Local	N/A	N/A	Not significant
Temporary dust soiling and change in nitrogen deposition in designated habitats as a result of construction dust emissions and emissions from NRMM.	Local	N/A	N/A	Not significant

Impact description	Importance	Level of Impact	Effect	Significance
Operation				
Change in the concentration of NO_2, PM_{10} and $PM_{2.5}$ at human receptors as a result of emissions from vehicles using new road infrastructure, and as a result of changes in vehicle flows and therefore emissions on the existing road network.	Local to regional	15 small, and one medium improvement where annual mean NO_2 AQS objective exceeded. One large, four medium and four small worsenings where annual mean NO_2 AQS objective exceeded. AQS objectives achieved at all other receptors, or Project change in air quality is imperceptible. No risk to the reported date of compliance with the Air Quality Directive (Directive 2008/50/EC).	N/A	Not significant
Change in nitrogen deposition in designated habitats as a result of changes in emissions from the Project within 200m of the Affected Road Network.	Local to regional	Nitrogen deposition has the potential to impact on the integrity of some of the habitats assessed. The competent expert for biodiversity has concluded that there are 29 sites where the change in N Deposition results in a significant effect.	N/A	Significant

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