

# Lower Thames Crossing

## **9.57 Without prejudice assessment of the air quality effects on European sites following Natural England advice**

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# 1 Executive summary

- 1.1.1 National Highways (the Applicant) has submitted an application under section 37 of the Planning Act 2008 for an order to grant development consent for the A122 Lower Thames Crossing (the Project). The application is supported by the Habitats Regulations Assessment – Screening Report and Statement to Inform an Appropriate Assessment [[APP-487](#)] (the HRA).
- 1.1.2 Natural England has provided advice on the assessment of air quality impacts on European sites which is recorded in the Statement of Common Ground (SoCG) [[APP-099](#)], the Relevant Representation [[RR-0784](#)] dated 24 February 2023 and the note ‘Summary of advice received on National Highways Air Quality assessment’ summarising the air quality advice received by email on 11 April 2023.
- 1.1.3 The Applicant does not agree with the advice from Natural England (dated 11 April 2023) in relation to the methods proposed for the assessment of air quality effects.
- 1.1.4 The Applicant, in due regard to the representations from Natural England and without prejudice to the position above, has undertaken a further assessment of the air quality effects on European sites. This has been done as a sensitivity test of the conclusions of the HRA and follows the methodological approaches advised by Natural England.
- 1.1.5 The without prejudice assessment considered the results of the air quality modelling of the concentrations of nitrogen oxides (NO<sub>x</sub>) and ammonia (NH<sub>3</sub>), as individual pollutants against the relevant critical levels for each European site. The assessment also considered the results of the predicted nitrogen deposition, regardless of the changes in NO<sub>x</sub>, against the relevant lower critical loads for each European site. The without prejudice assessment found that the Project would have no adverse effect on the integrity of any of the European sites alone or in combination with any other plans and projects.
- 1.1.6 The Applicant has concluded that there would be no material difference to the conclusions of the HRA for the purposes of considering whether the Project can be authorised under Regulation 63(5) of the Conservation of Habitats and Species Regulations 2017 (as amended).

## 2 Introduction

### 2.1 Purpose of this document

- 2.1.1 The Applicant has submitted an application under section 37 of the Planning Act 2008 for an order to grant development consent for the A122 Lower Thames Crossing (the Project). The application is supported by the Habitats Regulations Assessment – Screening Report and Statement to Inform an Appropriate Assessment [[APP-487](#)] (the HRA).
- 2.1.2 Natural England has made a number of representations on the assessment of air quality impacts on European sites in relation to nitrogen oxides (NO<sub>x</sub>) and ammonia (NH<sub>3</sub>).
- 2.1.3 The Applicant does not agree with the advice from Natural England (dated 11 April 2023) in relation to the methods proposed for the assessment of air quality effects.
- 2.1.4 However, the Applicant, in due regard to the representations from Natural England and without prejudice to the position above, has undertaken a further assessment of the air quality effects on European sites. This has been done as a sensitivity test of the conclusions of the HRA and follows the methodological approaches advised by Natural England. This document reports the results in light of the representations from Natural England.

### 2.2 Natural England representations

- 2.2.1 Natural England has provided advice on the assessment of air quality impacts on European sites which is recorded in the Statement of Common Ground (SoCG) [[APP-099](#)], the Relevant Representation [[RR-0784](#)] dated 24 February 2023 and the note 'Summary of advice received on National Highways Air Quality assessment' summarising the air quality advice received by email on 11 April 2023. Natural England's Written Representation [[REP1-262](#)] included the latter advice as Annex G.

### 2.3 Key issues identified by the Applicant

- 2.3.1 The Applicant identified the following key issues that are considered to remain 'under discussion' with regard to the assessment of air quality within the HRA [[APP-487](#)].
- Imperceptible modelled NO<sub>x</sub> and its application to NH<sub>3</sub> and nitrogen deposition (N deposition) – Natural England recommended that NO<sub>x</sub>, NH<sub>3</sub> and N deposition are calculated separately for each protected site and compared against the relevant critical levels and critical load.
  - It should be noted that the SoCG issues 2.1.88 and 2.1.91 regarding the conclusion of no Likely Significant Effect (LSE) for North Downs Woodlands Special Area of Conservation (SAC) and the use of inconsequential NO<sub>x</sub> are related to Natural England's recommendation included within the 'imperceptible impacts' issue listed in the most recent advice from Natural England.

## 3 Assessment methodologies and assumptions

### 3.1 Scope of the assessment

#### Data used

- 3.1.1 The change in air quality as a result of vehicle emissions (for both construction and operation of the Project), in particular concentrations of NO<sub>x</sub>, NH<sub>3</sub> and the resultant N deposition, has been assessed at all European sites within 200m of the relevant Affected Road Network (ARN). The air quality model predicts the N deposition as a result of both nitrogen oxides and ammonia emissions from road traffic.
- 3.1.2 The assessment has used the following sources of evidence when describing the likely changes to air quality as a result of the Project:
- The predicted changes in N deposition as calculated by the Project team.
  - The predicted changes in the concentrations of NO<sub>x</sub> and NH<sub>3</sub> as calculated by the Project team.

### 3.2 Statement of qualification

- 3.2.1 The lead author is a Chartered Environmentalist and Member of the Chartered Institute of Ecology and Environmental Management. She has over 20 years' experience in consultancy and has written numerous HRA reports for a variety of developments. In recent years she has authored and peer reviewed HRA reports including the Wylfa Newydd Nuclear New Build, A5025 On-line Highway Improvements Scheme, North Devon Link Road, and acted as the competent authority for various planning applications on behalf of Torbay Council.



### 3.3 Assessing likely significant effects

#### Use of thresholds

##### Changes in air quality

3.3.1 The air quality model predicts the change in annual mean NO<sub>x</sub> concentrations which are then factored to determine the NH<sub>3</sub> concentrations for the Do Minimum (DM) and Do Something (DS) scenarios. These are assessed against the appropriate critical levels (CL) for the habitats within 200m of the ARN. The CLs are set out for each European site on the Site Relevant Critical Loads tab of the Air Pollution Information System<sup>1</sup>. Table 3.1 sets out the CLs that have been used to assess LSE on each of the European sites identified.

**Table 3.1 The relevant critical levels used to determine LSE**

European site	Habitat within 200m of the ARN	Relevant NO <sub>x</sub> critical level µg m <sup>-3</sup>	Relevant NH <sub>3</sub> critical level µg m <sup>-3</sup>	Reasoning
Thames Estuary and Marshes Ramsar site	Coastal and floodplain grazing marsh	30	3	Bryophytes and lichens are not integral to this habitat
Epping Forest SAC	W1c5 Beech forests on acid soils (H9120)	30	1	Bryophytes and lichens are integral to this habitat
North Downs Woodlands SAC	W1f lowland deciduous woodland	30	3	Bryophytes and lichens are not integral to this habitat

3.3.2 The air quality N deposition assessment is carried out with respect to the appropriate lower critical load (LCL) for the habitats within 200m of the ARN. The LCLs are set out for each European site on the Site Relevant Critical Loads tab of the Air Pollution Information System<sup>1</sup>. Table 3.2 sets out the LCLs that have been used to assess LSE on each of the European sites identified.

**Table 3.2 The relevant lower critical loads used to determine LSE**

European site	Habitat within 200m of the ARN	Relevant N critical load class	Lower critical load kg N ha <sup>-1</sup> yr <sup>-1</sup>
Thames Estuary and Marshes Ramsar site	Coastal and floodplain grazing marsh	Low and medium altitude hay meadows	20
Epping Forest SAC	W1c5 Beech forests on acid soils (H9120)	Fagus woodland	10
North Downs Woodlands SAC	W1f lowland deciduous woodland	Coniferous woodland	5

<sup>1</sup> [www.APIS.ac.uk](http://www.APIS.ac.uk)



- 3.3.3 The methodology used to determine the potential for the Project to have a LSE as a result of vehicle emissions, follows the flow chart in Figure 2.98 of the Design Manual for Roads and Bridges (DMRB) LA 105 (Highways England, *et al.*, 2019) up to the 1% CL/LCL threshold. Where the 1% CL/LCL is exceeded, there is potentially an LSE on the European site as a result of the Project alone or in-combination with other plans and projects. Where the 1% CL/LCL is not exceeded then a conclusion of no LSE is reached for the Project alone and further assessment of the Project in-combination with other plans and projects is made to determine if the 1% LCL is exceeded as described in paragraph 3.5.11.

## 3.4 Assessment of effect on the integrity of the European site

### Effects as a result of changes in air quality

- 3.4.1 The methodology used to determine the potential for the Project to result in an adverse effect on integrity continues to follow the flow chart in Figure 2.98 of the DMRB LA 105 (Highways England, *et al.*, 2019) from the 1% threshold used to determine LSE at Stage 1 screening (paragraph 3.3.3).

### Information used to explore the magnitude/significance of the effect

- 3.4.2 For the European sites identified, the following steps, from Figure 2.98 of DMRB LA 105, were completed to explore the magnitude of the effect.
- a. Identify whether the site air quality attribute target is either restore or maintain:  
Restore – Use the lowest change in N deposition regardless of background N deposition which would bring about a change of a loss of one species corresponding to the lower critical load range.  
Maintain – Use change values to bring about loss of one species corresponding to background N deposition.
  - b. Identify if the change in N deposition associated with the Project (the Do Something scenario) would lead to the loss of one species.
  - c. If the change in N deposition is greater than or equal to  $0.4\text{kg N ha}^{-1}\text{yr}^{-1}$  then it is assumed that the loss of one species could occur and the assessment proceeds to the next step.
  - d. Undertake detailed site investigation and identify if there are species located in the area where the assessment has determined an increase in N deposition that could lead to loss of one species.
- 3.4.3 The extent of the habitat potentially affected was predicted using the change in nitrogen deposition model results in Esri Arcpro using the bounding tool to indicate the area within which nitrogen deposition was predicted to exceed the 1% LCL and  $0.4\text{kg N ha}^{-1}\text{yr}^{-1}$  thresholds.

- 3.4.4 A bespoke National Highways calculation tool has been used to compare the DM NOx total emissions (tonnes) at opening year (2030) with the future predicted changes in NOx emissions for the same ARN link for the DS scenario. The future predictions are calculated for the DS scenario annually from 2030 to 2045. The duration of effect is considered to occur from the opening year until the year the DS total emissions of NOx fall below the DM total emissions at opening year.
- 3.4.5 Ellenberg indicator values for fertility (Ellenberg N) published for the British vascular plant and bryophyte flora (Hill, et al., 2004; Hill, et al., 2007) were used to analyse the nitrogen sensitivity of the species recorded during the detailed site investigations. The purpose of assigning Ellenberg values is to provide an indication of existing nutrient status and to identify species that are potentially sensitive to nitrogen deposition and therefore could be at risk of loss due to a Project-related increase in nitrogen deposition. Ellenberg values of less than three are indicative of species associated with more-or-less infertile sites and are therefore likely to be sensitive to small changes in nitrogen availability. Ellenberg values above three were therefore used to indicate species that were not sensitive to nitrogen deposition and therefore unlikely to be lost from additional nitrogen deposition. Further details on the approach to using Ellenberg values to determine the sensitivity of habitats to nitrogen deposition is set out in Environmental Statement (ES) Appendix 8.14 [[APP-403](#) to [APP-406](#)].
- 3.4.6 The criterion of loss of one species is not used alone to assess effects on integrity. In considering the results of the detailed site investigation, the Applicant has used the following factors to explore the magnitude of the effect on the integrity of the European site:
- What conditions is the affected habitat currently exposed to (e.g. existing exceedance of critical level/critical load)?<sup>2</sup>
  - What is the area and quality of the habitat affected, as a proportion of the qualifying habitat within the European site?
  - Will there be any direct loss of habitat or change to the distribution of such habitats?
  - Are NOx/NH<sub>3</sub>/N deposition operational changes predicted below the current baseline deposition levels (e.g. due to technological improvements in vehicle emissions between now and the time the Project is operational)?
- 3.4.7 Using professional judgement and taking into account the above factors (paragraph 3.4.2 to 3.4.6), will there be a reduction in habitat area that significantly impedes achievement of the conservation objectives of the European site? As there are no published or accepted thresholds for any of the factors considered alone, or combinations of thresholds of different factors, as

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<sup>2</sup> 'Small contributions of nitrogen deposition from the air have the potential to lead to more significant changes in vegetation composition where a site is below but near to the Critical Load, compared to a site which significantly exceeds a critical load.' NECR210, Natural England 2016 as referenced in NEA001. 'Habitats that have already been subject to high background nitrogen deposition can develop an effective tolerance to the effects of further deposition.' NECR210, Natural England 2016 as referenced in NEA001.

to whether the effects could be considered to be significant, it is necessary for the competent expert (see paragraph 3.2.1) to make a judgement. That judgement is based on considering all of the factors, what is known about them and assessing the likely outcomes for the habitats from those factors.

### Assessment of effect on integrity

- 3.4.8 The attributes and targets contained within Natural England’s supplementary advice (listed in Table 4.2) were used as a basis for the assessment of the Project’s impacts on the integrity of the European sites by identifying whether the magnitude of the effect would be likely to undermine achievement of the target for each attribute.

## 3.5 Assessing effects in-combination

- 3.5.1 An assessment of the Project in-combination with other plans or projects has been completed at Stage 1 screening and Stage 2 appropriate assessment.
- 3.5.2 At Stage 1 screening the assessment is limited to the European sites and effect pathways where no LSE has been found as a result of the Project alone.
- 3.5.3 Any interactions between the European sites and the Project where a conclusion of potential LSE alone has been reached, have been considered in combination with other plans and projects at Stage 2 appropriate assessment.

### Identifying other plans and projects

- 3.5.4 The in-combination assessment includes consideration of the reasonably foreseeable plans and projects considered in ES Chapter 16: Cumulative Effects Assessment (CEA) [APP-154] undertaken for the Environmental Impact Assessment, amended to ensure compliance for the HRA, for example through refining potential pathways and receptors. The in-combination assessment for air quality effects uses the shortlist of plans and projects derived for the CEA as well as permitting information from the Environment Agency (permitting searches completed in July 2020).
- 3.5.5 This list of reasonably foreseeable plans and projects is based on Advice Note 17 (The Planning Inspectorate, 2019), with the following types of development considered:
- a. Projects that are under construction
  - b. Permitted application(s) not yet implemented
  - c. Submitted application(s) not yet determined
  - d. All refusals subject to appeal procedures not yet determined
  - e. Projects on the National Infrastructure Commission’s programme of projects
  - f. Projects identified in the relevant development plans and emerging development plans
- 3.5.6 Past projects and projects for which potential effects are fully determined were included in the environmental baseline and do not feature in the in-combination

assessment. Rejected and withdrawn planning applications were also not included in the in-combination assessment as they are not considered to be reasonably foreseeable developments.

- 3.5.7 Effects were considered to be potentially acting in combination where there are spatial and temporal overlaps of Project effects with similar effects from other projects on relevant receptors.

### **Spatial extent used to identify other plans or projects**

- 3.5.8 The contribution of changes in traffic from other plans or projects has already been considered with the 'Effects of the Project alone' assessment, as the data used within the traffic model includes the predicted changes in traffic from other plans and projects, described as traffic growth in the Traffic Forecasts Non-Technical Summary [APP-528]. That Non-Technical Summary also shows the future developments that have been included in the traffic model.
- 3.5.9 Therefore, the scope of the in-combination assessment for this effect pathway considers other potential sources of NO<sub>x</sub>, NH<sub>3</sub> and N deposition. Other plans and projects that potentially contribute to concentration of NO<sub>x</sub>, NH<sub>3</sub> and N deposition in ways other than traffic (and could be identified via the planning or permitting system) would be broadly limited to industrial processes and intensive agricultural units. Both of these types of development are given permission (at least in part) via Environment Agency permitting.
- 3.5.10 The search area for other plans or projects that may also contribute to N deposition at these European sites has been defined as follows and is illustrated on Figure 23 of the HRA [APP-487], and for North Downs Woodlands SAC, Plate 4.1. The size of search area has been determined based on the advice given by the Environment Agency in 'Risk assessments for your environmental permit' (Environment Agency, 2020) and includes project types within the following distances from where each European site is affected by changes in nitrogen deposition:
- 15km – coal or oil-fired power stations or >50 megawatt emitters
  - 10km – industrial emissions, e.g. energy generation plants
  - 5km – intensive livestock units
  - 500m – agricultural biomass boilers

### **Assessment method**

- 3.5.11 The predicted contribution of NO<sub>x</sub>, NH<sub>3</sub> and N deposition has been identified where available for the other plans and projects located within the search area. The combined contribution to N deposition was calculated by summing together the predicted N deposition (kg N ha<sup>-1</sup>yr<sup>-1</sup>) for each of the projects within the search area and determining the percentage of the critical load for the habitats of each site. The likelihood of an effect of all the projects in combination was determined based on the combined figure with consideration given to the likely sensitivity of the habitats present and in view of the conservation objectives of the European sites.

## 4 European sites potentially affected by the proposals

### 4.1 Sites identified

4.1.1 Table 4.1 sets out the European sites identified within 200m of the ARN as well as information on the key features, vulnerability and the conservation objectives.

**Table 4.1 European sites identified**

European site name and code	Location and distance	Size (ha)	Key features including the primary reasons for designation and any other qualifying interests	Vulnerability	Conservation objectives
Thames Estuary and Marshes Ramsar site UK11069	Adjacent to the Project	5,588.59	<p>Ramsar site criterion 2 – The site supports more than 20 British Red Data Book invertebrates and populations of the GB Red Book endangered least lettuce <i>Lactuca saligna</i>, as well as the vulnerable slender hare’s-ear <i>Bupleurum tenuissimum</i>, divided sedge <i>Carex divisa</i>, sea barley <i>Hordeum marinum</i>, Borrer’s saltmarsh-grass <i>Puccinellia fasciculata</i>, and dwarf eelgrass <i>Zostera noltei</i>.</p> <p>Ramsar site criterion 5 – Assemblages of international importance:</p> <p>Species with peak counts in winter:</p> <p>45,118 waterfowl (five-year peak mean 1998/99–2002/2003)</p> <p>Ramsar site criterion 6 – Species/populations occurring at levels of international importance. Qualifying Species/populations (as identified at designation):</p> <p>Species with peak counts in spring/autumn:</p> <p>Ringed plover <i>Charadrius hiaticula</i>, Europe/Northwest Africa 595 individuals, representing an average of 1.8% of the GB population (five-year peak mean 1998/9–2002/3)</p> <p>Black-tailed godwit <i>Limosa limosa islandica</i>, Iceland/W Europe 1,640 individuals, representing an average of 4.6% of the population (five-year peak mean 1998/9–2002/3)</p> <p>Species with peak counts in winter:</p> <p>Grey plover <i>Pluvialis squatarola</i>, E Atlantic/W Africa -wintering 1,643 individuals, representing an average of 3.1% of the GB population (five-year peak mean 1998/9–2002/3)</p> <p>Red knot <i>Calidris canutus islandica</i>, W &amp; Southern Africa (wintering) 7,279 individuals, representing an average of 1.6% of the population (five-year peak mean 1998/9–2002/3)</p> <p>Dunlin <i>Calidris alpina alpina</i>, W Siberia/W Europe 15,171 individuals, representing an average of 1.1% of the population (five-year peak mean 1998/9–2002/3)</p> <p>Common redshank <i>Tringa totanus</i>, 1,178 individuals, representing an average of 1% of the GB population (five-year peak mean 1998/9–2002/3)</p>	<p>Dredging</p> <p>Erosion</p> <p>Eutrophication</p> <p>General disturbance from human activities</p>	<p>The Applicant considers that the following Special Protection Area (SPA) conservation objectives are sufficient to support the management of the Ramsar site<sup>3</sup> interests.</p> <p>Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:</p> <ul style="list-style-type: none"> <li>• the extent and distribution of the habitats of the qualifying features</li> <li>• the structure and function of the habitats of the qualifying features</li> <li>• the supporting processes on which the habitats of the qualifying features rely</li> <li>• the population of each of the qualifying features</li> <li>• the distribution of the qualifying features within the site</li> </ul>

<sup>3</sup> For Ramsar sites, a decision has been made by Defra and Natural England not to produce Conservation Advice packages, instead focusing on the production of high-level conservation objectives. As the provisions on the Habitats Regulations relating to HRAs extend to Ramsar sites, Natural England considers the Conservation Advice packages for the overlapping European Marine Site designations to be, in most cases, sufficient to support the management of the Ramsar site interests. If there are Ramsar site qualifying features not covered by overlapping European Marine Sites, Natural England will consider the best approach on addressing these (e.g. to produce advice on a feature basis) if there is an operational risk.



European site name and code	Location and distance	Size (ha)	Key features including the primary reasons for designation and any other qualifying interests	Vulnerability	Conservation objectives
Epping Forest SAC UK0012720	Approximately 19km west of the Project	1,630.74	<p>Annex I habitats that are a primary reason for selection of this site:</p> <p>9120 Atlantic acidophilous beech forests with <i>Ilex</i> and sometimes also <i>Taxus</i> in the shrublayer (<i>Quercion robori-petraeae</i> or <i>Ilici-Fagenion</i>)</p> <p>Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site:</p> <p>4010 Northern Atlantic wet heaths with <i>Erica tetralix</i></p> <p>4030 European dry heaths</p> <p>Annex II species that are a primary reason for selection of this site:</p> <p>1083 Stag beetle <i>Lucanus cervus</i></p> <p>Other features present:</p> <p>1166 Great crested newt <i>Triturus cristatus</i></p>	<p>M02 Changes in biotic conditions</p> <p>H04 Air pollution, air-borne pollutants</p> <p>G01 Outdoor sports and leisure activities, recreational activities</p> <p>J02 Human-induced changes in hydraulic conditions</p> <p>A04 Grazing</p>	<p>Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:</p> <ul style="list-style-type: none"> <li>• the extent and distribution of qualifying natural habitats and habitats of qualifying species</li> <li>• the structure and function (including typical species) of qualifying natural habitats</li> <li>• the structure and function of the habitats of qualifying species</li> <li>• the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely</li> <li>• the populations of qualifying species</li> <li>• the distribution of qualifying species within the site</li> </ul> <p>Natural England also provides supplementary advice on conservation objectives for this site (Natural England, 2019a).</p>
North Downs Woodlands SAC UK0030225	Adjacent to the Project	288.58	<p>Annex I habitats that are a primary reason for selection of this site:</p> <p>9130 <i>Asperulo-Fagetum</i> beech forests</p> <p>91J0 <i>Taxus baccata</i> woods of the British Isles *Priority feature</p> <p>Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site:</p> <p>6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (*important orchid sites)</p>	<p>I01 Invasive Non-Native Species</p> <p>H04 Air pollution, air-borne pollutants</p> <p>G01 Outdoor sports and leisure activities, recreational activities</p> <p>B02 Forest and Plantation management &amp; use</p>	<p>Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:</p> <ul style="list-style-type: none"> <li>• the extent and distribution of the qualifying natural habitats</li> <li>• the structure and function (including typical species) of the qualifying natural habitats</li> <li>• the supporting processes on which the qualifying natural habitats rely</li> </ul> <p>Natural England also provides supplementary advice on conservation objectives for this site (Natural England, 2019b).</p>

## 4.2 Conservation objectives and site integrity

### Ramsar site

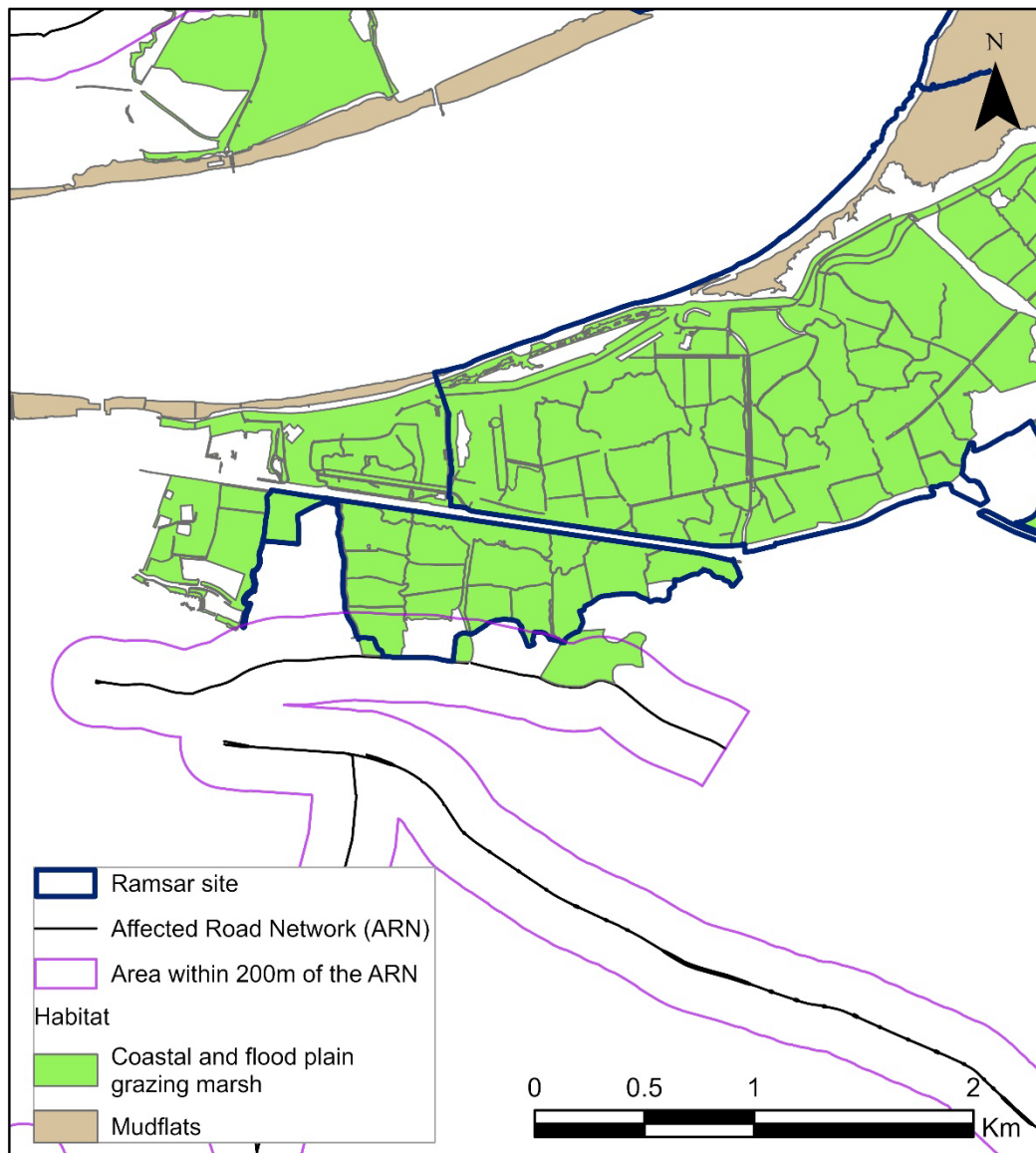
- 4.2.1 The conservation objectives used to inform the assessment for each of the European sites are set out within Table 4.1. Natural England has produced supplementary advice on conserving and restoring the site features of each of the SPAs and the attributes that are of relevance to this assessment are summarised in the following paragraphs. Where conservation objectives or targets are not available for the qualifying feature subject to assessment, proxy information has been used from the Standard Data Form for sites within the 'UK national site network of European sites', formerly the Natura 2000 standard form (in the case of the population size targets).

### Supplementary advice relating to air quality

- 4.2.2 The potential LSEs identified in Section 5.1 relate to the effects of changes in air quality as a result of construction vehicle emissions on the Thames Estuary and Marshes Ramsar site. Plate 4.1 illustrates the location of the area of the Thames Estuary and Marshes Ramsar site that is within 200m of the ARN and the habitats used by the qualifying features. The supplementary advice provided by Natural England (Natural England, 2018) relating to the air quality attribute was the same for all three European sites identified and had the following target for all qualifying features:
- a. Maintain concentrations and deposition of air pollutants at below the site-relevant critical load or level values given for this feature of the site on the Air Pollution Information System



**Plate 4.1 Area of the Thames Estuary and Marshes Ramsar site within 200m of the construction ARN**



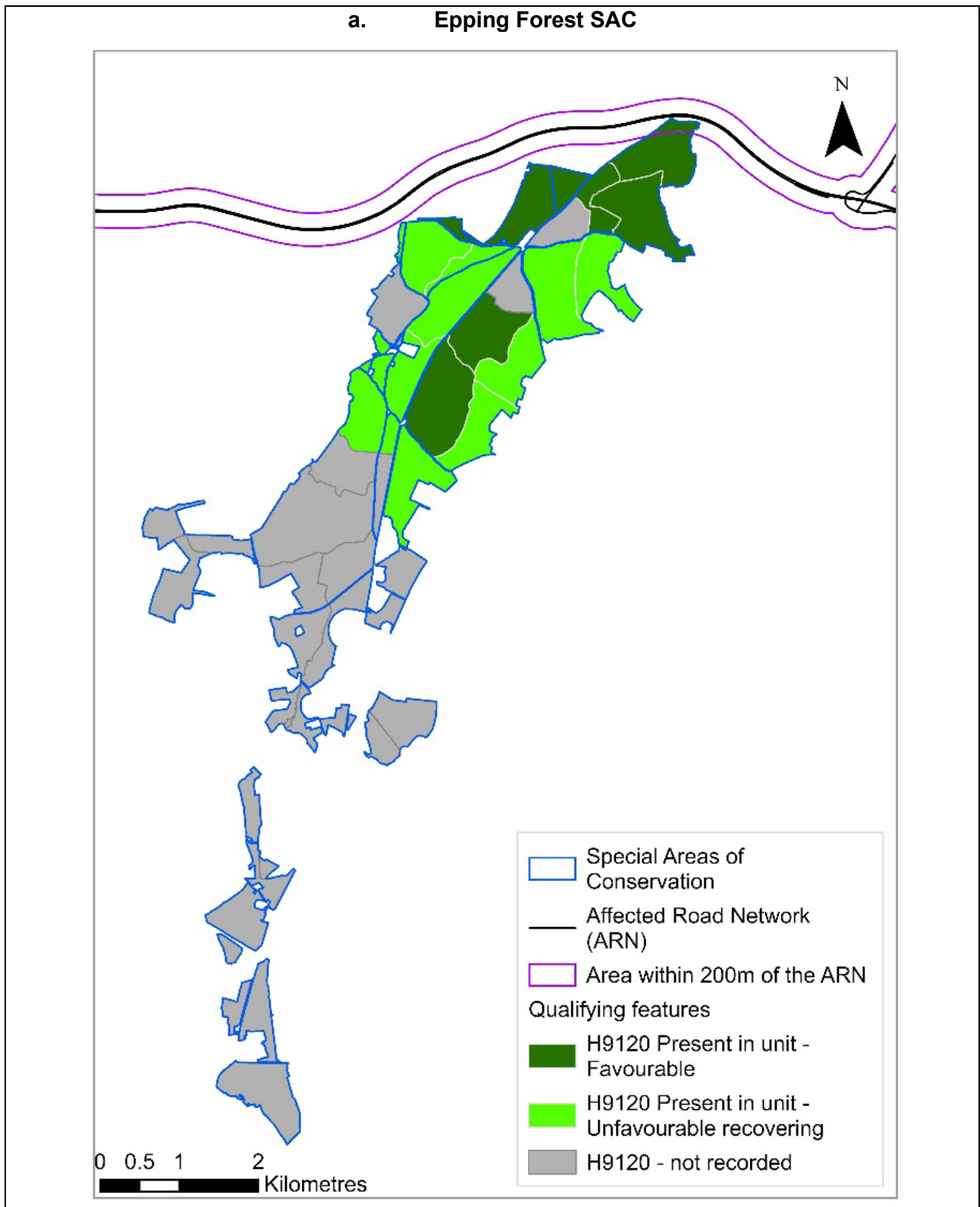
### SAC sites

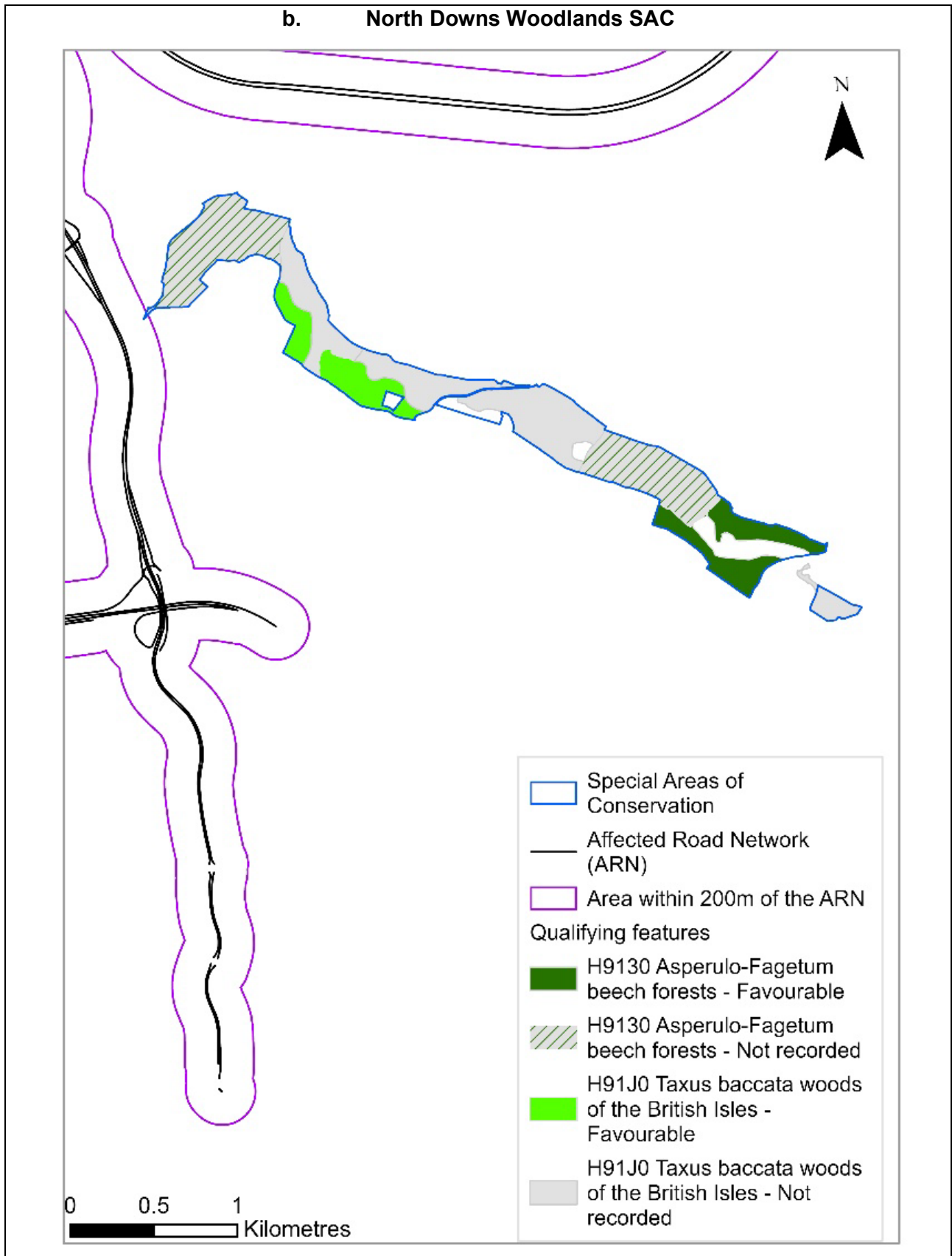
4.2.3 The conservation objectives for the Epping Forest and North Downs Woodlands SACs are set out within Table 4.1.

### Supplementary advice relating to air quality

4.2.4 The distribution of the qualifying habitats potentially affected (those within 200m of the ARN) within the European sites is shown in Plate 4.2. This is displayed using the information provided by the Natural England Designated Sites View (Natural England, n.d.) and relates to the Site of Special Scientific Interest (SSSI) units where the qualifying features have been recorded. Other smaller fragments of the qualifying habitat exist as recorded during field surveys, particularly within the North Downs Woodlands SAC.

**Plate 4.2 Extent of qualifying features within the European sites**





- 4.2.5 The preliminary survey work completed within the areas potentially affected (see paragraph 4.3.6 to 4.3.11) found that the qualifying features likely to be present were:
- a. Epping Forest SAC: H9120. Atlantic acidophilous beech forests with *Ilex* and sometimes also *Taxus* in the shrub layer (*Quercion robori-petraeae* or *Illici-Fagenion*); Beech forests on acid soils and therefore S1083 Stag beetle *Lucanus cervus*
  - b. North Downs Woodlands SAC: H9130 *Asperulo-Fagetum* beech forests and H91J0 *Taxus baccata* woods of the British Isles
- 4.2.6 Natural England has produced supplementary advice (Natural England, 2019a; Natural England, 2019b) on conserving and restoring the site features of each of the SACs, and the attributes that are of relevance to this assessment are set out within Table 4.2.
- 4.2.7 The potential LSEs identified in Section 5.1 relate to effects of changes in concentrations of NO<sub>x</sub> and NH<sub>3</sub> and N deposition resulting in habitat loss/degradation. Therefore, the attributes summarised are those that relate to air quality and the targets associated with these attributes are used as part of the assessment of effects on the integrity of the European sites.

**Table 4.2 The attributes and targets that apply to this assessment (extracted from Natural England’s supplementary advice (Natural England, 2019a; Natural England, 2019b))**

Qualifying feature	Attribute and target	Reason for target
<b>Epping Forest SAC</b>		
H9120. Atlantic acidophilous beech forests with <i>Ilex</i> and sometimes also <i>Taxus</i> in the shrub layer ( <i>Quercion robori-petraeae</i> or <i>Illici-Fagenion</i> ); Beech forests on acid soils	Attribute: Air quality – Supporting processes (on which the feature relies)  Target: Restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant critical load or level values given for this H9120 woodland feature of the site on the Air Pollution Information System ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ).	The annual mean critical levels for NH <sub>3</sub> and critical loads for N deposition are being exceeded for the H9120 woodland feature (and the defined mosaic). In addition to this, site-based evidence indicates that the annual mean critical level for NO <sub>x</sub> is also being exceeded, notably for areas close to main roads.
S1083 Stag beetle <i>Lucanus cervus</i>	Attribute: Air quality – Supporting processes (on which the feature relies)  Target: Maintain or, where necessary, restore concentrations and deposition of air pollutants to at or below the site-relevant critical load or level values given for this feature of the site on the Air Pollution Information System ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ).	The relevant critical levels and critical loads for the S1083 stag beetle feature at Epping Forest broadly align with the thresholds for the H9120 woodland feature.

Qualifying feature	Attribute and target	Reason for target
<b>North Downs Woodlands SAC</b>		
H9130 <i>Asperulo-Fagetum</i> Beech forests on neutral to rich soils	Attribute: Air quality – Supporting processes (on which the feature relies) Target: Restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant critical load or level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. N Deposition (kg ha <sup>-1</sup> yr <sup>-1</sup> ): 25.9 which is above critical loads (kg ha <sup>-1</sup> yr <sup>-1</sup> ): 10–20
H91J0 <i>Taxus baccata</i> woods of the British Isles *Priority feature	Attribute: Air quality – Supporting processes (on which the feature relies) Target: Restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant critical load or level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. N Deposition (kg ha <sup>-1</sup> yr <sup>-1</sup> ): 25.9 which is above critical loads (kg ha <sup>-1</sup> yr <sup>-1</sup> ): 5–15.

## 4.3 Baseline conditions

### Background

- 4.3.1 A preliminary site walkover was completed at the end of February 2020 within the areas of the European sites potentially affected by changes in air quality, i.e. the areas within 200m of the ARN. The aim of the surveys was to confirm the habitat types and inform the deposition velocity and lower critical load values applicable to the site for input to the air quality model. The walkover was carried out from the road network or Public Rights of Way and for some areas it was not possible to clearly see all of the area potentially affected, however the findings of the site walkover are considered a robust basis for assessment. The habitat types have been described in accordance with the UKHab classification system (The UKHab Working Group, 2018) where it was possible to do so.
- 4.3.2 Detailed site investigations were completed for the European sites where the change in nitrogen deposition was predicted to change by greater than 1% of the lower critical load.
- 4.3.3 A detailed site investigation for Epping Forest SAC was carried out in May 2020 and the survey report is included in Appendix D of the HRA [APP-487]. The survey was carried out on three 500m transects with plots spaced at 100m intervals along each transect. The locations of the transects and quadrats are



shown in Figure A.1 of Annex D.1 in Appendix D of the HRA [APP-487]. The transects were aligned along gradients of modelled N deposition, with origins at the point in the north of the SAC where changes in N deposition were highest. Along each transect, 50m x 50m plots for sampling vegetation were spaced at 100m intervals. Plots along transects one and three were truncated at 400m and 300m, respectively, as plots at these locations would have been, respectively, over a wide track and outside of the SAC.

- 4.3.4 A detailed site investigation for North Downs Woodlands SAC was carried out in May 2022 and 2023 and the survey methodology and results are included in Annex A. The surveys were carried out within the SAC, up to 200m from the ARN and up to approximately 500m from the ARN as shown within the location plans in Annex A. At each location surveyors walked a zig-zag transect through the habitat survey area to ground-truth the UKHab classification and vegetation composition and species abundance were recorded using the DAFOR scale ('dominant', 'abundant', 'frequent', 'occasional' or 'rare'). Evidence of any obvious vegetation gradients was noted as well as evidence of site management, pressures and threats (e.g. recreation, fly-tipping, encroaching development). Site condition in the habitat survey area was recorded using Defra's Biodiversity Metric 3.1 (Panks *et al.*, 2022). Note was made on whether habitats are degraded versions of habitats the site is important for (as detailed in the citation), or if they have been replaced by a different habitat type.

### Thames Estuary and Marshes Ramsar site habitats

- 4.3.5 The area within 200m of the construction ARN intersects the Ramsar site as shown on Plate 4.1. The Project Phase 1 habitat surveys indicate that the area within 200m of the construction ARN is poor semi-improved grassland with a network of ditches. The ditches have a variety of emergent, submerged and floating vegetation. The combination of pasture and ditch habitats would constitute coastal and floodplain grazing marsh.

### Epping Forest SAC

- 4.3.6 The SAC is approximately 10 metres south-east of the M25 as shown on Plate 4.2a. All of the plots supported mature broadleaved semi-natural woodland, with two woodland habitat and vegetation types recorded. The woodland nearest the M25 was generally more heavily disturbed by public use with a sparse understory and younger trees and heavily disturbed ground. The boundary between the two was very marked, following the route of a footpath, with younger oak woodland lying to the north and mature mixed woodland in the interior of the site to the south. The majority of plots comprised the UK Habitat Classification type 'w1c5 Beech forests on acid soils (H9120)', an Annex I habitat and qualifying feature of Epping Forest SAC.
- 4.3.7 The Ellenberg values of species recorded during the field survey (see Table D.5 in the HRA Appendix D [APP-487]) did not identify any species likely to be sensitive to N deposition. The qualifying features being assessed are habitat features which are listed as nitrogen-sensitive habitats in the Air Pollution Information System, but no species with an Ellenberg value of less than three (indicative of more-or-less infertile sites) were recorded in the affected area. The lack of nitrogen-sensitive species recorded in the survey therefore shows the habitat in this area is not nitrogen sensitive but does not imply the qualifying

feature as a whole is not nitrogen sensitive. The survey extent was greater than the 200m as set out in Appendix D of the HRA [APP-487]. A comparison with areas further away was discussed in the main survey report in Appendix D of the HRA [APP-487] and no discernible difference along the transects was recorded.

- 4.3.8 The distribution of the stag beetle feature (S1083) at Epping Forest is considered to broadly align with the distribution of the H9120 woodland feature.

### North Downs Woodlands SAC

- 4.3.9 The SAC is approximately 160 metres east of the A229 as shown on Plate 4.2b. Within the area 200m from the ARN (A229), the woodland block is narrow (approximately 20m wide) and bisected by a sunken lane (The North Downs Way Public Right of Way) comprising bare ground and vegetated banks. The woodland in this area is classified as UKHab w1f: lowland mixed deciduous woodland and recorded a habitat condition score of 29 (moderate). It comprises a narrow strip of ash woodland around a public footpath, with abundant ash *Fraxinus excelsior*, and frequent field maple *Acer campestre*, wild cherry *Prunus avium* and sycamore *Acer pseudoplatanus* in the canopy over an understorey of frequent hazel *Corylus avellana*, hawthorn *Crataegus monogyna*, yew *Taxus baccata* and wild privet *Ligustrum vulgare*. The ground layer is heavily shaded where yew occurs. Ivy *Hedera helix* is abundant, with frequent dog's mercury *Mercurialis perennis*, wood melick *Melica uniflora* and wild arum *Arum maculatum*. The area was relatively heavily disturbed due to the presence of the public footpath and ash die back observed as widespread throughout the habitat survey area. The survey found that ash was the most abundant canopy species in the survey area, and it does not meet the criteria for the habitats that are the primary reason for selection of the site as a SAC.
- 4.3.10 Further away (approximately 500m) from the A229, where the SAC boundary widens, the composition of the woodland is classified as UKHab w1c7 Yew-dominated woodland (H91J0) and recorded a habitat condition score of 33 (good). The habitat survey area is characterised by a closed yew tree canopy, with an almost bare field layer and very few Ancient Woodland Indicator (AWI) species. The area was disturbed due to presence of the public footpath and use by bikes. A burnt-out vehicle was recorded which had scorched and damaged nearby trees. The survey found that most of the area surveyed was made up of W13 *Taxus baccata* (Annex I, 91J0), one of the primary reasons for selection of the site as a SAC.
- 4.3.11 The Ellenberg values for the species, noted within the habitat survey area within 200m of the ARN, ranged from four to eight and did not include any species likely to be sensitive to N deposition. The qualifying features being assessed are habitat features which are listed as nitrogen-sensitive habitats in the Air Pollution Information System, but no species with an Ellenberg value of less than three (indicative of more-or-less infertile sites) were recorded in the affected area. The lack of nitrogen-sensitive species recorded in the survey therefore shows the habitat in this area is not nitrogen sensitive but does not imply the qualifying feature as a whole is not nitrogen sensitive.



## 4.4 Future changes in baseline conditions

- 4.4.1 Defra indicates that the trend in emissions of nitrogen oxides (NO<sub>x</sub>) has been decreasing since the 1990s with the introduction of catalytic converters in vehicles and increasingly stringent emission standards, with emission estimates for 2020 indicating a 51% reduction on the 2005 UK emissions total (Dore, et al., 2009). To some extent the reduction in emissions is being matched by a similar trend in nutrient N deposition. Rowe *et al.* (2020) showed that, for SACs in England, the percentage of sites with nutrient N exceedance decreased from 98.5% in 1996 to 94.4% in 2017.
- 4.4.2 The Thames Estuary and Marshes SPA/Ramsar site is large (4802.47ha), and the areas within 200m of the operational ARN comprise coastal floodplain grazing marsh habitat. The trends in N deposition at these sites are published on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2023) and are generally within the critical loads (20–30kgha<sup>-1</sup>yr<sup>-1</sup>) for the habitat type.
- 4.4.3 Both of the SAC sites identified (Epping Forest and North Downs Woodlands) have been exposed to atmospheric N deposition in excess of the critical loads, for the features within 200m of the operational ARN, for many decades as shown in the deposition trends published on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2023). The information recorded during the detailed habitat survey for Epping Forest (Appendix D of the HRA [APP-487]) appears to support this trend as no nitrogen-sensitive species were recorded within any of the transects surveyed, suggesting that the habitat within that area could have been adversely affected by long-term excess N deposition. Pristine or high-quality examples of the qualifying habitat might be expected to support nitrogen-sensitive species, but the surveys (Appendix D of the HRA [APP-487]) have shown that the area affected does not.
- 4.4.4 Both Epping Forest and the North Downs Woodlands SAC citations highlight air quality as a key attribute underpinning the conservation objectives of the sites. The Epping Forest Site Improvement Plan (Natural England, 2016) lists ‘air pollution: impact of atmospheric nitrogen deposition’ as the highest priority issue for the site. While air pollution is listed as an issue in the North Downs Woodlands Site Improvement Plan (Natural England, 2014) it was not the highest priority.
- 4.4.5 Both Epping Forest and North Downs Woodlands SAC have ‘restore’ targets for the air quality attribute of the conservation objectives which relate to the concentrations and deposition of air pollutants to at or below the site-relevant critical load or level values. The current trends indicate that progress is being made, however, Rowe *et al.* (2020) stated that ‘*Reducing deposition to below the critical load does not mean that ecosystems immediately recover. There are time lags before chemical recovery takes place, and further delays before biological recovery. The timescales for both chemical and biological recovery, could be very long, particularly for the most sensitive ecosystems*’.
- 4.4.6 Therefore, the qualifying features at these SACs are unlikely to change significantly in composition based on predicted improvements in air quality alone and this is recognised within the pressures and issues listed and measures proposed in the Site Improvement Plans for both European sites.

## 5 Stage 1 screening

### 5.1 Assessment of LSE

#### Changes in air quality from vehicle emissions

- 5.1.1 Changes in air quality as a result of vehicle emissions occur during construction and operation of the Project. The changes in air quality relevant to this assessment are in NO<sub>x</sub> and NH<sub>3</sub> as individual pollutants and their contribution to the deposition of nitrogen (N deposition).
- 5.1.2 Increases in the concentrations of NO<sub>x</sub> have the potential to: affect growth, photosynthesis and nitrogen assimilation/metabolism with few species showing visible injury and result in direct damage to mosses, liverworts and lichens with a reduction in species diversity.
- 5.1.3 Increases in the concentrations of NH<sub>3</sub> have the potential to: cause direct damage to foliage, increased sensitivity to drought and frost resulting in pest/pathogen attack and water stress, changes in ground flora, bryophyte and lichen composition coupled with changes to understorey with an increase in grass and ruderal species.
- 5.1.4 Increases in N deposition have the potential to change habitat composition, depending on the sensitivity of the habitat type. These changes could affect the habitats for which a European site is designated as well as the qualifying species if supporting habitat within the site is affected.
- 5.1.5 The European sites identified as potentially affected by vehicle emissions during construction and operation are:
- Thames Estuary and Marshes Ramsar – construction
  - Epping Forest SAC – operation
  - North Downs Woodlands SAC – operation
- 5.1.6 The contribution of changes in traffic from other plans or projects are considered with this ‘alone’ assessment as the data used within the traffic model includes the predicted changes in traffic from other plans and projects, as represented by the growth factor. The in-combination is assessed as the alone plus any contributions from other sources as described in paragraph 3.5.8.

#### Thames Estuary and Marshes Ramsar

##### Construction

##### *Effect alone*

- 5.1.7 Changes in air quality as a result of vehicle emissions could occur during construction of the Project. The changes in traffic that were predicted for the ARN within 200m of the Thames Estuary and Marshes Ramsar site are summarised in Table 5.1. Figure 22a (See HRA [APP-487]) illustrates where the construction ARN is within 200m of the Thames Estuary and Marshes Ramsar site and where the air quality model receptor point was located. Table 5.2 to Table 5.4 provide a summary of the air quality (AQ) model results for the

predicted concentrations of NO<sub>x</sub> and NH<sub>3</sub> as well as the predicted nitrogen deposition as a result of the vehicle emissions during each year of construction.

**Table 5.1 Summary of the traffic changes predicted during construction, within 200m of the Thames Estuary and Marshes Ramsar site (N/A indicates criteria not met)**

Road (Traffic model link ID)	Construction year	AADT <sup>4</sup> change	HDV <sup>5</sup> change	Speed band change	Carriageway alignment change
Lower Higham Road (20161_86027)	2025	1708	N/A	Yes	N/A
	2026	1636	N/A	Yes	N/A
	2027	1721	N/A	Yes	N/A
	2028	2126	N/A	Yes	N/A
	2029	N/A	N/A	Yes	N/A
	2030	N/A	N/A	N/A	N/A

**Table 5.2 Summary of the maximum predicted changes in NO<sub>x</sub> concentrations as a result of construction traffic for the ‘Base Year’<sup>6</sup> (BY), ‘Do Minimum’ (DM) and ‘Do Something’ (DS) scenarios**

Construction Year	Relevant CL µg/m <sup>-3</sup>	BY µg/m <sup>-3</sup>	DM µg/m <sup>-3</sup>	DS µg/m <sup>-3</sup>	DS-DM change µg/m <sup>-3</sup>
2025	30	42.57	29.48	31.35	1.87
2026	30	42.57	28.65	30.51	1.86
2027	30	42.57	27.82	29.63	1.81
2028	30	42.57	27.12	29.10	1.98
2029	30	42.57	26.50	26.94	0.44
2030	Criteria not met for inclusion within the ARN.				

**Table 5.3 Summary of the predicted changes in NH<sub>3</sub> concentrations as a result of construction traffic for the ‘Base Year’ (BY), ‘Do Minimum’ (DM) and ‘Do Something’ (DS) scenarios**

Construction Year	Relevant CL µg/m <sup>-3</sup>	BY µg/m <sup>-3</sup>	DM µg/m <sup>-3</sup>	DS µg/m <sup>-3</sup>	DS-DM change µg/m <sup>-3</sup>
2025	3	1.54	1.56	1.71	0.15
2026	3	1.54	1.56	1.72	0.16

<sup>4</sup> AADT – Annual Average Daily Traffic: An estimate of the average daily traffic along a defined segment of roadway. This value is calculated from short-term counts taken along the same section, which are then factored to produce the estimate of AADT. Because of this process, the most recent AADT for any given roadway will always be for the previous year.

<sup>5</sup> HDV – Heavy Duty Vehicle: Freight vehicles of more than 3.5 tonnes (e.g. lorries) or passenger transport vehicles of more than eight seats (e.g. buses).

<sup>6</sup> The Base Year in the air quality model is 2016.

Construction Year	Relevant CL $\mu\text{g}/\text{m}^3$	BY $\mu\text{g}/\text{m}^3$	DM $\mu\text{g}/\text{m}^3$	DS $\mu\text{g}/\text{m}^3$	DS-DM change $\mu\text{g}/\text{m}^3$
2027	3	1.54	1.55	1.73	0.18
2028	3	1.54	1.54	1.75	0.21
2029	3	1.54	1.54	1.59	0.05
2030	Criteria not met for inclusion within the ARN.				

5.1.8 The changes in traffic result in variations of both NO<sub>x</sub> and NH<sub>3</sub> concentrations over a period of five of the construction years where the ARN criteria were met. The total concentration of NO<sub>x</sub> in the DS scenario (Table 5.2) is predicted to exceed the CL in the first two years of construction and the change in concentration for those two years will exceed 1% of the CL. Therefore, a LSE on the Thames Estuary and Marshes Ramsar site cannot be discounted as a result of the Project alone.

5.1.9 The predicted total concentration of NH<sub>3</sub> in the DS scenario (Table 5.3) is less than the CL. Therefore, the changes in NH<sub>3</sub> concentrations would result in no change in habitat composition within the Thames Estuary and Marshes Ramsar site and no LSE is predicted to occur as a result of the Project alone.

**Table 5.4 Summary of the maximum predicted changes in nitrogen deposition as a result of construction traffic for the ‘Base Year’ (BY), ‘Do Minimum’ (DM) and ‘Do Something’ (DS) scenarios**

Construction year	Total N deposition (kg N ha <sup>-1</sup> yr <sup>-1</sup> )				
	Relevant LCL	BY	DM	DS	DS-DM change
2025	20	16.88	16.99	17.93	0.93
2026	20	16.88	16.95	17.95	1.00
2027	20	16.88	16.91	17.96	1.05
2028	20	16.88	16.81	18.10	1.24
2029	20	16.88	16.83	17.12	0.30
2030	Criteria not met for inclusion within the ARN				

5.1.10 The changes in traffic result in variations in nitrogen deposition over a period of five years. The predicted total N deposition in the DS scenario (Table 5.4), in all of the construction years where the ARN criteria were met, is less than the lower critical load, 20 kg N ha<sup>-1</sup>yr<sup>-1</sup>, for the Thames Estuary and Marshes Ramsar site. The change in nitrogen deposition is over a short duration, five years, as this site is not affected by the operational ARN therefore any changes are highly unlikely to result in any detectable changes in the habitat (Caporn, et al., 2016), particularly as the DS nitrogen deposition is less than the lower critical load.

5.1.11 Therefore, the changes in nitrogen deposition would result in no change in the habitats of the Thames Estuary and Marshes site and no LSEs are predicted to occur as a result of the Project alone.

*Effect in-combination*

- 5.1.12 Where uncertainty of LSE remains for the Project alone (for changes in NO<sub>x</sub> concentration), the possibility of LSE is also uncertain in-combination with other plans and projects for Thames Estuary and Marshes Ramsar site. The in-combination assessment is completed as part of the assessment of effect on integrity of European sites in Section 6.2.
- 5.1.13 The other plans and projects identified within the search areas were primarily on the National Infrastructure Planning register of applications and local authority planning portals. The Environment Agency's list of permit applications were reviewed, however they did not include any applications for permits that coincided with the construction years. Also, the majority of these permit applications did not appear on the local planning authority planning portals and are therefore sufficiently small and/or will not have any significant environmental effects such that they are extremely unlikely to contribute, in combination with the Project, to NH<sub>3</sub> concentration or N deposition over the wider area.
- 5.1.14 The projects identified within the search areas were then reviewed to determine the predicted NH<sub>3</sub> concentration and nitrogen deposition from them coincided with the construction years from the Project. The projects identified (see Figure 23a, of the HRA [\[APP-487\]](#), for locations) as potentially overlapping with the Project construction phase air quality changes are set out below.
- a. Tilbury2. A new port terminal on the site of the demolished Tilbury Power Station. Construction was completed in 2020 and it is now operational. The background emissions for the Project model are 2017–2019 therefore Tilbury2 was not included and therefore is assessed as part of the in-combination assessment as it will generate emissions from shipping which were considered as part of the Tilbury2 DCO application.
  - b. Thurrock Flexible Generation Plant. These works comprise a Nationally Significant Infrastructure Project (NSIP) and the DCO application was granted in February 2022 with the operation predicted to overlap the Project construction phase. The development comprises a gas-fired electricity generating station and a battery storage facility on land to the north of Tilbury substation, Thurrock.
  - c. Thurrock gas-fired electricity generation facility, Stanford (19/01534/FUL). A planning application was submitted to Thurrock Council in October 2019 and is awaiting decision, for installation of 25 gas engine generators, a gas house, distribution network operator building for transformers and associated vehicular access roads for a gas-fired electricity generation facility at Wharf Road, Stanford-le-Hope, Essex. For the purposes of this assessment the Applicant has assumed there is potential for the operation of this facility to overlap with the Project construction phase.
  - d. STOR 'Peaking' Power Plant, Purfleet (20/00360/FUL). Thurrock Council granted planning permission in May 2020 for a change of use of an existing building to house eight No. 2.5Mwe engines and associated plant. The

facility will generate a combined total of up to 20MW of electricity to feed into the National Grid. For the purposes of this assessment the Applicant has assumed there is potential for the operation of this facility to overlap with the Project construction phase.

- 5.1.15 Other plans or projects and the respective contributions to N deposition within the search area around Thames Estuary and Marshes Ramsar site are shown in Figure 23a of the HRA [APP-487]. The list of plans and projects is limited to where data on N deposition was available or where a reasonable proxy could be used.

**Table 5.5 Contribution to NH<sub>3</sub> concentrations and N deposition on Thames Estuary and Marshes Ramsar site from other plans and projects**

	NH <sub>3</sub> µgm <sup>-3</sup>	Nitrogen deposition kg N ha <sup>-1</sup> yr <sup>-1</sup>
Background (APIS 2017-2019)	1.52	15.69
CL/LCL of habitat affected by the Project alone	3	20
The Project alone – average change (DS-DM) over the construction period	0.15	0.9
<b>Other plans and projects</b>	<b>Contribution to NH<sub>3</sub> µgm<sup>-3</sup></b>	<b>Contribution to N deposition (kg N ha<sup>-1</sup>yr<sup>-1</sup>)</b>
Tilbury2	No effect identified in the application	0.00005
Thurrock Flexible Generation Plant	0.1	0.7
Thurrock gas-fired electricity generation facility (19/01534/ FUL)	No effect identified in the application	0.02
STOR ‘Peaking’ Power Plant (20/00360/FUL)	No effect identified in the application	No effect identified in the application
<b>Concentration/deposition attributable to in-combination projects</b>	<b>0.25</b>	<b>1.62</b>
<b>Total predicted concentration/deposition (Background plus in-combination)</b>	<b>1.77</b>	<b>17.31</b>

- 5.1.16 The background deposition to the Thames Estuary and Marshes Ramsar site does not exceed the CL or LCL for the habitat type potentially affected by the Project alone. The combined concentration and deposition added to the background from the Project in combination with other plans and projects is also less than the CL and LCL respectively. Therefore, using the framework set out in Figure 2.98 of LA 105 (Highways England, 2019), no LSEs are predicted for the Thames Estuary and Marshes Ramsar site for the Project in-combination with other plans or projects.



## Epping Forest SAC

### Operation

#### Effect alone

- 5.1.17 The traffic scoping criteria that were used to determine the ARN are defined by DMRB LA 105 (Highways England, et al., 2019). Table 5.6 summarises the changes predicted by the traffic model for ARN within 200m of Epping Forest SAC.

**Table 5.6 Summary of the traffic scoping criteria met at the ARN link identified within 200m of the Epping Forest SAC**

Road (Traffic model link ID)	AADT change	HDV change	Speed band change	Carriageway alignment change
M25 (82844_8267 & 184854_82810)	4784	877	N/A	N/A

- 5.1.18 The predicted concentrations of NO<sub>x</sub> and NH<sub>3</sub> and the total N deposition were calculated as a matrix of modelled points for Epping Forest SAC to reflect the potential effect of the plume from the tunnel portals. Figure 22b of the HRA [APP-487] shows the relationship between the modelled points and the boundary of the European sites.
- 5.1.19 Table 5.7 to Table 5.9 summarise the results of the modelling and illustrate the minimum and maximum changes recorded at Epping Forest SAC. The values for the CL and LCL are taken from the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2023) for most sensitive habitat types present within 200m of the ARN.

**Table 5.7 Summary of the maximum predicted changes in NO<sub>x</sub> concentrations as a result of operational traffic for the ‘Base Year’ (BY), ‘Do Minimum’ (DM) and ‘Do Something’ (DS) scenarios**

Minimum/ maximum changes	Relevant CL $\mu\text{g}/\text{m}^3$	BY $\mu\text{g}/\text{m}^3$	DM $\mu\text{g}/\text{m}^3$	DS $\mu\text{g}/\text{m}^3$	DS-DM change $\mu\text{g}/\text{m}^3$
Minimum	30	30.55	18.49	18.56	0.07
Maximum	30	106.36	69.10	70.84	1.74

**Table 5.8 Summary of the predicted changes in NH<sub>3</sub> concentrations as a result of operational traffic for the ‘Base Year’ (BY), ‘Do Minimum’ (DM) and ‘Do Something’ (DS) scenarios**

Minimum/ maximum changes	Relevant CL $\mu\text{g}/\text{m}^3$	BY $\mu\text{g}/\text{m}^3$	DM $\mu\text{g}/\text{m}^3$	DS $\mu\text{g}/\text{m}^3$	DS-DM change $\mu\text{g}/\text{m}^3$
Minimum	1	1.20	1.59	1.60	0.01
Maximum	1	3.64	3.94	4.03	0.09

- 5.1.20 The maximum total concentration of NO<sub>x</sub> in the DS scenario exceeds the relevant CL and the maximum change in concentration at opening year will



exceed 1% of the CL. The maximum total concentration of NH<sub>3</sub> in the DS scenario exceeds the relevant CL and the maximum change in concentration at opening year will exceed 1% of the CL. Therefore, LSEs on the Epping Forest cannot be discounted as a result of the Project alone.

**Table 5.9 Minimum and maximum changes in total nitrogen (N) deposition at Epping Forest SAC for the ‘Base Year’ (BY), ‘Do Minimum’ (DM) and ‘Do Something’ (DS) scenarios**

Minimum/ maximum changes	Total N deposition (kg N ha <sup>-1</sup> yr <sup>-1</sup> )				
	Relevant LCL	BY	DM	DS	DS-DM change
Minimum	10	32.75	32.44	32.50	0.06
Maximum	10	61.50	58.53	59.53	1.00

5.1.21 The methodology follows Figure 2.98 in LA 105 (Highways England, et al., 2019). Using the data summarised in Table 5.9, the following conclusions have been made:

- a. The total N deposition in the DS scenario exceeds the relevant LCL at all sample points within Epping Forest SAC.
- b. The change in N deposition between the DS and DM scenario is greater than 1% of the relevant LCL at some of the sample points within Epping Forest SAC.

5.1.22 As well as the changes in nitrogen deposition predicted at Epping Forest SAC being greater than 1% of the LCL, the qualifying habitats are considered likely to be present in the area affected and are listed as vulnerable to changes in N deposition within Natural England’s supplementary advice for Epping Forest (Natural England, 2019a). Therefore, LSE cannot be discounted at Epping Forest SAC as a result of the Project.

*Effect in-combination*

5.1.23 Where uncertainty of LSE remains for the Project alone, the possibility of LSE is also uncertain in-combination with other plans and projects for Epping Forest SAC. The in-combination assessment is completed as part of the assessment of effect on integrity of European sites in Section 6.2.

## North Downs Woodlands SAC

### Operation

#### Effect alone

- 5.1.24 The traffic scoping criteria that were used to determine the ARN are defined by DMRB LA 105 (Highways England, et al., 2019). Table 5.10 summarises the changes predicted by the traffic model for ARN within 200m of North Downs Woodlands SAC.

**Table 5.10 Summary of the traffic scoping criteria met at the ARN link identified within 200m of the North Downs Woodlands SAC**

Road (Traffic model link ID)	AADT change	HDV change	Speed band change	Carriageway alignment change
A229 (83301_83306 & 83310_88842)	10180	1063	N/A	NA

- 5.1.25 Table 5.11 to Table 5.13 summarise the results of the AQ modelling and illustrate the minimum and maximum changes recorded at North Downs Woodlands SAC. The values for the CL and LCL are taken from the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2023) for most sensitive habitat types present within 200m of the ARN. Figure 22c of the HRA [APP-487] shows the relationship between the modelled points and the boundary of the European site.

**Table 5.11 Summary of the maximum predicted changes in NO<sub>x</sub> concentrations as a result of operational traffic for the ‘Base Year’ (BY), ‘Do Minimum’ (DM) and ‘Do Something’ (DS) scenarios**

Minimum/ maximum changes	Relevant CL $\mu\text{g}/\text{m}^3$	BY $\mu\text{g}/\text{m}^3$	DM $\mu\text{g}/\text{m}^3$	DS $\mu\text{g}/\text{m}^3$	DS-DM change $\mu\text{g}/\text{m}^3$
Minimum	30	34.76	21.02	21.25	0.23
Maximum	30	35.48	21.47	21.74	0.27

**Table 5.12 Summary of the predicted changes in NH<sub>3</sub> concentrations as a result of operational traffic for the ‘Base Year’ (BY), ‘Do Minimum’ (DM) and ‘Do Something’ (DS) scenarios**

Minimum/ maximum changes	Relevant CL $\mu\text{g}/\text{m}^3$	BY $\mu\text{g}/\text{m}^3$	DM $\mu\text{g}/\text{m}^3$	DS $\mu\text{g}/\text{m}^3$	DS-DM change $\mu\text{g}/\text{m}^3$
Minimum	3	3.31	1.56	1.58	0.02
Maximum	3	3.28	1.58	1.60	0.02

- 5.1.26 The maximum total concentration of NO<sub>x</sub> in the DS scenario does not exceed the relevant CL and the maximum change in concentration at opening year will not exceed 1% of the CL. The maximum total concentration of NH<sub>3</sub> in the DS scenario does not exceed the relevant CL and the maximum change in concentration at opening year will not exceed 1% of the CL. Therefore, the

changes in NO<sub>x</sub> and NH<sub>3</sub> concentrations would result in no change in habitat composition within the North Downs Woodlands SAC and no LSEs are predicted to occur as a result of the Project alone.

**Table 5.13 Minimum and maximum changes in total nitrogen (N) deposition at North Downs Woodlands SAC for the ‘Base Year’ (BY), ‘Do Minimum’ (DM) and ‘Do Something’ (DS) scenarios**

Minimum/ maximum changes	Total N deposition (kg N ha <sup>-1</sup> yr <sup>-1</sup> )				
	Relevant LCL	BY	DM	DS	DS-DM change
Minimum	5	34.92	34.16	34.36	0.20
Maximum	5	35.23	34.40	34.62	0.22

5.1.27 The methodology follows Figure 2.98 in LA 105 (Highways England, et al., 2019). Using the data summarised in Table 5.13, the following conclusions have been made:

- a. The total N deposition in the DS scenario exceeds the relevant LCL at all sample points within North Downs Woodlands SAC.
- b. The change in N deposition between the DS and DM scenario is greater than 1% of the relevant LCL at all the sample points within North Downs Woodlands SAC.

5.1.28 As well as the changes in nitrogen deposition predicted at North Downs Woodlands SAC being greater than 1% of the LCL, the qualifying habitats are listed as vulnerable to changes in N deposition within Natural England’s supplementary advice for North Downs Woodlands SAC (Natural England, 2019b). Therefore, LSE cannot be discounted at North Downs Woodlands SAC as a result of the Project.

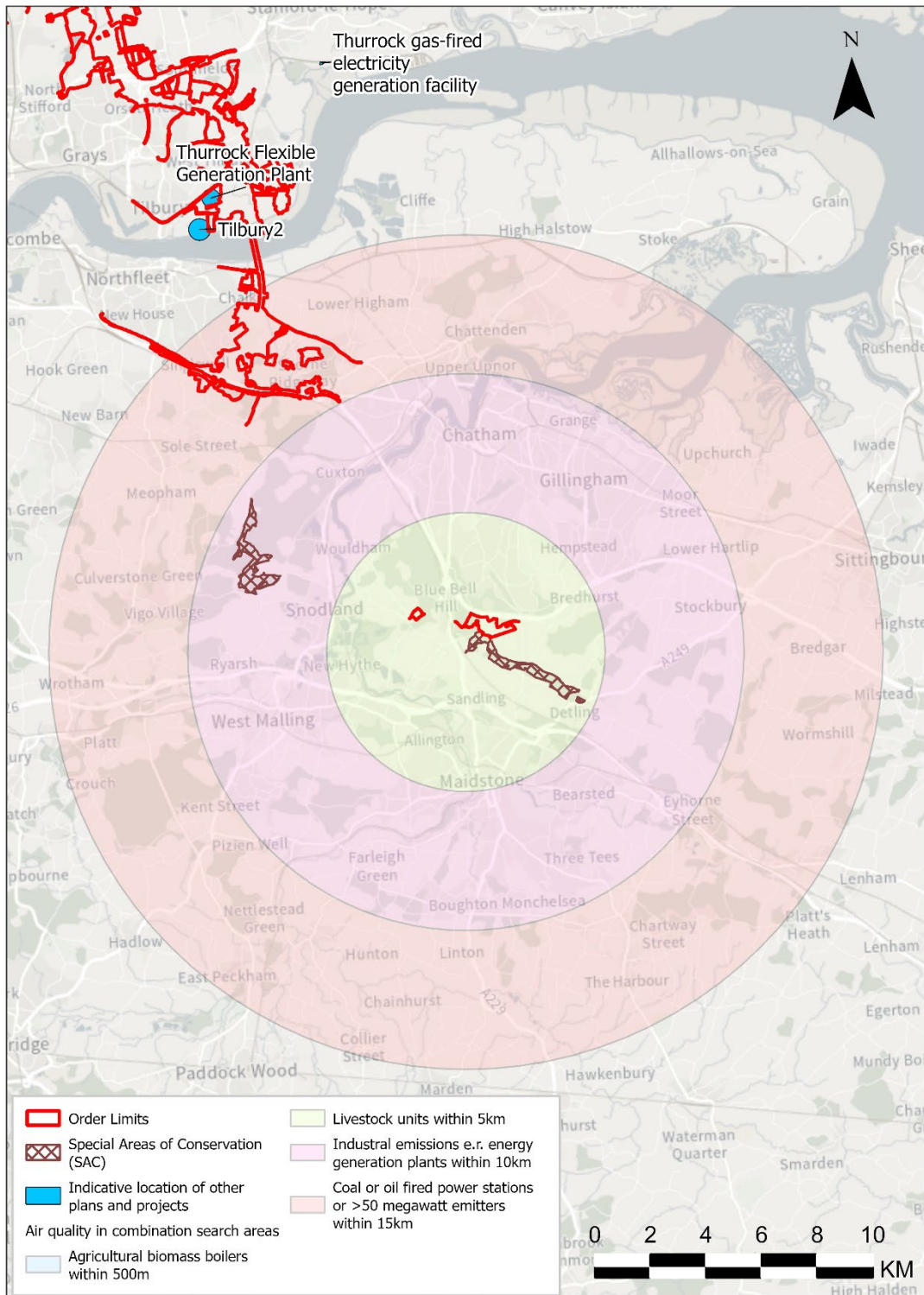
*Effect in-combination*

5.1.29 Where uncertainty of LSE remains for the deposition of nitrogen as a result of the Project alone (paragraph 5.1.28), the possibility of LSE is also uncertain in-combination with other plans and projects for North Downs Woodlands SAC. The in-combination assessment is completed as part of the assessment of effect on integrity of European sites in Section 6.2.

5.1.30 The effect of the changes in NO<sub>x</sub> and NH<sub>3</sub> were assessed in combination to determine if LSE could be ruled out for the Project in combination with other plans and projects.

5.1.31 No other plans or projects were identified within the search area around North Downs Woodlands SAC (See Plate 5.1). Therefore, changes in NO<sub>x</sub> and NH<sub>3</sub> concentrations predicted for the Project alone could not act in combination with any other plans and projects and no LSEs are predicted to occur as a result of the Project alone (paragraph 5.1.26) or in combination with any other plans and projects.

**Plate 5.1 Location of other plans and projects Identified for in-combination assessment – North Downs Woodlands SAC**



## 5.2 Conclusion of Stage 1 screening

5.2.1 The European sites identified were:

- a. Thames Estuary and Marshes Ramsar site
- b. Epping Forest SAC
- c. North Downs Woodlands SAC

5.2.2 The potential effects of the Project were assessed alone and in-combination with other plans and projects, and this identified three categories that reflect whether LSEs would occur at the European sites identified (or if uncertainty remains):

- a. Project effects where no pathway to effect was found
- b. Project effects that would be ecologically inconsequential and therefore where no LSE would occur
- c. Project effects where LSE could not be discounted

5.2.3 All LSEs considered were wholly within England and no effects were considered to be likely in respect of European sites in devolved administrations.

5.2.4 Table 5.14 to Table 5.16 summarise the results of the assessment.

**Table 5.14 Summary of the conclusion of the assessment of LSE on Thames Estuary and Marshes Ramsar site**

Potential LSE	No LSE		LSE not discounted
	Project effects with no pathway to effect	Inconsequential Project effects resulting in no LSE	Project effects where LSE cannot be discounted
Reduction in habitat area	Change in air quality – vehicle emissions – operation	Change in air quality – vehicle emissions – construction (within the site itself) relating to NH <sub>3</sub> changes and N deposition	Change in air quality – vehicle emissions – construction (within the site itself) relating to NOx changes

**Table 5.15 Summary of the conclusion of the assessment of LSE on Epping Forest SAC**

Potential LSE	No LSE		LSE not discounted
	Project effects with no pathway to effect	Inconsequential Project effects resulting in no LSE	Project effects where LSE cannot be discounted
Reduction in habitat area	None	None	Change in air quality – vehicle emissions – operation (within the site itself) relating to changes in NOx, NH <sub>3</sub> and N deposition

**Table 5.16 Summary of the conclusion of the assessment of LSE on North Downs Woodlands SAC**

Potential LSE	No LSE		LSE not discounted
	Project effects with no pathway to effect	Inconsequential Project effects resulting in no LSE	Project effects where LSE cannot be discounted
Reduction in habitat area	None	Change in air quality – vehicle emissions – operation (within the site itself) relating to changes in NOx and NH <sub>3</sub>	Change in air quality – vehicle emissions – operation (within the site itself) relating to N deposition



## 6 Stage 2 appropriate assessment

### 6.1 Mitigation

- 6.1.1 The mitigation measures that have been put in place to avoid or reduce the effect pathways identified at Stage 1 screening are set out in the following paragraphs and have been included within the Stage 2 appropriate assessment reported in Section 6.2.

#### Measures to reduce the effects of nitrogen deposition

##### Operation

- 6.1.2 The conclusion of the assessment is that adverse effects on the integrity of Thames Estuary and Marshes Ramsar site, Epping Forest SAC and North Downs Woodlands SAC can be excluded beyond reasonable scientific doubt on the basis that the predicted scale of the impact of N deposition would cause no consequential risk of a measurable change in the habitats. Consequently, no mitigation measures are required or proposed by the Applicant.
- 6.1.3 However, during consultation for the HRA [APP-487], Natural England advised that they did not agree that adverse effects on Epping Forest SAC could be discounted without mitigation. The SoCG [APP-099] between the Applicant and Natural England reports the positions of the two parties in relation to this matter; see Table 2.1 Item 2.1.94 of that document.
- 6.1.4 In order to show due regard to the representations of Natural England, on a without prejudice basis potential mitigation measures were investigated as to the feasibility of avoiding or reducing the predictions of the impact (N deposition) to below screening thresholds, as opposed to avoiding or reducing the adverse effect potentially caused by that impact (which is considered to be inconsequential, and which cannot be mitigated). The results of National Highways' without prejudice assessment of a potential speed limit reduction are presented in the Natural England SoCG Annex A.7 'Without prejudice consideration of mitigation for air quality effects on Epping Forest SAC' [APP-099]. As noted at paragraph 6.1.2 above the Applicant's position is that no mitigation measures are required or proposed.



## 6.2 Assessment of effect on integrity of European sites

### Thames Estuary and Marshes Ramsar site

#### Changes in air quality as a result of vehicle emissions in construction

- 6.2.1 There is a risk that LSE cannot be discounted on the Thames Estuary and Marshes Ramsar site as a result of the Project for the following effect pathways:
- Changes in air quality within the Thames Estuary and Marshes Ramsar site (affecting all features) as a result of vehicle emissions, specifically the changes in concentration of nitrogen oxides, in construction.

#### Magnitude/significance of the effects

##### *Effect alone*

- 6.2.2 This section describes the effects of the Project alone, to distinguish it from the in-combination assessment presented in paragraphs 6.2.6 to 6.2.9. It is recognised that the assessment here (as described in paragraph 3.5.8) is of the changes in vehicle emissions as a result of the Project in-combination (rather than strictly 'alone') with other plans and projects that would contribute traffic into the modelled road network. This is due to the way traffic figures are generated using government traffic growth forecasts and is the most appropriate data available for estimating Project effects alone.
- 6.2.3 The predicted concentrations of NO<sub>x</sub> at one of the sample points within the Thames Estuary and Marshes Ramsar site exceeded the relevant CL and the DS-DM changes also exceeded the 1% CL threshold (see Plate 6.1) within the first two years of construction. The other factors that influence this assessment are set out in Table 6.1.



**Table 6.1 Consideration of other factors for Thames Estuary and Marshes Ramsar site**

Other factors considered	Thames Estuary and Marshes Ramsar site
What conditions is the habitat affected currently exposed to (e.g. existing exceedance of critical load)?	Air Pollution Information System NO <sub>x</sub> critical levels for this part of the SAC (30µgm <sup>-3</sup> ) are not exceeded with the current three year (2019–2021) average concentration 22.4µgm <sup>-3</sup> .
What is the area and quality of the habitat affected as a proportion of the qualifying habitat within the European site?	<p>Site is 5,588.59ha.</p> <p>Extent of coastal and floodplain grazing marsh within the site is 1,126.11ha.</p> <ul style="list-style-type: none"> <li>• Approximately 0.8ha affected by changes in NO<sub>x</sub> concentrations &gt; 1% CL</li> </ul> <p>The survey work indicated that the habitat within this part of the Ramsar site is poor semi-improved grassland with a network of ditches. The ditches have a variety of emergent, submerged and floating vegetation.</p>
Will there be any direct loss of habitat or change to the distribution of such habitats?	No direct loss or change in distribution is predicted to occur.
What is the predicted duration of the impact?	Timescale of the impact was predicted to be a maximum of two years.
Are NO <sub>x</sub> changes predicted below the current baseline concentrations levels (e.g. due to technological improvements in vehicle emissions between now and the time the Project is operational)?	The NO <sub>x</sub> concentrations for the DS scenario (i.e. with the Project in place) were predicted to be greater than the current baseline (APIS background average for grid square) with the predicted changes between the DS and DM scenarios ranging from 6.20% to 6.23% of the critical level (30µgm <sup>-3</sup> ).
Using professional judgement, taking into account the above factors, will there be a reduction in habitat area that significantly contributes to the favourable conservation status of the European site?	No reduction in habitat area is predicted to occur given that the area is only predicted to be affected by small increases (1.35µgm <sup>-3</sup> and 0.51µgm <sup>-3</sup> ) in NO <sub>x</sub> concentration above the critical level in the first two years of construction. Therefore, it is considered that the conservation status of that part of the site would not change as a result.

6.2.4 The predicted changes in the concentration of NO<sub>x</sub> are over a short period (two years). The extent of habitat potentially affected by changes in NO<sub>x</sub> concentration within Thames Estuary and Marshes Ramsar site is 0.8ha which equates to 0.07% of the coastal and floodplain grazing marsh within the site.

6.2.5 It is considered that the changes in concentrations, over a small area of habitat, for a limited period of time would not result in any consequential changes in the habitat composition.

*Effect in-combination*

6.2.6 The other plans and projects identified within the search areas were primarily on the National Infrastructure Planning register of applications and local authority planning portals. The Environment Agency’s list of permit applications were reviewed, however they did not include any applications for permits that



coincided with the construction years. Also, the majority of these permit applications did not appear on the local planning authority planning portals and are therefore sufficiently small and/or will not have any significant environmental effects such that they are extremely unlikely to contribute, in combination with the Project, to NO<sub>x</sub> concentration over the wider area.

6.2.7 The projects identified within the search areas were then reviewed to determine whether the predicted NO<sub>x</sub> concentration from them coincided with the construction years from the Project. The projects identified (see Figure 23a of the HRA [APP-487] for locations) as potentially overlapping with the Project construction phase air quality changes are set out below.

- a. Tilbury2. A new port terminal on the site of the demolished Tilbury Power Station. Construction was completed in 2020 and it is now operational. The background emissions for the Project model are 2017–2019 therefore Tilbury2 was not included and therefore is assessed as part of the in-combination assessment as it will generate emissions from shipping which were considered as part of the Tilbury2 DCO application.
- b. Thurrock Flexible Generation Plant. These works comprise an NSIP and the DCO application was granted in February 2022 with the operation predicted to overlap the Project construction phase. The development comprises a gas-fired electricity generating station and a battery storage facility on land to the north of Tilbury substation, Thurrock.
- c. Thurrock gas-fired electricity generation facility, Stanford (19/01534/FUL). A planning application was submitted to Thurrock Council in October 2019 and is awaiting decision, for installation of 25 gas engine generators, a gas house, distribution network operator building for transformers and associated vehicular access roads for a gas-fired electricity generation facility at Wharf Road, Stanford-le-Hope, Essex. For the purposes of this assessment the Applicant has assumed there is potential for the operation of this facility to overlap with the Project construction phase.
- d. STOR 'Peaking' Power Plant, Purfleet (20/00360/FUL). Thurrock Council granted planning permission in May 2020 for a change of use of an existing building to house eight No. 2.5Mwe engines and associated plant. The facility will generate a combined total of up to 20MW of electricity to feed into the National Grid. For the purposes of this assessment the Applicant has assumed there is potential for the operation of this facility to overlap with the Project construction phase.

6.2.8 Other plans or projects and the respective contributions to NO<sub>x</sub> concentrations within the search area around Thames Estuary and Marshes Ramsar site are shown in Table 6.2. The list of plans and projects is limited to where data on NO<sub>x</sub> concentration was available or where a reasonable proxy could be used.

**Table 6.2 Contribution to NOx concentrations on Thames Estuary and Marshes Ramsar site from other plans and projects**

	NOx $\mu\text{gm}^{-3}$
Background (APIS 2017-2019 <sup>7</sup> )	25.5
CL/LCL of habitat affected by the Project alone	30
The Project alone – average change (DS-DM) over the construction period	1.59
<b>Other plans and projects</b>	<b>Contribution to NOx <math>\mu\text{gm}^{-3}</math></b>
Tilbury2	0.00048
Thurrock Flexible Generation Plant	2.1
Thurrock gas-fired electricity generation facility (19/01534/ FUL)	3.14
STOR 'Peaking' Power Plant (20/00360/FUL)	No effect identified in the application
<b>Concentration/deposition attributable to in-combination projects</b>	<b>6.83</b>
<b>Total predicted concentration/deposition (Background plus in-combination)</b>	<b>32.33</b>

6.2.9 The background concentration of NOx to the Thames Estuary and Marshes Ramsar site does not exceed the CL for the habitat type potentially affected by the Project alone. The combined concentration and deposition added to the background for the Project alone and in combination with other plans and projects is greater than the CL. However, the Project alone is considered to have an inconsequential effect, it is considered that the effect in combination is also highly unlikely to result in changes in habitat composition that would be of consequence to the Ramsar site qualifying features.

#### Assessment of effect on integrity

6.2.10 The Project alone and in-combination could potentially affect the achievement of the following conservation objectives for the Thames Estuary and Marshes SPA and by proxy the Thames Estuary and Marshes Ramsar site:

- a. The extent and distribution of the habitats of the qualifying features
- b. The population of each of the qualifying features
- c. The distribution of the qualifying features within the site

6.2.11 The Natural England supplementary advice (Natural England, 2018) to the conservation objectives for the Thames Estuary and Marshes SPA/Ramsar site includes supporting attributes and targets, as set out in paragraph 4.2.2, that could be affected by the Project.

<sup>7</sup> APIS 2017-2019 is used as the background for the in combination as it is the APIS years used within the air quality model when calculating the effect of the Project alone

6.2.12 The AQ attribute has been reviewed against the effects of the Project (as set out in Section 6.1) and based on the targets presented in the supplementary advice have been refined to those considered when determining the effect of the Project on the integrity of each of the European sites. Table 6.3 provides a summary of that review.

**Table 6.3 Summary of the review of attributes against the Project effects**

Attribute	Consideration in assessment of adverse effects
Supporting habitat: air quality	The effect of the Project increasing the concentrations of NOx over the critical level is limited to two construction years and would not alter the suitability of the habitat (freshwater and coastal grazing marsh) for the qualifying features. The target to maintain air quality would not be affected over such a short period with the later construction years recording NOx concentrations lower than the critical level, hence meeting the target of maintain.

**The extent and distribution of the habitats of the qualifying features**

6.2.13 The Natural England supplementary advice for the Thames Estuary and Marshes SPA provides the following targets associated with this conservation objective.

a. Thames Estuary and Marshes SPA. Supporting habitat: extent and distribution of supporting habitat for the non-breeding season. Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) at the following:

- i. Intertidal sand and muddy sand 1.16ha
- ii. Intertidal mixed sediment 0.61ha
- iii. Coastal reedbeds 30.83ha
- iv. Coastal lagoons 136.64ha
- v. Freshwater and coastal grazing marsh 1,126.11ha
- vi. Saltmarsh 108.14ha

6.2.14 The Project changes in NOx concentration would not result in any loss or degradation of freshwater and coastal grazing marsh.

**Conclusion**

6.2.15 The conservation objectives of the Thames Estuary and Marshes SPA, and by proxy the Thames Estuary and Marshes Ramsar site, would not be undermined by the construction and operation of the Project alone or in-combination with other plans and projects. Consequently, it is concluded that the Project alone or in-combination with other plans and projects would not have an adverse effect on the integrity of the Thames Estuary and Marshes Ramsar site.



## Epping Forest SAC

- 6.2.16 There is a risk of LSE on the Epping Forest SAC as a result of the Project due to the changes in air quality (NO<sub>x</sub> and NH<sub>3</sub> concentrations and nitrogen deposition) as a result of vehicle emissions in operation.

### Magnitude/significance of effect

#### Changes in air quality as a result of vehicle emissions in operation

##### *Effect alone*

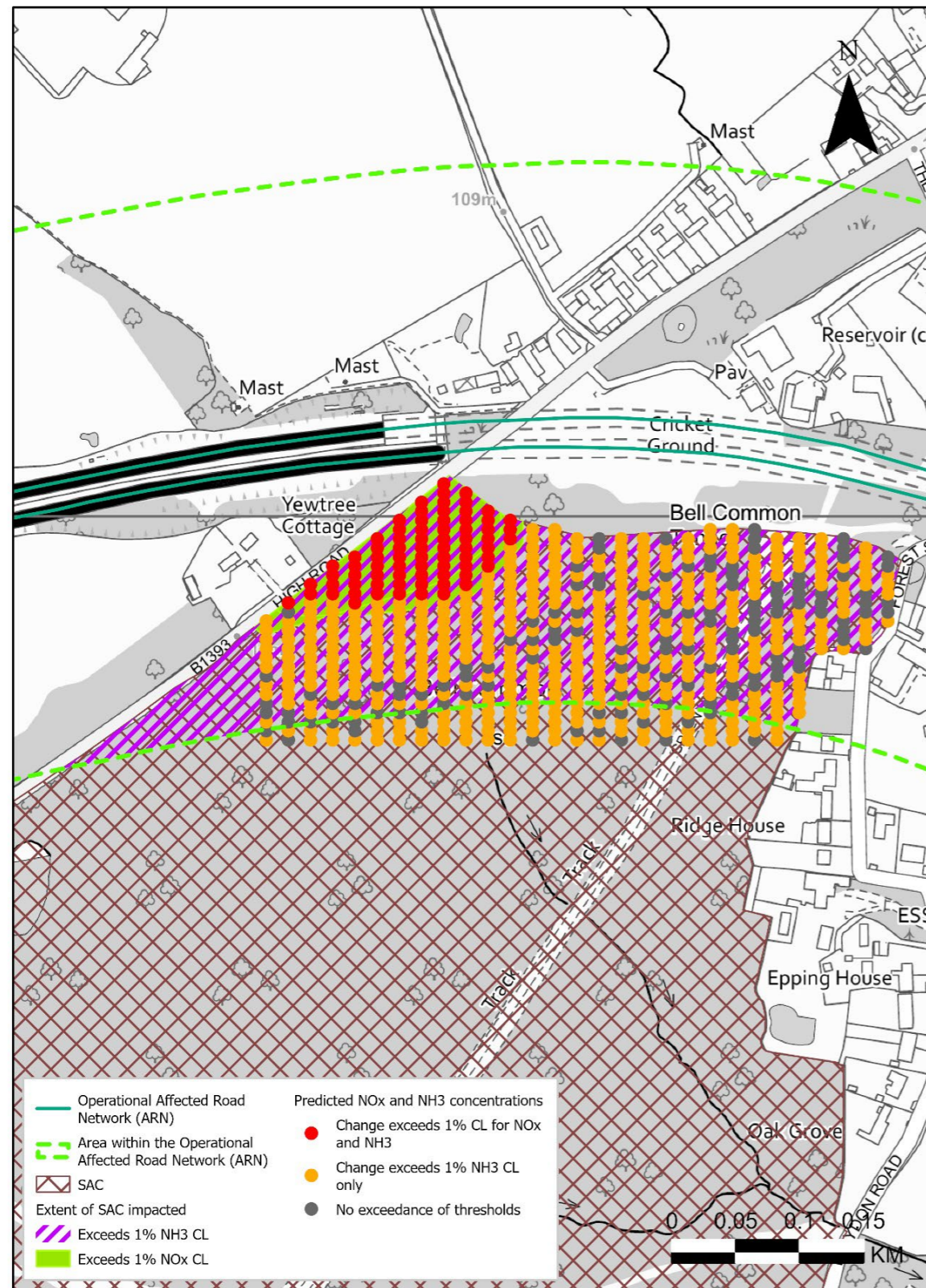
- 6.2.17 This section describes the effects of the Project alone, to distinguish it from the in-combination assessment presented in paragraphs 6.2.23 to 6.2.27. It is recognised that the assessment here (as described in paragraph 3.5.8) is of the changes in vehicle emissions as a result of the Project in-combination (rather than strictly 'alone') with other plans and projects that would contribute traffic into the modelled road network. This is due to the way traffic figures are generated using government traffic growth forecasts and is the most appropriate data available for estimating Project effects alone.
- 6.2.18 The predicted concentrations of NO<sub>x</sub> and NH<sub>3</sub> at a number of the sample points within the Epping Forest SAC exceeded the relevant CLs and DS-DM changes also exceeded the 1% CL threshold (see Plate 6.2). The current background data for NO<sub>x</sub> and NH<sub>3</sub> concentration provided by APIS (2019–2021) are a grid square average and not necessarily reflective of the higher concentrations of both pollutants in the areas closer to the M25. The base year in the air quality model (see Table 5.7 and Table 5.8) therefore provides a better reflection of the baseline conditions in this location rather than the APIS background<sup>8</sup> it is considered likely that these parts of the SAC are already exposed to concentrations exceeding the relevant critical levels. The survey data did not record any nitrogen sensitive species or any vegetation trends with distance from the road. Therefore, this habitat is considered likely to be resilient to these pollutants and no change in habitat composition is anticipated as a result of the predicted NO<sub>x</sub> and NH<sub>3</sub> concentrations in the DS scenario. The other factors that influence this assessment have been considered as set out in Table 6.4.
- 6.2.19 The change in N deposition exceeds 1% of the LCL at a number of the modelled points and is greater than 0.4kg N ha<sup>-1</sup>yr<sup>-1</sup> at sample points within the Epping Forest SAC, as shown on Plate 6.3. This could theoretically lead to the loss of one species (as described in paragraph 3.4.2), although this is not treated as a single criterion to assess effects on integrity. The species recorded during the survey in the area, where that N deposition change is predicted to be greater than 0.4kg N ha<sup>-1</sup>yr<sup>-1</sup>, did not include any that were sensitive to N deposition (as described in paragraphs 4.3.6 to 4.3.8 and Appendix D of the HRA [APP-487]). Therefore, this habitat is considered to be resilient to this impact and no loss of species is anticipated as a result of this change in N deposition. The other factors that influence this assessment have been considered as set out in Table 6.4.

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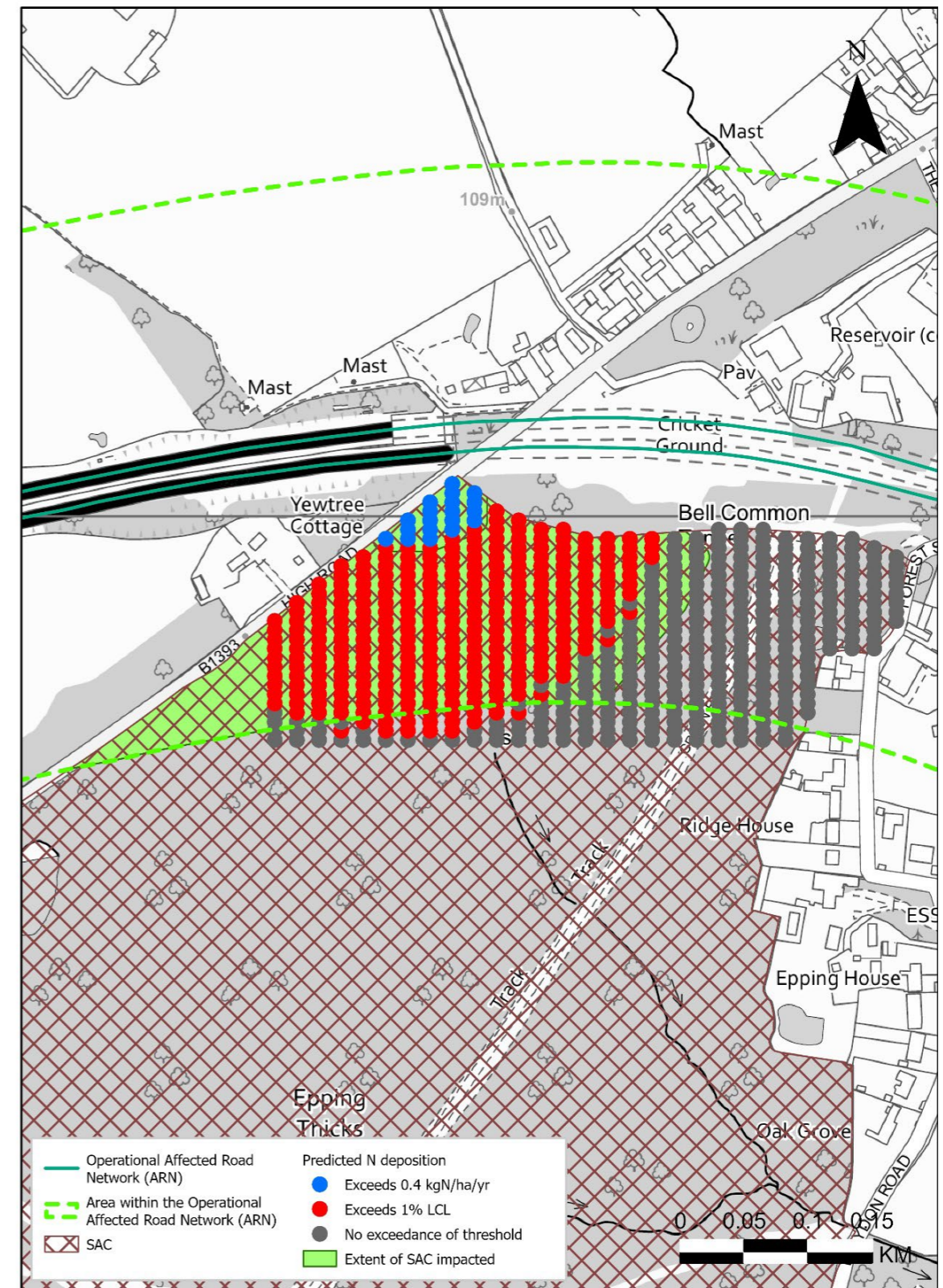
<sup>8</sup> The base year is 2016 and the APIS background for 2017–2019 recorded NO<sub>x</sub> concentration as 28.53µgm<sup>-3</sup> and NH<sub>3</sub> concentration as 1.63µgm<sup>-3</sup> for the relevant grid square.



**Plate 6.2 Extent of the predicted changes in NO<sub>x</sub> and NH<sub>3</sub> concentrations within the Epping Forest SAC**



**Plate 6.3 Extent of the predicted changes in nitrogen deposition within the Epping Forest SAC**





**Table 6.4 Consideration of other factors for Epping Forest SAC**

Other factors considered	Epping Forest
What conditions is the habitat affected currently exposed to (e.g. existing exceedance of critical load)?	<p>Air Pollution Information System NO<sub>x</sub> critical levels for this part of the SAC<sup>9</sup> (30 µgm<sup>-3</sup>) are not exceeded with the three year (2019–2021) average concentration 21.77µgm<sup>-3</sup>. Noting the comments on grid square averages in paragraph 0 above.</p> <p>Air Pollution Information System NH<sub>3</sub> critical levels for this part of the SAC<sup>9</sup> (1µgm<sup>-3</sup>) are exceeded with the three year (2019–2021) average concentration 1.42µgm<sup>-3</sup> and the exceedance of critical level ranging from 0.42µgm<sup>-3</sup>.</p> <p>Air Pollution Information System nitrogen critical loads for this part of the SAC<sup>9</sup> (10–20kg N ha<sup>-1</sup>yr<sup>-1</sup>) are exceeded with the three year (2019–2021) average deposition 26.97kg N ha<sup>-1</sup>yr<sup>-1</sup>, an exceedance of the lower critical load 16.97kg N ha<sup>-1</sup>yr<sup>-1</sup>.</p>
What is the area and quality of the habitat affected as a proportion of the qualifying habitat within the European site?	<p>Site is 1,630.74ha.</p> <p>Extent of qualifying habitat (H9120) within the site is 652.3ha</p> <ul style="list-style-type: none"> <li>• Approximately 0.8ha affected by changes in NO<sub>x</sub> concentrations &gt; 1% CL</li> <li>• Approximately 7.2ha affected by changes in NH<sub>3</sub> concentrations &gt; 1% CL</li> <li>• Approximately 4.9ha affected by nitrogen deposition changes &gt;1% LCL.</li> <li>• Approximately 0.3ha where change in nitrogen deposition is &gt;0.4kg N ha<sup>-1</sup>yr<sup>-1</sup></li> </ul> <p>The survey work indicated that the habitat within this part of the SAC was representative of the qualifying habitat (H9120 Beech forests), however the quality was low, and no nitrogen-sensitive species were recorded.</p>
Will there be any direct loss of habitat or change to the distribution of such habitats?	No direct loss or change in distribution is predicted to occur.
What is the predicted duration of the impact?	Timescale of the impact was predicted to be four years.
Are NO <sub>x</sub> / NH <sub>3</sub> / N deposition operational changes predicted below the current baseline concentrations/deposition levels (e.g. due to technological improvements in vehicle emissions between now and the time the Project is operational)?	<p>The DS scenario (i.e. with the Project in place) for NO<sub>x</sub> was predicted to be greater than the current baseline (APIS background average for grid square) with the predicted changes between the DS and DM scenarios ranging from 0.23% to 5.8% of the critical level (30µgm<sup>-3</sup>).</p> <p>The DS scenario (i.e. with the Project in place) and DM scenario (i.e. without the Project in place) for NH<sub>3</sub> was predicted to be higher than the baseline (current) situation with predicted changes between DS and DM ranging from 1% and 9% of the critical level (1µgm<sup>-3</sup>).</p> <p>The DS scenario (i.e. with the Project in place) for N deposition was predicted to equal or be slightly less than the baseline (current) situation.</p> <p>The AQ modelling used a conservative estimate when predicting the future changes in background N deposition and assumes no change between the base year (2016) and opening year (2030), i.e. does not consider improvements from technology. With the anticipated improvements in technology regarding vehicle emissions, the predicted concentrations of NO<sub>x</sub> and N deposition with the Project (DS scenario) are in reality likely to be lower than calculated and below the current baseline levels. NH<sub>3</sub> concentrations are not predicted to improve with the AQ modelling predicting both DM and DS scenarios above base year and the APIS background.</p>
Using professional judgement, taking into account the above factors, will there be a reduction in habitat area that significantly contributes to the favourable conservation status of the European site?	The habitat composition of the area affected by the predicted changes in NO <sub>x</sub> and NH <sub>3</sub> concentrations, and N deposition is not considered likely to change given the lack of nitrogen-sensitive species recorded, no gradient in vegetation composition with distance from the road and the small increase in both concentration and deposition predicted. Therefore, it is considered that the conservation status of that part of the site would not change as a result.

<sup>9</sup> Data from APIS GIS map tool for Site Relevant Critical Loads & Search by Location. Grid reference used for area affected in Epping Forest – TL4458901026

6.2.20 The extent of qualifying habitat potentially affected by changes in NO<sub>x</sub> and NH<sub>3</sub> concentrations, and N deposition within Epping Forest SAC has been calculated and the proportions in relation to each of these sites shown in Table 6.5.

**Table 6.5 Proportions of habitat affected in Epping Forest SAC**

<b>Extent of the SAC</b>	Total area of SAC (ha)	1,630.74
	Proportion of site affected by changes in concentration of NO <sub>x</sub> >1% CL	0.05%
	Proportion of site affected by changes in concentration of NH <sub>3</sub> >1% CL	0.44%
	Proportion of site affected by changes in N deposition of >1% LCL (%)	0.3%
	Proportion of site affected by changes in N deposition of >0.4kg N ha <sup>-1</sup> yr <sup>-1</sup> (%)	0.02%
<b>Extent of the qualifying habitat</b>	Total area of qualifying habitat within SAC (ha)	652.3
	Proportion of habitat affected by changes in concentration of NO <sub>x</sub> >1% CL	0.13%
	Proportion of habitat affected by changes in concentration of NH <sub>3</sub> >1% CL	1.10%
	Proportion of habitat affected by changes in N deposition of >1% LCL (%)	0.75%
	Proportion of habitat affected by changes in N deposition of >0.4kg N ha <sup>-1</sup> yr <sup>-1</sup> (%)	0.05%

6.2.21 The background concentrations of NO<sub>x</sub>, NH<sub>3</sub> and nitrogen deposition reported on APIS are provided as a three-year average for a 1km grid square that includes the location within Epping Forest SAC that is closest to the ARN. The limitation of relying on the background from APIS to judge how far the critical levels and loads are exceeded for this part of the site is that the average grid square does not provide an accurate representation of the influence of the M25 (the ARN) on the concentrations of NO<sub>x</sub>, NH<sub>3</sub> and nitrogen deposition. The base year (2016) calculated in the AQ model provides a better representation of the baseline conditions being experienced by the habitats in this part of the SAC.

6.2.22 Table 6.6 provides a summary of the extent of the exceedances of critical levels/loads in the baseline conditions in comparison to the changes predicted as a result of the Project.

**Table 6.6 Comparison of the exceedances of critical loads for Epping Forest SAC with the predicted change as a result of the Project**

		<b>N deposition kg N ha<sup>-1</sup> yr<sup>-1</sup></b>	<b>NOx µgm<sup>-3</sup></b>	<b>NH<sub>3</sub> µgm<sup>-3</sup></b>
<b>Baseline conditions (Current APIS background)</b>	Relevant LCL/CL	10	30	1
	Three-year (2019–2021) average concentration/ deposition (Current APIS background)	26.97	21.77	1.42
	Maximum range of exceedance of critical levels/ critical loads	16.97	-8.23	0.42
	Maximum range of exceedance of critical levels/loads as a percentage of the LCL/CL	169%	-27%	42%
<b>Baseline conditions (Base Year)</b>	Maximum total concentration/deposition calculated for the Base Year (2016)	61.50	106.36	3.64
	Maximum range of exceedance of critical levels/ loads as a percentage of the CL/LCL	515%	254%	264%
<b>Do Minimum scenario at opening year</b>	Maximum total concentration/deposition at opening year (Do Minimum scenario)	58.53	69.10	3.94
	Maximum range of exceedance of critical loads as a percentage of the CL/LCL	485%	130%	294%
<b>Do Something scenario at opening year</b>	Maximum total concentration/ deposition at opening year (Do Something scenario)	59.53	70.84	4.03
	Maximum change in concentration/deposition as a result of the Project	1.01	1.74	0.09
	Change in concentration/deposition as a result of the Project (Do Something scenario) as a percentage of the CL/LCL	10.1%	5.8%	9.0%

*Effect in-combination*

- 6.2.23 The contribution of changes in traffic from other plans or projects has already been considered with the ‘Effects of the Project alone’ assessment, as the data used within the traffic model takes into account predicted changes in traffic from other plans and projects. The other plans and projects identified within the search areas were primarily on the National Infrastructure Commission’s programme of projects and the Environment Agency’s list of permit applications.
- 6.2.24 The Environment Agency’s list of permit applications did not include any future permit applications that would have coincided with the Project opening year,

2030. However, any Environment Agency permits, once granted, would have a variety of thresholds for emissions to air which aim to protect the surrounding environment.

6.2.25 Therefore, the projects identified within this assessment are considered to be a reasonable representation of the other plans or projects likely to have an effect on N deposition in-combination with the Project. The locations are shown on Figure 23b, of the HRA [APP-487], and are as follows:

- a. North London Heat and Power Project. An NSIP that was granted development consent in February 2017. It is an energy recovery facility located at the Edmonton EcoPark and will replace the existing Energy from Waste facility. The site is currently under construction and predicted to be operational from 2025. It is approximately 12km south-west of the area of the Epping Forest SAC affected by the Applicant’s Project.

6.2.26 Other plans or projects and the respective contributions to N deposition within the search area around Epping Forest SAC are shown in Table 6.7. The list of plans and projects is limited to where data on N deposition was available or where a reasonable proxy could be used.

**Table 6.7 Contribution to N deposition on Epping Forest SAC from the Project in-combination with other plans and projects**

Pollutant	Background (APIS 2017–2019)	CL/LCL of habitat affected by the Project alone	Project alone	Other plans or projects	Total combined potential concentration/deposition
				North London Heat and Power Project	
NOx µgm <sup>-3</sup>	28.53	30	1.74	No effect identified in the application	30.27
NH <sub>3</sub> µgm <sup>-3</sup>	1.63	1	0.09		1.72
Nitrogen deposition kg N ha <sup>-1</sup> yr <sup>-1</sup>	29.63	10	1.01	0.076	30.72

6.2.27 Table 6.7 shows that the other plans and projects did not identify any changes in NOx or NH<sub>3</sub>, therefore the effect of these pollutants in combination is the same as the Project alone. Table 6.7 shows that the background N deposition (29.63kg Nha<sup>-1</sup>yr<sup>-1</sup>) at Epping Forest far exceeds the LCL for the habitat type potentially affected by the Project alone. The combined change in N deposition of all the projects identified (see Table 6.7) is 1.086kg Nha<sup>-1</sup>yr<sup>-1</sup>, 10.86% of the LCL. The duration of effect from the Project alone is considered short term as the NOx emissions are equal to the DM scenario after four years. The length of time the Project could act in-combination with other plans and projects is limited to four years and therefore the changes in nitrogen deposition would be inconsequential to the receiving habitats. Also, the detailed site investigations



completed as part of the assessment of the Project alone indicate that the habitat within the SAC potentially affected by the Project did not support any nitrogen-sensitive species, suggesting that further changes in N deposition would not result in the loss of one species.

### Assessment of effect on integrity

- 6.2.28 The conservation objectives for the Epping Forest include attributes and targets relating to air quality and the assessment of effect on the integrity of the sites is judged on the basis of whether the Project would undermine these targets being achieved. The Project has the potential to result in a reduction in habitat area which could affect the following conservation objectives:
- The supporting processes on which the qualifying natural habitats rely
  - The extent and distribution of the qualifying natural habitats
  - The structure and function (including typical species) of the qualifying natural habitats
- 6.2.29 The supplementary advice for Epping Forest SAC (Natural England, 2019a) included an air quality attribute and related target and has a restore target for the concentrations and deposition of air pollutants, to below or equal to the site-relevant critical load.
- 6.2.30 The maximum predicted NO<sub>x</sub> concentration with the Project in place is slightly higher than the Do Minimum scenario and both exceed the critical level and are greater than background (noting discussion in paragraph 6.2.21) but equal to or less than the Base Year, due to the predicted improvements in vehicle emissions. The maximum predicted NH<sub>3</sub> concentration with the Project in place is slightly higher than the Do Minimum scenario and both exceed the critical level as well as the background and the Base Year. The future predicted concentrations of NH<sub>3</sub> from vehicle emissions, unlike NO<sub>x</sub>, are uncertain. However the ban of full petrol and diesel vehicles from 2030 and the accelerated uptake of electric vehicles will result in a reduction of NH<sub>3</sub> from road transport. The maximum predicted N deposition with the Project in place is slightly higher than the Do Minimum scenario, but both scenarios predict N deposition greater than background (noting discussion in paragraph 6.2.21) but equal to or less than the Base Year, due to predicted improvements in vehicle emissions.
- 6.2.31 The site-relevant critical levels for NO<sub>x</sub> are currently (APIS 2019–2021) not exceeded, however as set out in paragraph 6.2.21 these are unlikely to reflect the conditions in the areas close to the M25, hence the use of the Base Year as providing a better measure of the current baseline. The Base Year concentrations exceed the site relevant critical levels by over 350% and the contribution of the Project, alone and in combination, would be small (5.8%). The site-relevant critical levels for NH<sub>3</sub> are currently (APIS 2019–2021) exceeded however as set out in paragraph 6.2.21 these are unlikely to reflect the conditions in the areas close to the M25, hence the use of the Base Year as providing a better measure of the current baseline. The Base Year concentrations exceed the site relevant critical levels by over 264% and the contribution of the Project, alone and in-combination, would be small (9%), noting the discussion in paragraph 6.2.30 regarding the likely conservative

nature of the ammonia emissions, i.e. these are likely to see the greatest improvements with electric vehicle take up. The proportions of the site affected by the increased concentrations of NO<sub>x</sub> and NH<sub>3</sub> in the Do Something scenario are very small (<0.5%).

- 6.2.32 The site-relevant critical loads are currently (APIS 2019–2021) exceeded by over 150% and the contribution of the Project to the N deposition on the site, alone and in combination, would be small (10%). Although the Project would result in a slightly higher N deposition than would occur in the Do Minimum scenario, this would occur only within a very small proportion of the site (0.3%) and there would be no slowing of progress towards the target by any material degree. Progress to achieving this target is affected by a variety of factors and vehicle emissions are only part of the source of the site-relevant pollutants. The Project would contribute a very small proportion in the context of the very substantial decreases in N deposition that would be required to meet this target and would affect only a very small proportion of the site. Achievement of the restore target would require many years of sustained significant reductions in pollution that would likely require new national policy and wholesale behavioural changes.
- 6.2.33 The improvement in vehicle emissions and the potential for habitats to improve in quality are discussed in paragraphs 4.4.1 to 4.4.6. It is considered that the effect the Project would have on air quality at this location is not material compared to the very substantial reductions (see Table 6.6) that would have to be achieved through changes such as improvements in vehicle emissions to bring the NO<sub>x</sub> and NH<sub>3</sub> concentrations below site-relevant critical levels and N deposition below site-relevant critical loads.
- 6.2.34 There are no pathways to an effect identified in terms of the extent or distribution of the qualifying habitats, the vegetation structure within them, or their function as woodland. Any air quality effect would not degrade the habitat to the extent that it would no longer be classified as that qualifying habitat. The qualifying habitat within the area affected by the changes in N deposition would not change in extent and distribution, or structure and function as a result of the Project.
- 6.2.35 The assessment has considered the effects of the Project alone and in combination as a result of a reduction/degradation in habitat and concluded that there would be no adverse effect on the integrity of the Epping Forest SAC in view of its conservation objectives.

## North Downs Woodlands SAC

- 6.2.69 There is a risk of LSE on the North Downs Woodlands SAC as a result of the Project due to the changes in nitrogen deposition as a result of vehicle emissions in operation.

### Magnitude/significance of effect

#### Changes in air quality as a result of vehicle emissions in operation

##### *Effect alone*

- 6.2.70 This section describes the effects of the Project alone, to distinguish it from the in-combination assessment presented in paragraphs 6.2.75 to 6.2.77. It is

recognised that the assessment here (as described in paragraph 3.5.8) is of the changes in vehicle emissions as a result of the Project in-combination (rather than strictly 'alone') with other plans and projects that would contribute traffic into the modelled road network. This is due to the way traffic figures are generated using government traffic growth forecasts and is the most appropriate data available for estimating Project effects alone.

- 6.2.71 The change in N deposition does not exceed  $0.4\text{kg N ha}^{-1}\text{yr}^{-1}$  at modelled points within the North Downs Woodlands SAC and therefore there is no risk that there would be a theoretical loss of one species (as described in paragraph 3.4.2), although this is not treated as a single criterion to assess effects on integrity. The extent of the SAC impacted by the predicted changes is shown in Plate 6.4. The predicted changes in nitrogen deposition although greater than 1% of the LCL are extremely small and when considered in conjunction with the predicted changes in NO<sub>x</sub>, which are less than 1% of the critical level, are considered imperceptible.
- 6.2.72 The species recorded during the survey in the area, where that N deposition change is predicted to be greater than 1% of the LCL, did not include any that were sensitive to N deposition (as described in 4.3.9 to 4.3.11). Therefore, this habitat is considered to be resilient to this impact and no loss of species is anticipated as a result of this change in N deposition. The survey results also indicate that the affected area does not represent any of the qualifying feature habitats of the SAC and so no impacts of the qualifying features would occur. The other factors that influence this assessment have been considered as set out in Table 6.8.

**Plate 6.4 Extent of the predicted changes in nitrogen deposition within the North Downs Woodlands SAC**





**Table 6.8 Consideration of other factors for North Downs Woodlands SAC**

Other factors considered	North Downs Woodland
What conditions is the habitat affected currently exposed to (e.g. existing exceedance of critical load)?	Air Pollution Information System nitrogen critical loads for this part of the SAC <sup>10</sup> (5–15kg N ha <sup>-1</sup> yr <sup>-1</sup> ) are exceeded with the three year (2019–2021) average deposition 25.38kg N ha <sup>-1</sup> yr <sup>-1</sup> an exceedance of the lower critical load of 20.38 kg N ha <sup>-1</sup> yr <sup>-1</sup> .
What is the area and quality of the habitat affected as a proportion of the qualifying habitat within the European site?	<p>Site is 288.58ha.</p> <p>Extent of qualifying habitat H9130 within the site is 53.1ha and H91J0 is 66.08ha</p> <p>Approximately 0.03ha within SAC boundary affected by changes &gt;1% (but the area does not represent any of the qualifying features).</p> <p>Approximately 0ha where change is &gt;0.4kg N ha<sup>-1</sup>yr<sup>-1</sup>.</p> <p>The survey work indicated that the habitat within the affected area of the SAC was not representative of any of the qualifying features of the SAC.</p> <p>The surveys also showed that areas of habitat in the SAC further away from the road (outside the 200m zone where significant effect are possible) were representative of the qualifying habitats H9130 <i>Asperulo-Fagetum</i> beech forests and H91J0 <i>Taxus baccata</i> woods of the British Isles, but the habitat quality was low, and no nitrogen-sensitive species were recorded.</p>
Will there be any direct loss of habitat or change to the distribution of such habitats?	No direct loss or change in distribution is predicted to occur.
What is the predicted duration of the impact?	Timescale of the impact was predicted to be less than one year.
Are N deposition/NOx operational changes predicted below the current baseline deposition levels (e.g. due to technological improvements in vehicle emissions between now and the time the Project is operational)?	<p>The DS scenario (i.e. with the Project in place) for N deposition was predicted to equal or be slightly less than the baseline (current) situation.</p> <p>The AQ modelling used a conservative estimate when predicting the future changes in background N deposition and assumes no change between the base year (2016) and opening year (2030), i.e. does not consider improvements from technology. With the anticipated improvements in technology regarding vehicle emissions, the predicted N deposition with the Project (DS scenario) is in reality likely to be lower than calculated and below the current baseline levels.</p>

<sup>10</sup> Data from APIS GIS map tool for Site Relevant Critical Loads & Search by Location. Grid reference used for area affected in North Downs Woodland – TQ 75307 60256

Other factors considered	North Downs Woodland
Using professional judgement, taking into account the above factors, will there be a reduction in habitat area that significantly contributes to the favourable conservation status of the European site?	The habitat composition of the area affected by the predicted change in N deposition is not considered to represent any of the qualifying features, and is not likely to change given the lack of nitrogen-sensitive species recorded and the small increase in deposition predicted. Therefore, it is considered that the conservation status of that part of the site would not change as a result.

6.2.73 The extent of qualifying habitat potentially affected by changes in N deposition within North Downs Woodlands SAC has been calculated and the proportions in relation to each of these sites shown in Table 6.9.

**Table 6.9 Proportions of habitat affected in North Downs Woodlands SAC**

<b>Extent of the SAC</b>	Total area of SAC (ha)	288.58
	Proportion of site affected by changes in N deposition of >1% LCL (%) Note: Habitat affected does not represent any qualifying habitat of the SAC	0.01%
	Proportion of site affected by changes in N deposition of >0.4kg N ha <sup>-1</sup> yr <sup>-1</sup> (%)	0.0%
<b>Extent of the qualifying habitats</b>	Total area of qualifying habitat within SAC (ha) H9130	53.1
	Total area of qualifying habitat within SAC (ha) H91J0	66.08
	Note: Habitat affected does not represent any qualifying habitat of the SAC Proportion of habitats affected by changes in N deposition of >1% LCL (%)	0.0%
	Proportion of any qualifying habitat affected by changes in N deposition of >0.4kg N ha <sup>-1</sup> yr <sup>-1</sup> (%)	0.0%

6.2.74 As set out in Table 6.8 and Table 6.9 the habitat present in the area affected by changes in nitrogen deposition is not representative of the qualifying habitats for which the North Downs Woodlands SAC is designated. Table 6.10 provides further analysis of the changes in nitrogen deposition predicted against the baseline conditions and Do Minimum scenarios in relation to the site-relevant lower critical load for the SAC.



**Table 6.10 Comparison of the exceedances of critical loads for North Downs Woodlands SAC with the predicted change as a result of the Project**

<b>Baseline conditions (Current APIS background)</b>	Relevant LCL	5
	Three-year (2019–2021) average deposition (using location within APIS GIS map tool <sup>11</sup> ) (Current APIS background) kg N ha <sup>-1</sup> yr <sup>-1</sup>	25.38
	Maximum range of exceedance of critical loads kg N ha <sup>-1</sup> yr <sup>-1</sup>	20.38
	Maximum range of exceedance of critical loads as a percentage of the LCL	408%
<b>Baseline conditions (Base Year)</b>	Maximum total deposition calculated for the Base Year (2016) kg N ha <sup>-1</sup> yr <sup>-1</sup>	35.23
	Maximum range of exceedance of critical loads as a percentage of the LCL (Base Year) kg N ha <sup>-1</sup> yr <sup>-1</sup>	605%
<b>Do Minimum scenario at opening year</b>	Maximum total deposition at opening year (Do Minimum scenario) kg N ha <sup>-1</sup> yr <sup>-1</sup>	34.4
	Maximum range of exceedance of critical loads as a percentage of the LCL (Do Minimum scenario)	588%
<b>Do Something scenario at opening year</b>	Maximum total deposition at opening year (Do Something scenario) kg N ha <sup>-1</sup> yr <sup>-1</sup>	34.6
	Maximum change in deposition as a result of the Project (Do Something scenario) kg N ha <sup>-1</sup> yr <sup>-1</sup>	0.22
	Change in deposition as a result of the Project (Do Something scenario) as a percentage of the LCL	4.4%

*Effect in-combination*

- 6.2.75 The contribution of changes in traffic from other plans or projects has already been considered with the ‘Effects of the Project alone’ assessment, as the data used within the traffic model takes into account predicted changes in traffic from other plans and projects. The other plans and projects identified within the search areas were primarily on the National Infrastructure Commission’s programme of projects and the Environment Agency’s list of permit applications.
- 6.2.76 The Environment Agency’s list of permit applications did not include any future permit applications that would have coincided with the Project opening year, 2030. However, any Environment Agency permits, once granted, would have a variety of thresholds for emissions to air which aim to protect the surrounding environment.
- 6.2.77 No other plans or projects were identified within the search area around North Downs Woodlands SAC as shown on Plate 5.1.

**Assessment of effect on integrity**

- 6.2.78 The conservation objectives for the North Downs Woodlands include attributes and targets relating to air quality and the assessment of effect on the integrity of

<sup>11</sup> APIS GIS map tool. Location TQ75307 60256. The baseline figures in Table 6.10 are from the ‘grid information tab’ within the ‘results’.

the sites is judged on the basis of whether the Project would undermine these targets being achieved. The Project has the potential to result in a reduction in habitat area which could affect the following conservation objectives:

- a. The supporting processes on which the qualifying natural habitats rely
- b. The extent and distribution of the qualifying natural habitats
- c. The structure and function (including typical species) of the qualifying natural habitats

- 6.2.79 The supplementary advice for North Downs Woodlands SAC (Natural England, 2019b) included an air quality attribute and related targets for both qualifying habitats (H9130 and H91J0) and both have a restore target for the concentrations and deposition of air pollutants, to below or equal to the site-relevant critical load.
- 6.2.80 The predicted N deposition with the Project in place is slightly higher than the Do Minimum scenario, but both scenarios predict N deposition equal to or less than the baseline, due to predicted improvements in vehicle emissions.
- 6.2.81 The site-relevant critical loads are currently exceeded by over 540% and the contribution of the Project to the N deposition on the site, alone and in combination, would be small (<5%). Although the Project would result in a slightly higher N deposition than would occur in the Do Minimum scenario, this would occur only within a very small proportion of the site (0.03%) and the affected habitats do not represent any of the qualifying habitats of the SAC. Progress to achieving the 'restore' target is affected by a variety of factors and vehicle emissions are only part of the source of the site-relevant pollutants. The Project would contribute a very small proportion in the context of the very substantial decreases in N deposition that would be required to meet this target and would affect the qualifying features of the SAC. Achievement of the restore target would require many years of sustained significant reductions in pollution that would likely require new national policy and wholesale behavioural changes.
- 6.2.82 The improvement in vehicle emissions and the potential for habitats to improve in quality are discussed in paragraphs 4.4.1 to 4.4.6. It is considered that the effect the Project would have on air quality at this location is not material compared to the very substantial reductions (see Table 6.10) that would have to be achieved through changes such as improvements in vehicle emissions to bring the N deposition below site-relevant critical loads.
- 6.2.83 There are no pathways to an effect identified in terms of the extent or distribution of the qualifying habitats, the vegetation structure within them, or their function as woodland. The qualifying habitats were not present within the area affected by the changes in N deposition, therefore would not change in extent and distribution, or structure and function as a result of the Project.
- 6.2.84 The assessment has considered the effects of the Project alone and in combination as a result of a reduction/degradation in habitat and concluded that there would be no adverse effect on the integrity of the North Downs Woodlands SAC in view of its conservation objectives.

## 6.3 Conclusion of Stage 2 appropriate assessment

- 6.3.1 This without prejudice assessment has been completed using the methodological approaches advised by Natural England in their note ‘Summary of advice received on National Highways Air Quality assessment’ summarising the air quality advice received by email on 11 April 2023.
- 6.3.2 The without prejudice assessment concludes, beyond reasonable scientific doubt, that the Project will not adversely affect the integrity of the:
- d. Thames Estuary and Marshes Ramsar site during its construction phase, either alone or in combination with other plans or projects.
  - e. North Downs Woodlands SAC during its operational phase, either alone or in combination with other plans or projects.
  - f. Epping Forest SAC during its operational phase, either alone or in combination with other plans or projects.

# 7 Conclusion

## 7.1 Review of the assessment against the HRA

7.1.1 This section provides a comparison of the assessment of air quality effects as reported in the HRA [APP-487] and this without prejudice assessment.

### Thames Estuary and Marshes Ramsar

7.1.2 The HRA [APP-487] considered the effect of nitrogen deposition as a result of vehicle emission during construction and concluded at Stage 1 screening that the Project would have no LSE on the Thames Estuary and Marshes Ramsar site alone and in combination with other plans and projects.

7.1.3 The without prejudice assessment considered the effect of NOx and NH<sub>3</sub> as individual pollutants as well as nitrogen deposition. The predicted NH<sub>3</sub> concentration and nitrogen deposition was concluded at Stage 1 screening with no LSE on the Thames Estuary and Marshes Ramsar site from the Project alone and in combination with other plans and projects. The effect of NOx was considered at Stage 1 screening with LSE unable to be discounted. The conclusion at Stage 2 appropriate assessment was that the Project would have no adverse effect on the integrity of the Thames Estuary and Marshes Ramsar site alone and in combination with other plans and projects.

7.1.4 Table 7.1 summarises the work done and clearly shows that the conclusion of the HRA [APP-487] is not materially different to that concluded in the without prejudice assessment.

**Table 7.1 Comparison of the HRA process and conclusion for assessment of air quality effects on the Thames Estuary and Marshes Ramsar site**

AQ parameter	HRA [APP-487]		Without prejudice assessment	
	Conclusion stage 1 screening	Conclusion stage 2 appropriate assessment	Conclusion stage 1 screening	Conclusion stage 2 appropriate assessment
NOx	Not required	Not required	LSE could not be discounted	No adverse effect on integrity (AEol)
NH <sub>3</sub>	Not required	Not required	No LSE	Not required
Nitrogen deposition	No LSE	Not required	No LSE	Not required

## Epping Forest SAC

- 7.1.5 The HRA [APP-487] considered the effect of nitrogen deposition as a result of vehicle emission during operation and concluded at Stage 1 screening that LSE could not be discounted on the Epping Forest SAC. The Stage 2 appropriate assessment concluded that the Project would have no adverse effect on the integrity of the SAC alone or in combination with other plans and projects.
- 7.1.6 The without prejudice assessment considered the effect of NO<sub>x</sub> and NH<sub>3</sub> as individual pollutants as well as nitrogen deposition. The effect of NO<sub>x</sub>, NH<sub>3</sub> concentration and nitrogen deposition was considered at Stage 1 screening and concluded that LSE could not be discounted on the Epping Forest SAC. The Stage 2 appropriate assessment concluded that the Project would have no adverse effect on the integrity of the SAC alone or in combination with other plans and projects.
- 7.1.7 Table 7.2 summarises the work done and clearly shows that the conclusion of the HRA [APP-487] is not materially different to that concluded in the without prejudice assessment.

**Table 7.2 Comparison of the HRA process and conclusion for assessment of air quality effects on the Epping Forest SAC**

AQ parameter	HRA [APP-487]		Without prejudice assessment	
	Conclusion stage 1 screening	Conclusion stage 2 appropriate assessment	Conclusion stage 1 screening	Conclusion stage 2 appropriate assessment
NO <sub>x</sub>	Not required	Not required	LSE could not be discounted	No AEoI
NH <sub>3</sub>	Not required	Not required	LSE could not be discounted	No AEoI
Nitrogen deposition	LSE could not be discounted	No AEoI	LSE could not be discounted	No AEoI

## North Downs Woodlands SAC

- 7.1.8 The HRA [APP-487] considered the effect of nitrogen deposition as a result of vehicle emission during operation and concluded at Stage 1 screening the Project would have no LSE on North Downs Woodlands SAC alone or in combination with other plans and projects.
- 7.1.9 The without prejudice assessment considered the effect of NO<sub>x</sub> and NH<sub>3</sub> as individual pollutants as well as nitrogen deposition. The effect of NO<sub>x</sub> and NH<sub>3</sub> was considered at Stage 1 screening and concluded that the Project would have no LSE on the North Downs Woodlands SAC alone and in combination with other plans and projects. The effect of nitrogen deposition was considered at Stage 1 screening with LSE unable to be discounted. The conclusion at Stage 2 appropriate assessment was that the Project would have no adverse effect on the integrity of the North Downs Woodlands SAC alone and in combination with other plans and projects.

7.1.10 Table 7.3 summarises the work done and clearly shows that the conclusion of the HRA [APP-487] is not materially different to that concluded in the without prejudice assessment.

**Table 7.3 Comparison of the HRA process and conclusion for assessment of air quality effects on the North Downs Woodlands SAC**

AQ parameter	HRA [APP-487]		Without prejudice assessment	
	Conclusion stage 1 screening	Conclusion stage 2 appropriate assessment	Conclusion stage 1 screening	Conclusion stage 2 appropriate assessment
NO <sub>x</sub>	Not required	Not required	No LSE	Not required
NH <sub>3</sub>	Not required	Not required	No LSE	Not required
Nitrogen deposition	No LSE	Not required	LSE could not be discounted	No AEoI

## 7.2 Concluding remarks

7.2.1 The without-prejudice assessment has been completed in accordance with the methodologies advised by Natural England and concluded that there would be no adverse effects on integrity on any European sites. The without prejudice mitigation for Epping Forest SAC remains as referred to within the HRA [APP-487] and reported within Annex 7 of the SoCG [APP-099].

7.2.2 The Applicant has concluded that there would be no material difference to the conclusions of the HRA for the purposes of considering whether the Project can be authorised under Regulation 63(5) of the Conservation of Habitats and Species Regulations 2017 (as amended).



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## Appendix A North Downs Woodlands SAC detailed botanical survey results

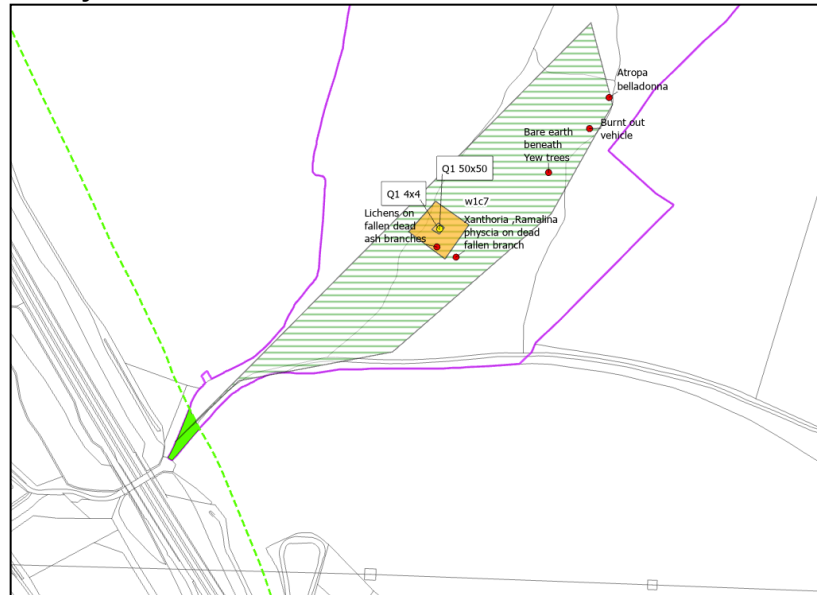
### A.1 Survey methodology

- A.1.1 Two habitat survey areas were surveyed: one, the area within 200m of the ARN and the other further into the SAC, up to approximately 500m from the ARN to inform whether or not a vegetation gradient from the ARN existed.
- A.1.2 At each location surveyors walked a zig-zag transect through the habitat survey area to ground-truth the UKHab classification and amend it if necessary. Vegetation composition and species abundance were recorded using the DAFOR scale ('dominant', 'abundant', 'frequent', 'occasional' or 'rare') to provide a relatively rapid characterisation of the vegetation in the habitat survey area. Particular note was made of invasive non-native species, ancient woodland indicator species, species that are reasons for designation and species that are known to be sensitive to nitrogen. One quadrat was then sampled in each UKHab Level 4 habitat type using the Domin scale, as described in Rodwell (2006). This provides a quantitative measure of cover/abundance of every higher plant in the sampled area. The quadrat size sampled depended on the structural variation in the plant community, with 50m x 50m quadrats for woodland canopy and shrub layers and 2m x 2m for short herbaceous vegetation. The combination of DAFOR and quantitative sampling of quadrats was considered sufficient to provide a comprehensive list of the higher plants present in the habitat survey area and their relative abundances.
- A.1.3 Evidence of any obvious vegetation gradients was noted, indicated by changes in vegetation structure and composition with distance from the woodland edge with an existing road which may indicate whether any existing factors such as site management or nitrification/pollution from external sources have influenced or are influencing the habitat. Evidence of site management and pressures and threats were recorded (e.g. recreation, fly-tipping, encroaching development). Surveyors also made notes of the potential for beneficial management.
- A.1.4 Site condition in the habitat survey area was recorded using Defra's Biodiversity Metric 3.1 (Panks, et al., 2022), with additional notes on justification of the score and on features of interest. Note was made on whether habitats are degraded versions of habitats the site is important for (as detailed in the citation), or if they have been replaced by a different habitat type.
- A.1.5 Representative photographs were collected to illustrate the features recorded.

## A.2 Survey results

### Field survey results 2022

#### Survey Location



Purple line – SAC boundary  
 Green hatch – Habitat survey area.  
 Green dotted line – 200m distance from Affected Road Network (ARN)  
 Orange box – Quadrat location  
 Target notes are shown.

#### Survey Summary

Survey date: 19/05/2022  
 UK Hab classification: w1c7 Yew-dominated woodland (H91J0)  
 Habitat description: Closed yew tree canopy, with almost bare field layer with very few Ancient Woodland Indicator (AWI) species.  
 Presence of SAC qualifying habitats: The survey found that most of the area surveyed was made up of W13 *Taxus baccata* (Annex I, 91J0).  
 Vegetation gradient: No species gradients observed.  
 Pressures and threats: Human disturbance due to bike jumps and a burnt-out vehicle which had scorched and damaged nearby trees. A fence had been knocked down, possibly for access.

**Table 1 Summary of condition score of Habitat Parcel**

Criteria	Score
1 Age distribution of trees	3
2 Wild, domestic and feral herbivore damage	3
3 Invasive plant species	2
4 Number of native tree species	3
5 Cover of native tree and shrub species	2
6 Open space within woodland	3
7 Woodland regeneration	2
8 Tree health	2
9 Vegetation and ground flora	3
10 Woodland vertical structure	2
11 Veteran trees	3
12 Amount of dead wood	3
13 Woodland disturbance	2
Total:	33 (Good)

**Table 3 Species recorded in Quadrat 1, with DOMIN and Ellenberg values**

Latin Name	DOMIN	EV
<b>Canopy</b>		
<i>Acer pseudoplatanus</i>	5	6
<i>Fagus sylvatica</i>	4	5
<i>Fraxinus excelsior</i>	4	6
<i>Taxus baccata</i>	8	5
<b>Understorey</b>		
<i>Corylus avellana</i>	4	6
<i>Crataegus monogyna</i>	2	6
<i>Daphne laureola</i>	1	5
<i>Ligustrum vulgare</i>	5	5
<b>Field layer</b>		
<i>Arum maculatum</i>	1	7
<i>Hedera helix</i>	5	6
<i>Ligustrum vulgare</i>	4	5
<i>Mercurialis perennis</i>	4	7
<i>Bare ground</i>	8	N/A
<i>Leaf litter</i>	8	N/A

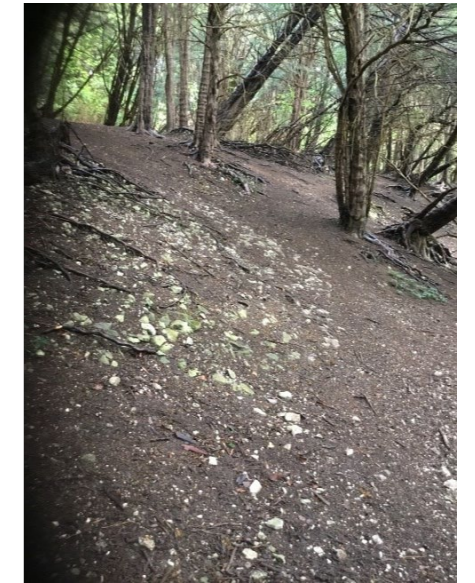
**Table 2 Species recorded in habitat survey area, with DAFOR and Ellenberg values**

Latin Name	DAFOR	EV
<b>Canopy</b>		
<i>Acer campestre</i>	O and LA	6
<i>Acer pseudoplatanus</i>	F	6
<i>Fraxinus excelsior</i>	F	6
<i>Quercus robur</i>	R	4
<i>Sorbus aria</i>	R	4
<i>Taxus baccata</i>	A	5
<b>Understorey</b>		
<i>Buddleja davidii</i>	R	5
<i>Cornus sanguinea</i>	R	6
<i>Corylus avellana</i>	O	6
<i>Crataegus monogyna</i>	O	6
<i>Ilex aquifolium</i>	R	5
<i>Ligustrum vulgare</i>	F	5
<i>Prunus avium</i>	R	6
<i>Prunus spinosa</i>	R	6
<i>Sambucus nigra</i>	R	7
<i>Viburnum lantana</i>	R	5

Latin Name	DAFOR	EV	Latin Name	DAFOR	EV
<b>Field layer</b>					
<i>Ajuga reptans</i>	R	5	<i>Iris foetidissima</i>	O	5
<i>Alliaria petiolata</i>	R	8	<i>Melica uniflora</i>	R	5
<i>Arctium minus</i>	R	5	<i>Mercurialis perennis</i>	F/LA	7
<i>Arum maculatum</i>	O	7	<i>Poa trivialis</i>	R	6
<i>Atropa belladonna</i>	R	6	<i>Potentilla reptans</i>	R	5
<i>Ballota nigra</i>	R	6	<i>Prunella vulgaris</i>	R	4
<i>Brachypodium sylvaticum</i>	O	5	<i>Ranunculus repens</i>	R	7
<i>Bryonia dioica</i>	R	7	<i>Rosa sp.</i>	R	N/A
<i>Carex sylvatica</i>	R	5	<i>Rubus fruticosus</i>	O	6
<i>Cirsium vulgare</i>	R	6	<i>Sanicula europaea</i>	R	5
<i>Clematis vitalba</i>	O	5	<i>Scrophularia auriculata</i>	R	7
<i>Daphne laureola</i>	O	5	<i>Scrophularia nodosa</i>	R	6
<i>Digitalis purpurea</i>	R	5	<i>Tamus communis</i>	R	6
<i>Fragaria vesca</i>	R	4	<i>Taraxacum officinale agg.</i>	R	6
<i>Fraxinus excelsior</i>	O	6	<i>Veronica serpyllifolia</i>	R	5
<i>Geranium robertianum</i>	R	6	<i>Viola hirta</i>	R	2
<i>Geum urbanum</i>	R	7			
<i>Glechoma hederacea</i>	R	7			
<i>Hedera helix</i>	A	6			
<i>Hypericum hirsutum</i>	O	5			
<i>Hypericum perforatum</i>	R	5			

**Table 4: Summary of Ellenberg Values for all recorded species**

Minimum	2
Mean	5.58
Maximum	8



**Photograph 1** Densely shaded bare ground beneath canopy of yew coppice

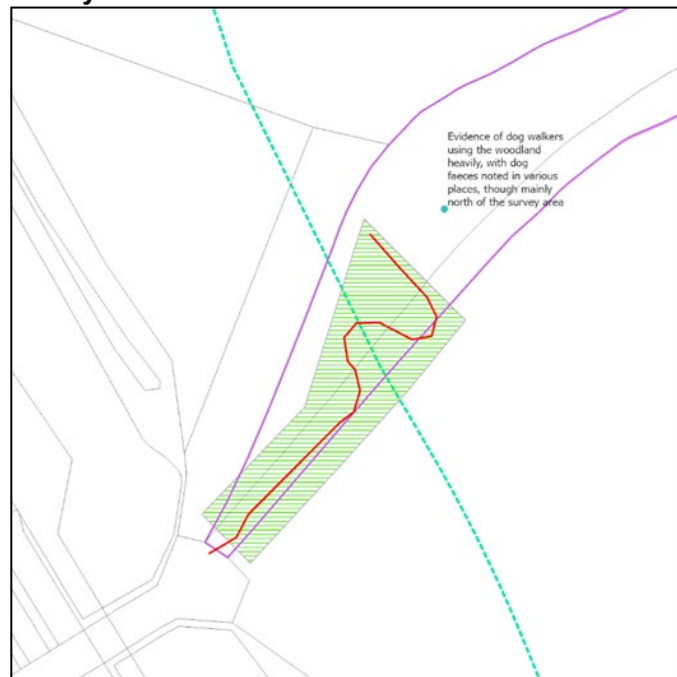


**Photograph 2** Deadwood showing presence of some nitrogen tolerant lichens including *Xanthoria* species



### Field survey results 2023

#### Survey Location



Purple line – SAC boundary  
 Green hatch – Habitat parcel survey area.  
 Green dotted line: 200m distance from Affected Road Network (ARN)  
 Red line – Transect location  
 Target notes are shown  
 Quadrat – The surveyed woodland had an area of approximately 480 m<sup>2</sup>, i.e. approximately 20% of a standard 50mx50mm woodland quadrat.

#### Survey Summary

Survey date: 15/05/2023  
 UK Hab classification: w1f: lowland mixed deciduous woodland  
 Habitat description: A narrow strip of ash woodland around a public footpath, with abundant ash, and frequent field maple, wild cherry and sycamore in the canopy over an understorey of frequent hazel, hawthorn, yew and wild privet. The ground layer is heavily shaded where yew occurs. Ivy is abundant, with frequent dog's mercury, wood melick and wild arum. The path is well used by dog walkers. Ash dieback is widespread. There is no sign of recent management.  
 Presence of SAC qualifying habitats: Ash was the most abundant canopy species in the survey area, which does not meet the criteria for the habitats that are the primary reason for selection of the site as a SAC.  
 Vegetation gradient: No species gradients observed. Nettle is slightly more frequent at southern end along with cleavers and barren brome but this seems more related to the open nature of the southern end and possibly run off of fertilisers from the arable land above  
 Pressures and threats: Ash dieback is widespread. Footpath well used by public.

**Table 1 Summary of condition score of Habitat Parcel**

Criteria	Score
1 Age distribution of trees	2
2 Wild, domestic and feral herbivore damage	3
3 Invasive plant species	3
4 Number of native tree species	3
5 Cover of native tree and shrub species	3
6 Open space within woodland	1
7 Woodland regeneration	2
8 Tree health	1
9 Vegetation and ground flora	3
10 Woodland vertical structure	2
11 Veteran trees	1
12 Amount of dead wood	2
13 Woodland disturbance	3
<b>Total:</b>	<b>29 (Moderate)</b>

**Table 3 Species in Quadrat, with DOMIN and Ellenberg values**

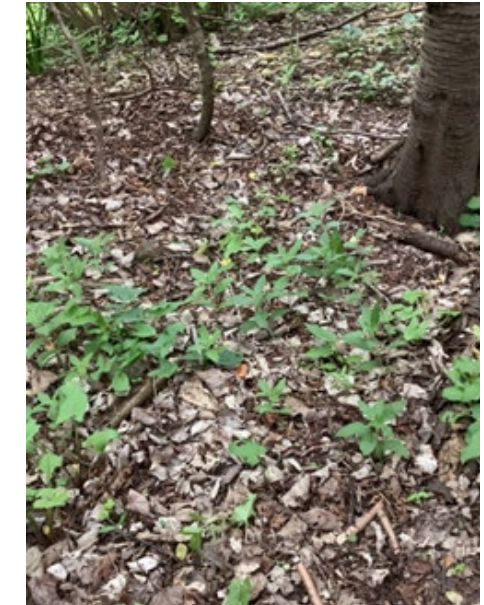
Latin Name	DAFOR	EV
<b>Canopy</b>		
<i>Acer campestre</i>	4	6
<i>Acer pseudoplatanus</i>	5	6
<i>Fraxinus excelsior</i>	7	6
<i>Prunus avium</i>	4	6
<b>Understorey</b>		
<i>Cornus sanguinea</i>	1	6
<i>Corylus avellana</i>	4	6
<i>Crataegus monogyna</i>	4	6
<i>Euonymus europaeus</i>	3	5
<i>Hedera helix</i>	5	6
<i>Ilex aquifolium</i>	1	5
<i>Ligustrum vulgare</i>	4	5
<i>Prunus spinosa</i>	1	6
<i>Rosa canina</i>	1	6
<i>Sambucus nigra</i>	2	7
<i>Taxus baccata</i>	4	5
<b>Field layer</b>		
<i>Acer campestre</i>	1	6
<i>Acer pseudoplatanus</i>	1	6
<i>Arum maculatum</i>	4	7
<i>Galium aparine</i>	1	8
<i>Hedera helix</i>	3	6
<i>Iris foetidissima</i>	2	5
<i>Mercurialis perennis</i>	4	7
<i>Prunus avium</i>	1	6

**Table 2 Species recorded in Transect, with DAFOR and Ellenberg values**

Latin Name	DAFOR	EV
<b>Canopy</b>		
<i>Acer campestre</i>	F	6
<i>Acer pseudoplatanus</i>	F	6
<i>Fraxinus excelsior</i>	A	6
<i>Prunus avium</i>	F	6
<b>Understorey</b>		
<i>Cornus sanguinea</i>	O	6
<i>Corylus avellana</i>	F	6
<i>Crataegus monogyna</i>	F	6
<i>Euonymus europaeus</i>	F	5
<i>Hedera helix</i>	A	6
<i>Ilex aquifolium</i>	R	5
<i>Ligustrum vulgare</i>	F	5
<i>Prunus spinosa</i>	O	6
<i>Rosa canina</i>	O	6
<i>Sambucus nigra</i>	R	7
<i>Taxus baccata</i>	F	5
<b>Field layer</b>		
<i>Anisantha sterilis</i>	O	7
<i>Anthriscus sylvestris</i>	R	7
<i>Arum maculatum</i>	F	7
<i>Ballota nigra</i>	O	6
<i>Brachypodium sylvaticum</i>	O	5
<i>Clematis vitalba</i>	O	5
<i>Galium mollugo</i>	O	4
<i>Galium aparine</i>	F	8
<i>Geranium pusillum</i>	R	7
<i>Geranium robertianum</i>	R	6
<i>Hedera helix</i>	A	6
<i>Iris foetidissima</i>	F	5
<i>Lactuca virosa</i>	R	7
<i>Lamium album</i>	R	8
<i>Melica uniflora</i>	F	5
<i>Mercurialis perennis</i>	F	7
<i>Origanum vulgare</i>	R	4
<i>Plantago major</i>	R	7
<i>Poa trivialis</i>	O	6
<i>Rubus fruticosus</i>	O	6
<i>Tamus communis</i>	O	6
<i>Taraxacum officinale agg.</i>	O	6
<i>Urtica dioica</i>	O	8
<i>Vicia sativa</i>	R	4
<i>Viola sp. (EV for Viola riviniana used)</i>	O	4

**Table 4 Summary of Ellenberg Values for all recorded species**

Minimum	4
Mean	5.95
Maximum	8



Photograph 1 Sparse field layer over predominantly bare ground



Photograph 2 Woodland in survey area



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