M3 Junction 9 Improvement

Scheme Number: TR010055

6.3 Environmental Statement Appendix 8.3 - Assessment of Operational Air Quality Impacts on Biodiversity

APFP Regulation 5(2)(a)

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6.3 ENVIRONMENTAL STATEMENT - APPENDIX 8.3: ASSESSMENT OF OPERATIONAL AIR QUALITY IMPACTS ON BIODIVERSITY

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1.1 Introduction

1.1.1 Stantec UK is working with Volker Fitzpatrick and National Highways to undertake the design and assessment of the M3 Junction 9 Improvement Scheme (the Scheme).

1.1.2 This appendix reports the results of the assessment of potential impacts on biodiversity receptors as a result of changes in pollutants from vehicle exhaust emissions, as a result of the Scheme. This appendix has been prepared to inform **Chapter 5 (Air Quality)** and **Chapter 8 (Biodiversity)** of the Environmental Statement **(ES) (Document Reference 6.1)** and has been completed by a competent expert for biodiversity **(Appendix 1.1 (Competent Expert Evidence)** of the **ES Technical Appendices (Document Reference 6.3).**

1.2 Methodology

1.2.1 The assessment of potential operational effects on designated habitats from vehicle exhaust emissions has been undertaken with regard to:

- Design Manual for Roads and Bridges (DMRB) LA105 Air Quality (Highways England, 2019) with particular reference to Figure 2.98 Assessment of significant effects on designated sites (see **Plate 1** below)

1.2.2 The following documents have also been consulted:

- *Advice on Ecological Assessment of Air Quality Impacts* (Chartered Institute of Ecology and Environmental Management, 2021)
- *A guide to the assessment of air quality impacts on designated nature conservation sites – version 1.0* (Holman *et al.*, 2020) (referred to as the Institute of Air Quality Management or 'IAQM guidance' within this technical note)

1.2.3 Designated habitats scoped into the assessment include the following:

- European or internationally designated areas; including Special Protection Areas (SPAs) and potential / proposed SPA (pSPA), Special Areas of Conservation (SACs) and candidate SAC (cSAC) or possible / proposed SAC (pSAC), and Ramsar sites or proposed Ramsar sites.
- Sites of Special Scientific Interest (SSSIs)
- Local Nature Reserves (LNRs)

- Sites of Importance for Nature Conservation (SINCs)
- Local Wildlife Sites (LWS)
- Ancient Woodland (AWL)

1.2.4 LA105 also identifies veteran trees and Nature Improvement Areas (NIA) as sensitive receptors. No veteran trees have been identified within 200m of the Affected Road Network (ARN). Much of the Scheme falls within the South Downs Way Ahead NIA. The focus of this NIA was safeguarding endangered chalk grassland in the South Downs National Park. The highest quality areas of chalk grassland are protected as SSSIs or SINCs and are already assessed within this report, therefore no separate assessment on the South Downs Way Ahead NIA has been undertaken.

1.2.5 In line with *DMRB LA105 Air Quality* (Highways England, 2019), only designated habitats sensitive to nitrogen deposition within 200m of the Affected Road Network (ARN)[1] have been taken forward for assessment. Beyond this distance effects from vehicle exhaust emissions are negligible. A full list of designated habitats scoped into the assessment can be found in **Chapter 5 (Air Quality)** of the **ES** (**Document Reference 6.1)**. Where more than one designation covers the same geographical area, for instance some SSSIs are also designated as SINCs, the designation of higher geographical importance has been used to inform the assessment.

1.2.6 In terms of the potential impact of exhaust emissions on designated habitats, concentrations and deposition rates have been calculated and compared against site relevant critical levels and loads for the habitats in question. Critical loads (to be used as standards for the assessment of significance) have been obtained from the Air Pollution Information System ('APIS') website.

1.2.7 As per Figure 2.98 within LA 105, nitrogen deposition less than 1% of the applicable annual average critical level or load is the threshold for determining no likely significant effects. It should be noted that an impact of more than 1% is not, per se, an indication that a significant effect exists, only the possibility of one, which would trigger the need for further, more detailed assessment of the ecological sensitivity and value of the habitat.

1.2.8 Where the predicted annual average impact exceeds 1% consideration needs to be given to the overall critical level or load. Where the critical level or load is exceeded, further ecological assessment has been undertaken to ascertain the potential significance of the impact and resultant effects.

1.2.9 Where the change in nitrogen deposition within the biodiversity receptor is greater than 0.4kg N/ha/yr, further assessment has been provided in the context of Natural England Report 210 *Assessing the effects of small increments of atmospheric nitrogen deposition (above the critical load) on semi-natural*

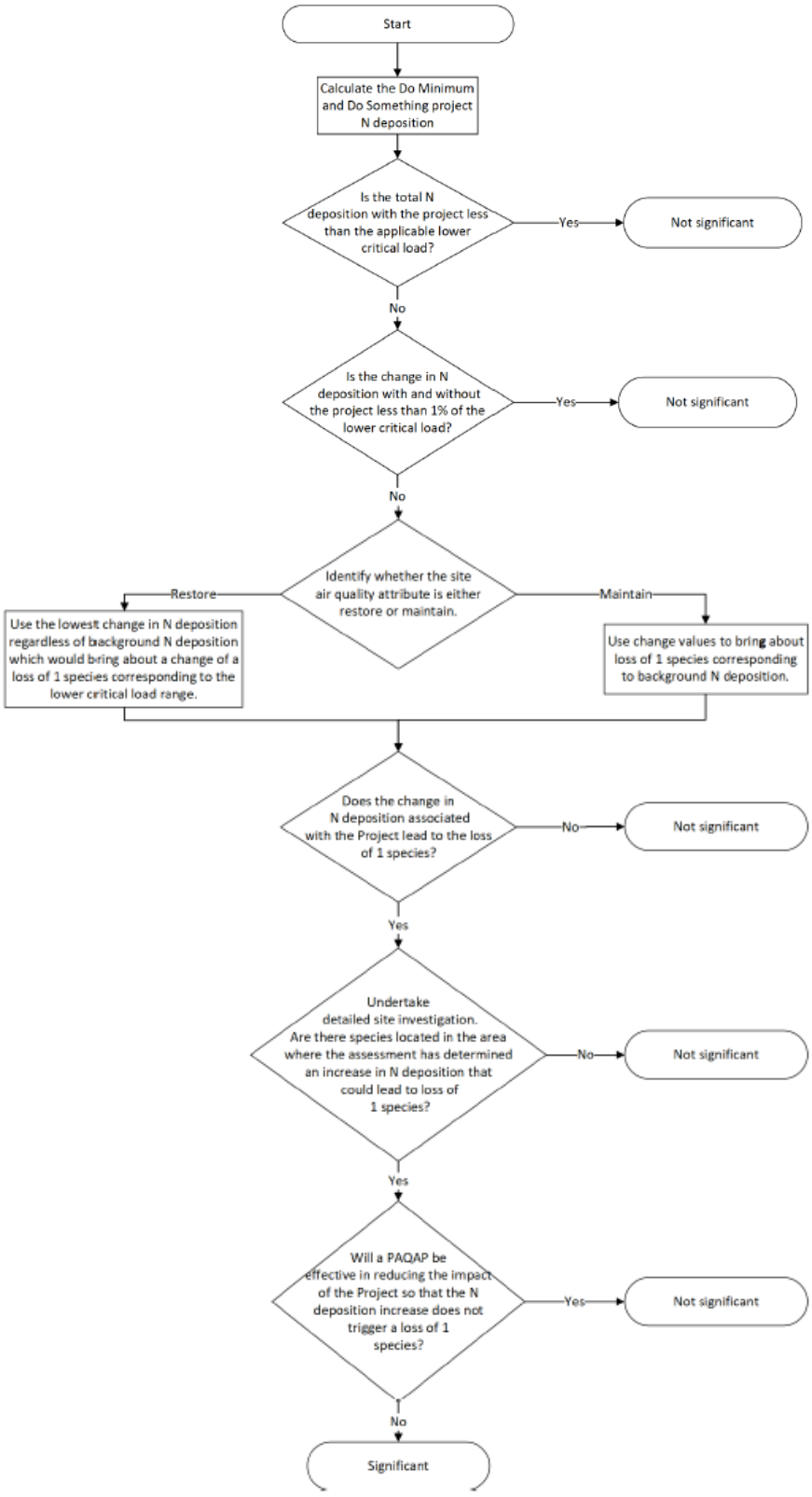
1 Defined as the road network where the Scheme results in traffic change >1000 Annual Average Daily Traffic

habitats of conservation importance (with particular reference to Table 21). This report indicates increases of at least 0.4kg N/ha/yr can result in the loss of one species from a habitat, although this is a precautionary level based on sensitive heathland habitats. The report also indicates that habitats receiving high baseline rates of nitrogen deposition are less sensitive to nitrogen deposition, and much higher increases are required to reduce species diversity.

1.2.10 Further details of the air quality modelling which has been used to inform the assessment of impact and subsequent effects on designated habitats can be found in the **Chapter 5 (Air Quality)** of the **ES** (**Document Reference 6.1**).

Plate 1. Figure 2.98 Assessment of significant effects on designated sites taken from LA105 Air Quality (Highways England, 2019)

Figure 2.98 Assessment of significant effects on designated sites



Assumptions

1.2.11 The modelling work has used background nitrogen deposition data from APIS which uses data from 2016-18. This makes limited allowance for decreases in vehicle emissions between 2015 and 2026. In addition, the model uses a 'gap factor' which aims to remove uncertainty around the effectiveness of reduction of emission of oxides of nitrogen from vehicles, as per DMRB guidance.

1.3 Assessment

1.3.1 Full results of the air quality modelling which has been used to inform the assessment of effects on designated habitats can be found in **Appendix 5.3** (**Designated Habitats, Backgrounds and Operational Phase Results)** of the **ES Technical Appendices** (**Document Reference 6.3**).

1.3.2 The air quality transects which have been used to model potential changes in pollutants, along with the designated habitats assessed, are presented on **Figure 5.4 Air Quality: Ecology Transect** of the **ES Figures** (**Document Reference 6.2**). Each air quality transect has a unique code, for example 'ERIA' relates to the River Itchen.

1.3.3 An assessment of impacts and subsequent effects from vehicle exhaust emissions to all identified designated habitats is set out below. Where the air quality modelling in **Appendix 5.3** (**Designated Habitats, Backgrounds and Operational Phase Results) of the ES Technical Appendices** (**Document Reference 6.3**) demonstrates that pollutant concentrations will increase by less than 1% of the relevant threshold, at the point where the air quality transect intersects within the designated habitat, in line with Figure 2.98 within LA 105 effects are assessed as not significant.

River Itchen Special Area of Conservation (SAC)

1.3.4 The River Itchen SAC is designated for its chalk river habitat, and associated species including southern damselfly, bullhead, white-clawed crayfish, brook lamprey, Atlantic salmon and otter.

1.3.5 Paragraph 2.26.1 of LA105 Air Quality (Highways England, 2019) states that: *Only sites that are sensitive to nitrogen deposition should be included in the assessment, it is not necessary to include sites for example that have been designated as a geological feature or water.* As such, the qualifying chalk river habitat, along with fully aquatic species within it (bullhead, white-clawed crayfish, brook lamprey, Atlantic salmon) are deemed not sensitive to nitrogen.

1.3.6 Habitats within this section of the River Itchen are considered unsuitable for Southern damselfly (see **Appendix 8.1o** of the **ES (Document Reference 6.3)**).

1.3.7 Otter are known to be present within this stretch of the River Itchen. Otters will utilise both river habitats and adjacent terrestrial habitats such as woodland and

wetland for foraging and resting. As discussed above, the qualifying river habitat of the SAC will not be affected by any changes in nitrogen deposition. There is potential for changes in nitrogen deposition to affect terrestrial habitats outside the SAC which may be used by otter, such as woodland and wetlands. The typical home range of otters is large, sometimes up to 35km of watercourse. Any changes to terrestrial habitats from increases in nitrogen deposition would be incurred only over 10s of metres adjacent to the Scheme, therefore would be negligible in the context of the overall habitat within an otter's territory. In addition, terrestrial habitats outside the SAC are largely covered by the River Itchen SSSI designation which is assessed below and concludes no significant effects.

1.3.8 As such, effects from changes in emissions from the Scheme will be not significant to the River Itchen SAC, of International importance.

River Itchen Site of Special Scientific Interest (SSSI)

1.3.9 As stated in **Section 1.3.5** above, the DMRB confirms that riverine habitat (water) is not sensitive to nitrogen deposition. However, APIS does assign critical loads for other habitats covered by the SSSI designation, including fen meadow, flood pasture and swamp.

1.3.10 The SSSI is designated for a range of habitats including the chalk river habitat along with adjacent habitats including fen meadow, flood pasture and swamp, and their associated species. The SSSI area is crossed by the Scheme at a number of locations, and a range of air quality transects have been used to model changes in air quality (see air quality transects ERIA – ERIN on **Figure 5.4 Air Quality: Ecology Transect** of the **ES Figures** (**Document Reference 6.2**)).

1.3.11 The modelling identifies that there are some increases in nitrogen deposition above 1% (e.g. Transects ERID and ERIG) at the point where the transect intersects the SSSI. At transect ERID increases are 14.7% at the road edge, reducing to -0.5% 10m from the road edge. The only SSSI habitat within 10m of the road edge is the river, which is not sensitive to nitrogen. None of the SSSI habitats that are sensitive to nitrogen (fen meadow, flood pasture and swamp) are present within this 10m zone.

1.3.12 At transect ERIG increases are 1.5% at the point along the transect where SSSI habitats which are sensitive to nitrogen are encountered (40m), reducing beyond this. However, none of the modelled increases in nitrogen to habitats which are sensitive to nitrogen are at or above 0.4kg N/ha/yr, indicating there would be no loss of species diversity.

1.3.13 In other locations along the SSSI, modelling predicts a reduction in the modelled pollutants. At air quality transect ERIB, adjacent to Kingsworthy Bridge, modelling predicts a *reduction* below the existing baseline for nitrogen (-23.9%).

At air quality transect ERII, adjacent to the A33, modelling predicts a *reduction* below the existing baseline for nitrogen (-2.1%).

1.3.14 The modelling demonstrates that where there are increases in pollutants, these are below the relevant screening thresholds, and therefore effects from changes in emissions from the Scheme will be not significant to the River Itchen SSSI, of National importance.

St Catherine's Hill SSSI

1.3.15 This SSSI is approximately 500m south of the Scheme (see **Figure 8.1 (Statutory Designated Sites)** of the **ES (Document Reference 6.2**). A range of air quality transects have been used to model changes in air quality (ESCHA – ESCHC **Figure 5.4 Air Quality: Ecology Transect** of the **ES** (**Document Reference 6.2**)). St Catherine's Hill SSSI is designated for its chalk grassland habitat, of which there are two parcels located either side of the existing M3.

1.3.16 The air quality transect which indicates the largest increase in pollutants is ESCHA to the east of the M3, which predicts a 2.8% increase in nitrogen above the existing baseline at the point where the air quality transect intersects the SSSI. This increase equates to 0.43kg N/ha/yr on the boundary of the SSSI to the east of the M3, reducing to 0.21kg N/ha/yr 10m from road edge. Increases are below 0.4kg N/ha/yr at all areas of the SSSI to the west of the M3. Excessive nitrogen can have negative impacts to plants and habitats by altering the biochemistry of the plants, or through stimulating the growth of competitive plant species which can reduce species diversity within a habitat (apis.ac.uk, 2018). Natural England Report 210 indicates increases of at least 0.4kg N/ha/yr can result in the loss of one species from a habitat[2], although it is worth noting this a precautionary threshold based on sensitive heathland habitats.

1.3.17 Natural England Report 210 also demonstrates that habitats receiving high background rates of nitrogen deposition are less sensitive to nitrogen deposition. Existing background nitrogen deposition at ESCHA is approximately 38kg N/ha/yr. Report 210 indicates at this level of background deposition, increases of over 2.4 kg N/ha/yr are required to reduce species richness. As such, the increases in nitrogen at the edge of the SSSI are well below the level at which a theoretical reduction in species diversity might occur. As such, effects from changes in emissions from the Scheme will be not significant to St Catherine's Hill SSSI, of National importance.

Cheesefoot Head SSSI

1.3.18 Along the A272 the ARN passes adjacent to Cheesefoot Head SSSI, east of the Scheme. The SSSI is designated for chalk grassland habitat, and associated species.

[2] Excluding sand dune habitats

1.3.19 The air quality transect which indicates the largest increase in pollutants at the point where these air quality transects intersect the SSSI (approximately 10m from the road edge) is ERCHA to the east of the A272. The modelling predicts a 3.5% increase in nitrogen at the edge of the SSSI.

1.3.20 This increase equates to 0.52kg N/ha/yr on the boundary of the SSSI, reducing to 0.31kg N/ha/yr 10m into the SSSI. Excessive nitrogen can have negative impacts to plants and habitats by altering the biochemistry of the plants, or through stimulating the growth of competitive plant species which can reduce species diversity within a habitat (apis.ac.uk, 2018). Natural England Report 210 indicates increases of at least 0.4kg N/ha/yr can result in the loss of one species from a habitat[3], although it is worth noting this a precautionary threshold based on sensitive heathland habitats.

1.3.21 Natural England Report 210 also demonstrates that habitats receiving high background rates of nitrogen deposition are less sensitive to nitrogen deposition. Existing background nitrogen deposition at ERCHA is approximately 24kg N/ha/yr. Report 210 indicates at this level of background deposition, increases of over 1 kg N/ha/yr are required to reduce species richness. As such, the increases in nitrogen at the boundary of the SSSI are well below the level at which a theoretical reduction in species diversity might occur. As such, effects from changes in emissions from the Scheme will be not significant to Cheesefoot Head SSSI, of National importance.

River Test SSSI

1.3.22 The SSSI is designated for the chalk river habitat, fen meadow, flood pasture and swamp habitats, along with associated species. The River Test SSSI is crossed by the ARN at a number of locations, and two air quality transects have been used to model changes in air quality (ERTA-ERTB).

1.3.23 At the boundary of the SSSI adjacent to the road, increases in nitrogen levels are 1.2% above the existing baseline. However, the only SSSI habitat in this location is the river, which is not sensitive to increases in nitrogen. At locations where non-river habitats occur, increases in nitrogen are below the 1% threshold. Therefore, effects from changes in emissions from the Scheme will be not significant to the River Test SSSI, of National importance.

Highclere Park SSSI

1.3.24 Highclere Park SSSI is designated for extensive open parkland containing unimproved grassland with mature trees, pasture woodland and lakes. The ARN passes adjacent to this SSSI north of the Scheme along the A34.

1.3.25 Two air quality transects have been used for this SSSI, namely ERHcP and ERDWBC. At the point at which these transects intersect the SSSI there are predicted increases in nitrogen of 1.6% and 1.7% above the existing baseline.

[3] Excluding sand dune habitats

None of the modelled increases in nitrogen are at or above 0.4kg N/ha/yr, indicating there would be no reduction in species diversity.

1.3.26 The modelling demonstrates that where there are increases in pollutants, these are below the relevant screening thresholds, would not result in a reduction in species richness, and therefore effects from changes in emissions from the Scheme will be not significant to Highclere Park SSSI, of National importance.

Non-statutory designated areas and ancient woodland

1.3.27 An assessment of potential impacts from vehicle exhaust emissions to non-statutory designated areas and ancient woodland is set out below. Where the air quality modelling in **Appendix 5.3 (Designated Habitats Backgrounds and Operational Phase Results)** of the **ES** (**Document Reference 6.3**) demonstrates that pollutant concentrations will increase by less than 1% of the relevant threshold, at the point where the air quality transect intersects within the biodiversity receptor, these have been scoped out of further assessment because ecological effects are considered to be negligible.

1.3.28 **Table 1.1** identifies those receptors where background levels of nitrogen currently exceed the critical level or load, and where modelled increases in nitrogen are above the 1% threshold. Where increases in nitrogen are below 0.4 kg N/ha/yr, there will be no loss of species richness and effects will be not significant. Where increases in nitrogen are above 0.4 kg N/ha/yr, further assessment is provided below.

Table 1.1: Level of potential impacts to non-statutory designated areas & ancient woodland where increases in oxides of nitrogen or nitrogen are above the 1% threshold

Receptor	Approximate distance from ARN road edge	Maximum nitrogen increase (%) [5]	Maximum nitrogen increase (kg N/ha/yr) [5]	Significance[4]
Bradley Wood SINC	10m	1.5%	0.15	Not significant
Durden Copse SINC & AWL	60m	1.6%	0.16	Not significant
Freementles & Great Moorlands Copse Complex SINC and AWL	0m	3.0%	0.3	Not significant
Great Pen Wood SINC & AWL	0m	3.0%	0.3	Not significant

[4] See Design Manual for Roads and Bridges (DMRB) LA105 Air Quality (Highways England, 2019)

Receptor	Approximate distance from ARN road edge	Maximum nitrogen increase (%) [5]	Maximum nitrogen increase (kg N/ha/yr) [5]	Significance[4]
Hedgerow Copse SINC & AWL	0m	1.6%	0.16	Not significant
Little Hitchens Copse SINC	20m	1.0%	0.1	Not significant
Magdalen Hill Down SINC	0m	3.5%	0.53	Further assessment provided below
Powells Grove Copse SINC & AWL	0m	16.7%	1.67	Further assessment provided below
Shorley Copse SINC & AWL	80m	1.3%	0.13	Not significant
Tidbury Ring Wood SINC & AWL	20m	1.1%	0.11	Not significant
Unnamed Ancient Woodland (ERAWA)	0m	3.3%	0.33	Not significant
Unnamed Ancient Woodland (ERAWB)	10m	4.1%	0.41	Further assessment provided below
Hitchens Copse & Clearing SINC & AWL	10m	1.2%	0.12	Not significant
A31 Petersfield Road SINC & Road Verge of Ecological Importance (RVEI)	0m	2.3%	0.34	Not significant

Magdalen Hill Down SINC

1.3.29 Increases in nitrogen at Magdalen Hill Down SINC are 0.53 kg N/ha/yr at road edge, reducing to 0.19kg N/ha/yr 10m into the SINC. Excessive nitrogen can have negative impacts to plants and habitats by altering the biochemistry of the plants, or through stimulating the growth of competitive plant species which can reduce species diversity within a habitat (apis.ac.uk, 2018). Natural England

Report 210 indicates increases of at least 0.4kg N/ha/yr can result in the loss of one species from a habitat, although it is worth noting this a precautionary threshold based on sensitive heathland habitats.

1.3.30 Natural England Report 210 also demonstrates that habitats receiving high baseline rates of nitrogen deposition are less sensitive to nitrogen deposition. Existing nitrogen deposition at the roadside at Magdalen Hill Down SINC is approximately 26kg N/ha/yr. Report 210 indicates at this level of background deposition, increases of over 2kg N/ha/yr are required to reduce species richness. As such, the increases in nitrogen at the edge of the SINC are well below the level at which a theoretical reduction in species diversity might occur. As such, effects from changes in emissions from the Scheme will be not significant to Magdalen Hill Down SINC, of County importance.

Powells Grove Copse SINC & AWL

1.3.31 Increases in nitrogen at Powells Grove Copse SINC & AWL are 1.67 kg N/ha/yr at road edge, reducing to 0.4 kg N/ha/yr 20m from the roadside. Excessive nitrogen can have negative impacts to plants and habitats by altering the biochemistry of the plants, or through stimulating the growth of competitive plant species which can reduce species diversity within a habitat (apis.ac.uk, 2018). Natural England Report 210 indicates increases of at least 0.4kg N/ha/yr can result in the loss of one species from a habitat, although it is worth noting this a precautionary threshold based on sensitive heathland habitats. The area of SINC which may experience exceedance of 0.4kg N/ha/yr is c.0.25ha, which is approximately 1% of the total area (23 ha) of the SINC and ancient woodland.

1.3.32 Natural England Report 210 also demonstrates that habitats receiving high baseline rates of nitrogen deposition are less sensitive to nitrogen deposition. The existing background levels of nitrogen deposition in this area of the SINC and ancient woodland are already very high, currently approximately 42kg N/ha/yr at road edge, and approximately 33 kg N/ha/yr 20m from the roadside. Report 210 indicates at this level of background deposition, increases of over 2.4 kg N/ha/yr are required to reduce species richness.

1.3.33 Due to improvements in vehicle technology (and anticipated transition away from internal combustion engines), emissions of NOx are predicted to decrease over time. The time taken for NOx emissions in the 'Do-Something' scenario (with the Scheme) to reduce to the Opening Year 'Do Minimum' (without the Scheme) levels is estimated at 5-10 years. As such, the increases in nitrogen deposition at Powells Grove Copse SINC will be temporary

1.3.34 Increases in nitrogen above the 0.4kg N/ha/yr threshold are only over a very small area (c. 1%) of the SINC, and are below the level at which a theoretical reduction in species diversity might occur. As such, effects from changes in emissions from the Scheme will be not significant to Powells Grove Copse SINC and ancient woodland, of National importance.

Unnamed ancient woodland (ERAWB)

1.3.35 Increases are 0.41kg N/ha/yr at the edge of the ancient woodland, and the level reduces to 0.27kg N/ha/yr 10m into the woodland. Excessive nitrogen can have negative impacts to plants and habitats by altering the biochemistry of the plants, or through stimulating the growth of competitive plant species which can reduce species diversity within a habitat (apis.ac.uk, 2018). Natural England Report 210 indicates increases of at least 0.4kg N/ha/yr can result in the loss of one species from a habitat, although it is worth noting this a precautionary threshold based on sensitive heathland habitats.

1.3.36 Natural England Report 210 also demonstrates that habitats receiving high baseline rates of nitrogen deposition are less sensitive to nitrogen deposition. The existing background levels of nitrogen deposition in this area of the ancient woodland are already very high, currently approximately 47kg N/ha/yr at the edge of the ancient woodland. Report 210 indicates at this level of background deposition, increases of over 2.4kg N/ha/yr are required to reduce species richness.

1.3.37 Increases in nitrogen above the 0.4kg N/ha/yr threshold are only at the boundary of the ancient woodland, and are well below the level at which a theoretical reduction in species diversity might occur. As such, effects from changes in emissions from the Scheme will be not significant to this unnamed ancient woodland, of National importance.

1.4 Conclusions

1.4.1 The assessment has identified that for the majority of designated sites and ancient woodlands, increases in nitrogen deposition are below the 1% threshold, or if above the 1% threshold absolute changes are below 0.4 kg N/ha/yr. Where increases are above the 1% threshold and 0.4 kg N/ha/yr, due to existing high levels of nitrogen deposition, the increases are well below the level at which a theoretical reduction in species diversity might occur (Natural England Report 210 *Assessing the effects of small increments of atmospheric nitrogen deposition (above the critical load) on semi-natural habitats of conservation importance*). As such, effects from changes in emissions from the Scheme will be not significant.

1.4.2 The modelling results also show reductions in pollutants at some receptors. For instance, modelling demonstrates reductions in nitrogen of up to 12.9% at A31 Petersfield Road (East) SINC & RVEI, and up to 2.9% at St. Swithun, Headbourne Worthy SINC.

1.5 References

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