In Parliament – Session 2022 - 2023

HS2

High Speed Rail (Crewe – Manchester)

Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement

Volume 5: Appendix EC-016-00006

Ecology and biodiversity

Designated site assessment for the Midland Meres and Mosses Phase 2 Ramsar site (Oakhanger Moss)

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Department for Transport

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1 Introduction

1.1 Purpose of this appendix

1.1.1 This report is an appendix to the ecology and biodiversity assessment which forms part of Volume 5 of the Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES).

1.1.2 It provides an assessment to enable the identification of likely significant effects on the Oakhanger Moss Site of Special Scientific Interest (SSSI) component of the Midland Meres and Mosses Phase 2 Ramsar site (hereafter referred to as Oakhanger Moss).

1.1.3 This report provides the background assessment for identifying any likely significant effects on Oakhanger Moss as a result of the AP2 revised scheme to be reported under the EIA Regulations 2017 (as amended)[1]. This background assessment is provided in Section 3 of this report.

1.1.4 The High Speed Two (HS2) High Speed Rail (Crewe – Manchester) Environmental Statement (ES) was published in 2022[2] (the main ES). Volume 5 of the main ES and SES1 and AP1 ES included a draft assessment to inform a Habitats Regulations Assessment for Oakhanger Moss[3&4]. Further and separate assessment is being carried out in line with Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended)[5]. Section 4 of this report provides the emerging results at this current stage of design and assessment, which will be finalised as part of the further and separate assessment.

1.1.5 This report should be read in conjunction with the SES2 and AP2 ES Volume 2, Community Area report: Hough to Walley's Green report (MA01).

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[1] *The Town and Country Planning (Environmental Impact Assessment) Regulations 2017*. Available online at: https://www.legislation.gov.uk/uksi/2017/571/pdfs/uksi_20170571_en.pdf.

[2] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement.* Available online at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

[3] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement*, *Document to inform a Habitats Regulations Assessment for the Midland Meres and Mosses Phase 2 Ramsar site (Oakhanger Moss),* Volume 5, Appendix: EC-016-00006. Available online at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

[4] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-supplementary-environmental-statement-1-and-additional-provision-1-environmental-statement.

[5] *The Conservation of Habitats and Species Regulations 2017* (2017/1012), as amended by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (2019/579). Her Majesty's Stationery Office, London.

1.1.6 In order to differentiate between the original scheme and the subsequent changes, the following terms are used in the SES2 and AP2 ES:

- 'the original scheme' – the Bill scheme submitted to Parliament in 2022, which was assessed in the main ES;
- 'the SES1 scheme' – the original scheme with any changes described in SES1 that are within the existing powers of the Bill;
- 'the AP1 revised scheme' – the original scheme as amended by SES1 changes and AP1 amendments;
- 'the SES2 scheme' – the original scheme with any changes described in SES1 (submitted in July 2022) and the SES2; and
- 'the AP2 revised scheme' – the original scheme as amended by SES1 and SES2 changes (as relevant) and AP2 amendments.

1.1.7 This report assesses the impacts on Oakhanger Moss using an updated methodology for the assessment of air pollution arising from traffic flows. Further details are provided in the SES2 and AP2 ES Volume 5, Appendix: CT-001-00003 Air quality – Technical note – Updated guidance on the assessment methodology for Phase 2b SES2 and AP2 ES.

2 Context

2.1 AP2 revised scheme

2.1.1 Oakhanger Moss lies approximately 4.4km east from the land required for the construction of the AP2 revised scheme in the Hough to Walley's Green (MA01) community area. Here, the route of the AP2 revised scheme will extend from its southern connection with HS2 Phase 2a northwards to the Wimboldsley to Lostock Gralam (MA02) community area. The AP2 revised scheme will result in changes to traffic flows during construction, along the M6, which, at its closest point lies approximately 120m to the east of Oakhanger Moss.

2.1.2 These changes will arise from HS2 construction traffic (including construction Heavy Duty Vehicles[6] (HDV) and workforce vehicles), as well as traffic re-distributed from other routes in the area. Construction traffic is anticipated to make use of the M6 from 2027 to 2038, although peak flows will be limited to 2027 to 2031, with flows declining markedly thereafter.

2.2 Site description and nature conservation targets

Midland Meres and Mosses Phase 2 Ramsar site

2.2.1 The Midland Meres and Mosses Phase 2 Ramsar site extends over 2,365ha across 18 discrete SSSI sites[7] distributed throughout the northwest Midlands and northeast Wales, over a land area that extends 75km from north to south and 60km from west to east. Figure 1 shows the location and extent of the Ramsar site and Figure 2 shows the location of Oakhanger Moss relevant to the AP2 revised scheme. The Ramsar Information Sheet[8] identifies that Oakhanger Moss qualifies for Ramsar status under criteria (1) and (2) on account of the presence of 'a diverse range of habitats from open water to raised bog' and the presence of a number of rare plants and invertebrates. Elsewhere, it describes the entire Ramsar site as comprising open water (meres) and their associated fringing habitats (for example, reed swamps, fen, carr and damp pasture) and a smaller number of nutrient poor peat bogs (mosses). However, not all features are present on all sites. Although the Ramsar-

[6] HDV are defined as those with an unladen weight of greater than 3.5 tonnes, including: large vans; medium goods vehicles (rigid and artic); heavy goods vehicles (rigid and artic); and, buses/coaches.

[7] Note that the favourable condition table for Oakhanger Moss suggests that there are 19 components and includes Rostherne Mere in the list of sites. This appears to be an error. Rostherne Mere is a standalone Ramsar site. Confirmation of this can be gained by accessing the following sites: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK11080&SiteName=&countyCode=&responsiblePerson=&unitId=&SeaArea=&IFCAArea= and https://jncc.gov.uk/jncc-assets/RIS/UK11080.pdf.

[8] Joint Nature Conservation Committee (1997), *Ramsar Information Sheet (RIS): Midland Meres and Mosses Phase 2*. Available online at: https://jncc.gov.uk/jncc-assets/RIS/UK11080.pdf.

qualifying features are quite broadly described, together they encompass a distinctive group of water bodies with characteristic hydrological regimes, water chemistry and animal and plant communities. However, the Ramsar Information Sheet confirms its primary interest remains the 'wide range of lowland wetland types and successional stages within a distinct biogeographical area'.

2.2.2 As Natural England does not produce conservation objectives, supplementary advice or site improvement plans (SIP) for Ramsar sites, evidence is drawn from the citation[9] for Oakhanger Moss SSSI (which was notified for broadly similar reasons) and its Favourable Condition Tables (FCT)[10]. The citation (1994) describes Oakhanger Moss as one of the shallowest water bodies in the area west of Alsager, though of great importance for its range of mire communities and range of successional stages, from open water to raised bog. Four different mire communities are present, each with a well-developed shrub layer. Whilst swamp dominates much of Oakhanger Moss, more diverse fen communities are found along the eastern boundary 'where nutrient levels are at their highest'. An 'incipient raised bog' (higher than the surrounding fen) is present in the centre. The location and local setting of Oakhanger Moss is shown in Figures 1 and 2, respectively. Further detail is provided in the FCT and in accompanying notes.

[9] English Nature (1994), *Citation for Oakhanger Moss, SSSI*. Available online at: https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1006639.pdf.

[10] Natural England (2015), *Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest. Oakhanger Moss.*

Figure 1: Location of the constituent SSSI forming the Midland Meres and Mosses Phase 2 Ramsar (Oakhanger Moss)

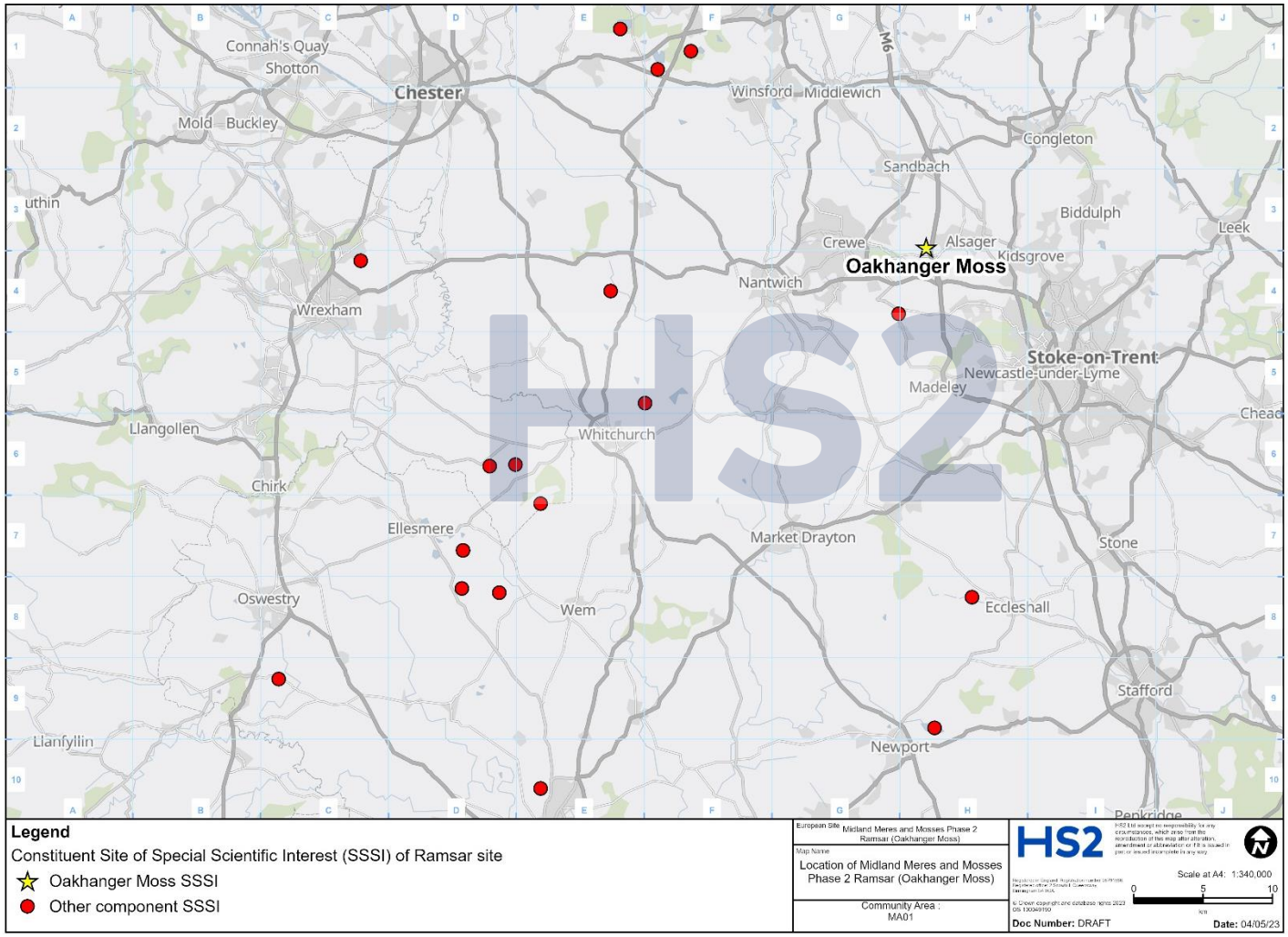
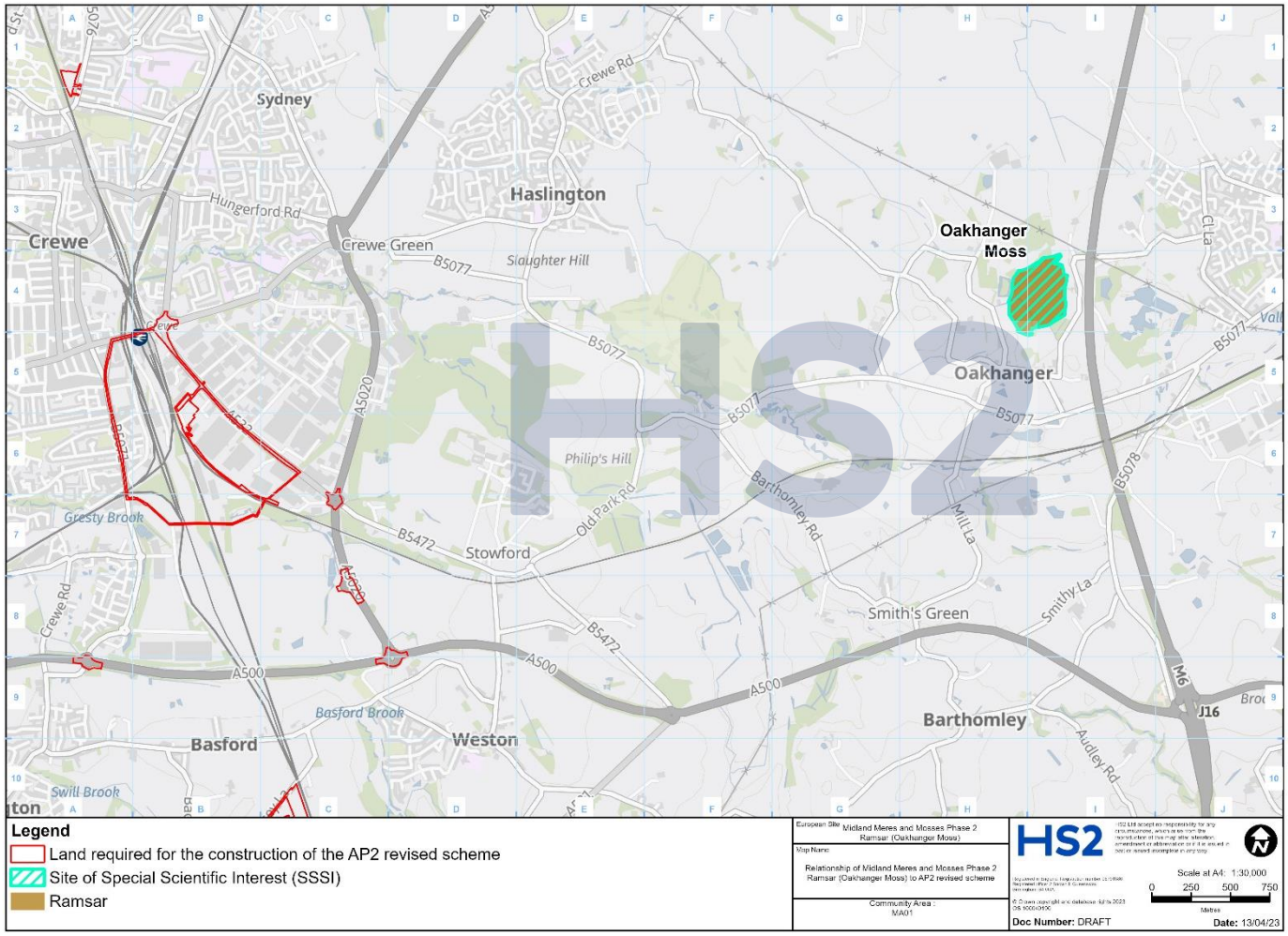


Figure 2: Relationship of Oakhanger Moss to the AP2 revised scheme



2.2.3 At a broad level, the more recent FCT defines the complex of habitats at Oakhanger Moss as fen, marsh and swamp, but it is the range of mire communities that present the primary interest in terms of the Ramsar site although only two communities, M2 and M18, are now thought to remain. Despite succession to woodland, fen, marsh, swamp and mire communities persist beneath the canopy and in clearings and continue to represent a valuable component of the overall Ramsar site. The FCT lists the following features that are considered to represent features of the Ramsar site:

- basin fen (lowland): M2 Sphagnum cuspidatum/recurvum bog pool community (or Basin fen: ombrogenous nuclei (topogenous bog));
- basin fen (lowland): M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire (or Basin fen: ombrogenous nuclei (topogenous bog));
- basin fen (lowland): S3 *Carex paniculata* swamp (or base-poor and base-rich sump wetland);
- basin fen (lowland): S7 *Carex acutiformis* swamp (or base-poor and base-rich sump wetland);
- basin fen (lowland): S27 *Carex rostrata-Potentilla palustris* swamp (or base-poor and base-rich sump wetland);
- wet woodland: W1 *Salix cinerea-Galium palustre* fen woodland (or Fen woodland);
- wet woodland: W4 *Betula pubescens-Molinia caerulea* fen woodland (or Fen woodland); and
- wet woodland: W5 *Alnus glutinosa-Carex paniculata* woodland (or Fen woodland).

2.2.4 Natural or near-natural examples of mires and bogs are nutrient-poor (or oligotrophic) habitats and, as such, are sensitive to changes in the hydrological regime and eutrophication (including via atmospheric inputs of nitrogen see Section 3.2) which can prompt changes in species composition, abundance, and distribution at the community scale. This is perhaps manifested most clearly at Oakhanger Moss, which can be considered to be nutrient-rich, by the dominance of woodland communities and the loss of the natural, surrounding 'lagg fen'. The FCT also provides evidence to show that Oakhanger Moss is impacted by ditches which may not only drain the site but also introduce nutrient enriched water from surrounding farmland. Whilst ditch blocking and other measures to re-wet Oakhanger Moss have been implemented, it would appear to be in a state of flux. For instance, the M18 and M25 communities were once considered by Natural England to have been lost from the site. However, the M18 community now appears to be in the process of becoming re-established. In 2014, Natural England estimated that the mire communities occupied just 0.2ha, swamp 0.3ha whilst woodland extended across the remaining 12.8ha. Consequently, Oakhanger Moss can be considered to be far from a natural system and in an unfavourable condition (see condition assessment below).

Conservation objectives

2.2.5 In lieu of formal Ramsar conservation objectives, the targets set out in the FCT have been considered. Whilst it is acknowledged that the FCT was designed for monitoring purposes and not impact assessment, and any thresholds in the FCT refer primarily to site management and monitoring, they identify key features and aspirations which other plans or projects should address, and which can be considered with caution for the purposes of this report. Therefore, the FCT is regarded as a reasonable surrogate for Ramsar conservation objectives for Oakhanger Moss. An extract of the most relevant higher-level targets from the FCT is provided below.

2.2.6 In relation to habitat extent, the FCT states that '…To maintain the designated features in favourable condition, which is defined in part in relation to a balance of habitat extents (extent attribute). Favourable condition is defined at this site in terms of the site-specific standards for lowland fens (basin mire): there should be no reduction in the total combined extent of wetland in relation to the established baseline.'

2.2.7 Site-specific definitions of favourable condition for fen, marsh and swamp are '…To maintain the fen, marsh and swamp at Oakhanger Moss in favourable condition, with particular reference to relevant specific designated interest features:

- basin fen – Habitat extent: There should be no reduction in the total combined extent of wetland, including all associated pools and lagg fen, in relation to the established baseline;
- wet woodland – Habitat extent: At least current area (as surveyed in 2014) of recent semi-natural stands maintained, although their location may alter; and
- basin fen – Habitat composition: There should be no loss of the component types M2, M18, S3, S7 and S27. Balance between open fen and wet woodland W1, W4 and W5 maintained at current levels and in roughly the current locations. Community and habitat transitions are maintained at current levels and in current locations.'

2.2.8 While it is clear the above communities represent elements of the 'diverse range of habitats' described in the Ramsar Information Sheet, it is noted that there is no specific reference to the assemblage of rare plants and invertebrates provided in either the FCT or SSSI citation. Consequently, these are considered to be absent, and no consideration is given to these in this report. If, however, they are shown to be present, their requirements are considered to be satisfactorily addressed by the assessment of the supporting habitats.

2.2.9 Similarly, although the W1 woodland community is referred to throughout the FCT, it is not shown in habitat maps produced by Natural England and it is assumed it is accommodated within references to W4 and W5, which are more fully described throughout.

Condition Assessment

2.2.10 The most recent formal condition monitoring assessment of Oakhanger Moss was carried out by Natural England in 2012[11], although this pre-dated, and so would not have taken account of, the objectives embedded in the current FCT. This found that the entire site was considered to be in an 'unfavourable declining' condition. It described Oakhanger Moss (including the mire) as 'very dry', with both the wetland and woodland communities failing their respective objectives due to the lack of positive, or presence of negative, indicator species. It added that management measures did 'not seem to be effective', concluding that the key interest feature (basin fen (lowland), M18) had been lost in 2007 and, though subject to restoration management, was 'unlikely to reappear'. In addition, Natural England confirmed that the woodland (W10) and bracken community along the edges of Oakhanger Moss were only included within the designated site as a 'hydrological buffer'.

2.2.11 However, the FCT includes site visit notes that describe Oakhanger Moss in 2007 and 2014, respectively, after scrub had been removed to restore the mire communities (referred to above):

- in 2007, Oakhanger Moss was regarded as being in 'unfavourable recovering' condition. However, all M18 communities were recorded as 'lost'. Enrichment of Oakhanger Moss was put down to nutrient rich surface waters flowing through the site; and
- in 2014, Oakhanger Moss was regarded as 'very dry', despite a wet summer, and the dams did not appear to be working. The area cleared of scrub in 2007 was reverting to woodland. As in 2012, it failed its FCT objectives.

2.2.12 While the most recent assessment was carried out over ten years ago, there is little to suggest circumstances have changed and, overall, it is assumed that Oakhanger Moss remains in an unfavourable condition and vulnerable to external influences.

[11] Natural England (2012), *Condition of SSSI Units for Site Oakhanger Moss SSSI*. Available online at: https://designatedsites.naturalengland.org.uk/ReportUnitCondition.aspx?SiteCode=S1006639&ReportTitle=Oakhanger%20Moss%20SSSI.

3 Assessment of the AP2 revised scheme

3.1 Introduction

3.1.1 This section provides the background assessment for identifying any likely significant effects on Oakhanger Moss to be reported under the EIA Regulations 2017 (as amended). The conclusions of this assessment are summarised in the SES2 and AP2 ES Volume 2, Community Area report: Hough to Walley's Green report (MA01).

3.1.2 This assessment identifies the likely significant effects as a result of the AP2 revised scheme. In addition, the air quality modelling, from which the impacts and effects reported below are derived, has taken into account cumulative effects from background traffic growth, committed developments[12] and impacts related to traffic emissions arising from the SES2 changes and AP2 amendments.

3.2 Scope, assumptions, and limitations

3.2.1 Oakhanger Moss lies 4.4km away from the land required for the construction of the AP2 revised scheme. Given the distance from Oakhanger Moss, direct impacts can be ruled out. The only potential impacts that could arise as a result of the AP2 revised scheme are restricted to changes in air quality and hydrology.

3.2.2 Oakhanger Moss is located approximately 4.4km upstream of the AP2 revised scheme and occupies higher ground. Making the reasonable assumption that groundwater flow in the superficial deposits follows topography, there would be no hydraulic connection between the site and the AP2 revised scheme. Therefore potential impacts from changes in hydrology can be ruled out.

3.2.3 Consequently, the only plausible impact is from air pollution caused by changes in traffic brought about by the AP2 revised scheme, allied with the general growth in traffic in the area. This issue is assessed below.

[12] Committed developments relevant to the AP2 revised scheme are reported in Volume 5 Planning data report of the SES2 and AP2 ES (see SES2 and AP2 ES Volume 5, Appendix: CT-004-00000). Committed developments are defined as developments with planning permission and sites allocated for development in adopted development plans, on or close to the land required for the scheme.

Air pollution assessment methodology

3.2.4 The assessment of air pollution is informed by established best practice provided by National Highways[13,14], Natural England[15,16], and the Institute for Air Quality Management (IAQM)[17].

3.2.5 These provide evidence that natural or semi-natural habitats can be harmed by vehicle emissions through two intimately linked pathways: via the concentration of nitrogen oxides (NOx) and ammonia (NH_3) and the subsequent deposition of nitrogen and acid. The assessment of the impact of air pollution therefore comprises the analysis of the dispersal of these compounds.

3.2.6 In sufficient concentrations, airborne NOx and NH_3 can result in direct toxic effects on vegetation. Further, the subsequent deposition of nitrogen compounds can lead to the acidification and nutrient enrichment of land and water. Over time, this may not only hinder the growth, abundance and distribution of plants, and especially, bryophytes and lichens, but can also prompt the growth of ruderal species or algal blooms which can lead to changes in the structure and function of qualifying or supporting habitats. Whilst certain species and communities are less susceptible to harm than others, increases in the airborne concentration of pollutants or the rate of their deposition can also exacerbate the effects of other factors such as climate change or pathogens leading to negative, synergistic effects.

3.2.7 The concentrations and/or rates of the deposition of nitrogen compounds fall quickly in the first few metres from the roadside before gradually levelling out; beyond 200m, it becomes difficult to distinguish from background levels. This means that impacts at 10m, 50m or 200m or more can be very different from those at the roadside.

3.2.8 The assessment of air pollution impacts for ecologically sensitive sites within 200m of roads is undertaken where one or more of the following Design Manual for Roads and Bridges (DMRB)[13] criteria are met:

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[13] Highways Agency (2019), *Design Manual for Roads and Bridges (DMRB), Sustainability and Environmental Appraisal, LA 105 Air Quality*, Highways Agency, London. Available online at: https://www.standardsforhighways.co.uk/dmrb/search/10191621-07df-44a3-892e-c1d5c7a28d90https://www.standardsforhighways.co.uk/dmrb/.

[14] National Highways (2021), *Ammonia N Deposition Tool V2.*

[15] Natural England (2018), *Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations.* Available online at: http://publications.naturalengland.org.uk/publication/4720542048845824.

[16] Although designed for Habitats Regulations Assessments, Natural England (2018) guidance is applicable for the assessment under the EIA Regulations, 2017 (as amended). Section 1.1.6 states: '...this guidance does not specifically cover nationally significant sites, which are covered by a different regulatory framework. However, the general principles for air quality assessment outlined here for European Sites are likely to be equally relevant for this and other designations...'.

[17] Institute of Air Quality Management (2020), *A guide to the assessment of air quality impacts on designated nature conservation sites*, v1.1. Available online at: https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf.

- change in road alignment by 5m or more;
- change in daily traffic flows by 1,000 vehicles or more as Annual Average Daily Traffic (AADT);
- change in daily flows of HDV by 200 AADT or more;
- change in daily average speed by 10kph or more; or
- change in peak hour speed by 20kph or more.

3.2.9 It can be seen, therefore, that the additional emissions that might arise from increased traffic are only likely to be significant where:

- a designated site lies within 200m of a road;
- traffic flows are expected to increase (or other DMRB criteria are met); and
- a qualifying feature is known to be sensitive to such impacts.

3.2.10 Should all three criteria be met, best practice guidance recommends that the ecological characteristics of the site should be explored and, if necessary, traffic and/or air quality assessments carried out to evaluate any impacts during construction or operation.

3.2.11 The ecological characteristics of a site are derived from the formal citations, condition assessments, conservation objectives, FCT, SIP, supplementary advice and any other surveys and management plans where available.

3.2.12 Traffic flows are assessed by calculating AADT figures using established models[18]. Should increases in traffic be less than 1,000 AADT[19] or 200 HDV, the risk of a significant effect can be ruled out and no further assessment is required. Should flows exceed these values, air quality analysis is necessary.

3.2.13 The air quality analysis typically models any changes at fixed points on a 200m transect extending from the roadside. Impacts identified through the air quality analysis are assessed by calculating the relative contribution of the plan or project in relation to the relevant critical levels for NOx and NH_3 and the critical loads for the deposition of nitrogen and acid, as described by the Air Pollution Information System (APIS)[20], as follows:

- the critical level for NOx is fixed and is expressed as a concentration: 30µg/m^3. It is a precautionary threshold below which there is confidence that harmful effects on vegetation communities will not arise, and further assessment may not be necessary;

[18] It should be noted that traffic data used in the air quality assessment presented in the SES2 and AP2 ES is based on daily peak derived traffic data. The assessment presented in this appendix is based on annualised traffic data which is considered more appropriate for the purposes of the Designated Site Assessment.

[19] These values are utilised as there is evidence to show that these equate approximately to a 1% change in critical loads.

[20] UK Centre for Ecology and Hydrology (2021), *Air Pollution Information System*. Available online at: http://www.apis.ac.uk/.

- the critical level for NH_3 is also expressed as a concentration and is set at 3µg/m^3 for higher plants and at 1µg/m^3 where bryophytes or lichens are present and are considered to '...form a key part of the ecosystem integrity'[21];
- the critical loads for nitrogen deposition vary and are specific to each qualifying feature. These are presented as a range of values (expressed as a rate, e.g. 10kg N/ha/yr – 20kg N/ha/yr) and typically, only the lowest value is used (unless there are compelling reasons to do otherwise) as this will emphasise any negative outcomes; and
- acid deposition is also assessed via critical loads, though measured in keq/ha/yr.

3.2.14 Natural England best practice guidance[15] specifies that should nitrogen deposition increase by less than 1% of the lower critical load or concentrations of NOx or NH_3 increase by less than 1% of the critical level, likely significant effects can be ruled out. However, should the 1% threshold be exceeded, a likely significant effect cannot be ruled out.

3.2.15 The assessment of significance of acid deposition differs. If the total concentration is predicted to be less than the lower critical load, then the effect is considered not to be significant. However, a likely significant effect cannot be ruled out when: the change in concentration is more than 1% of the maximum critical load and the total for acid deposition is also greater than the maximum critical load.

3.2.16 The 1% threshold, set at two orders of magnitude below the critical load or level, is highly precautionary. Account must also be taken of the type of habitats (some are more resilient than others) and the distribution of the designated features as not all will be distributed evenly across sites, and other factors may be at play.

3.3 Assessment of impact and effects

3.3.1 Oakhanger Moss lies approximately 120m from the M6, within the 200m threshold described in Section 3.2. Consequently, an assessment of traffic flows is required.

3.3.2 The following assessment utilises relevant traffic and air quality analysis as set out in Annex A and reports any likely significant effects on a precautionary basis. HS2 Ltd is continuing to identify suitable measures to mitigate or compensate for potential significant effects identified on designated sites.

[21] Air Pollution Information Systems (2016), *Critical Loads and Critical Levels – a guide to the data provided in APIS*. Available online at: https://www.apis.ac.uk/critical-loads-and-critical-levels-guide-data-provided-apis#_Toc279788054.

Assessment of traffic flows and air pollution during construction

3.3.3 The traffic analysis (see Section 5.1, Annex A) indicates that the construction of the AP2 revised scheme will exceed the AADT or HDV traffic thresholds described in Section 3.2. Therefore, an air quality assessment is required.

3.3.4 The air quality assessment of traffic flows is summarised in Annex A. This has been undertaken in accordance with the Volume 5, Appendix: CT-001-00001, Environmental Impact Assessment Scope and Methodology Report (SMR)[22] and the SES2 and AP2 ES Volume 5, Appendix: CT-001-00003 Air quality – Technical note – Updated guidance on the assessment methodology for Phase 2b SES2 and AP2 ES.

3.3.5 Only one air quality modelling transect (represented by yellow dots on Figure 2) was employed, extending from the M6 to the east, situated to reflect the greatest air quality impact as well as to take account of the most sensitive habitat features.

3.3.6 The transect initially crosses agricultural land before intercepting with the SSSI/Ramsar site boundary at a distance of 122m and remaining within it to the full extent of the transect, though the designated site extends beyond this.

Critical loads and levels

3.3.7 In the main ES, all but the central clearing of Oakhanger Moss was assessed as a lagg fen (with corresponding nitrogen and acid deposition critical loads and levels); however, this report reflects Natural England's published information on the site. Whilst critical loads change accordingly, the outputs of the assessment indicate a greater impact. The characterisation of the habitats and the identification of the most appropriate critical loads will be kept under review and will be informed by the results of current surveys, and consultation with Natural England, including any future restoration activities.

3.3.8 Drawing on the type and distribution of habitats provided in Annex 1 of the FCT, and evidence derived from APIS, the habitat types found within the 200m transect comprised, in order from the road, 'W10' woodland, 'W5' fen or alluvial woodland and 'W4' fen or bog woodland. Importantly, the maximum extent of the transect fell on the edge of the important mire ('M2' and 'M18') and swamp ('S3' and 'S7') communities that occupy the centre of Oakhanger Moss.

3.3.9 Importantly, APIS did not provide critical loads for the W10 community at Oakhanger Moss. W10 is a relatively widespread habitat across lowland England but one that is more typical of base-poor brown earth soils. W10 is typically dominated by pedunculate oak and silver birch, other components including ash, sycamore and wych elm become more frequent in the

[22] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Environmental Impact Assessment Scope and Methodology Report,* Volume 5, Appendix: CT-001-00001. Available online at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

north. It lacks the characteristic woodland ground flora of bluebell and dog's mercury, instead being characterised by the presence of brambles and bracken though a wide range of other species can be found. Though undeniably of ecological interest, and a qualifying feature of other SSSIs in the Phase 2 Ramsar site (e.g. Oak Mere), it is not regarded to be of special interest at Oakhanger Moss. In this case, it was, as part of the woodland community, included within the boundary as a 'hydrological buffer' to provide some influence over the hydrological management of the surrounding land as water levels in the woodland communities will no doubt have some influence on water levels in the centre of Oakhanger Moss. Indeed, Natural England has recommended that it should be considered part of the 'lagg fen'.

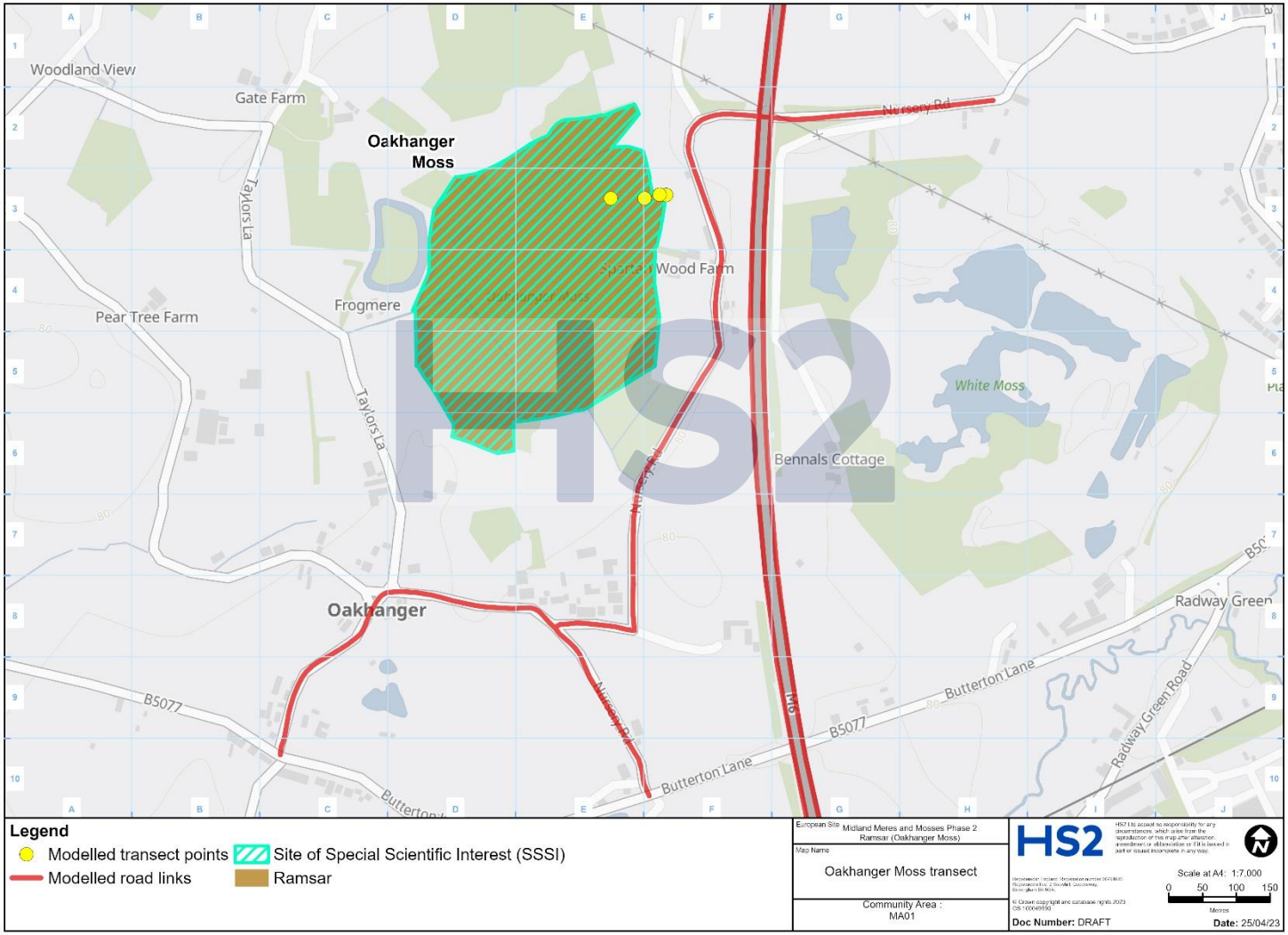
3.3.10 Reflecting these circumstances, the critical load for W10 from Oak Mere were adopted as it is considered that this represented a reasonable surrogate for the same habitat at Oakhanger Moss. Other habitats at Oakhanger Moss used the values provided by APIS[20]. The transect first intercepted each community as follows: W10, W5 W4 and M2/M18 at end of the transect.

- W10 broadleaved deciduous woodland (15kg N/ha/yr – 20kg N/ha/yr);
- W5 alluvial woodland (10kg N/ha/yr – 20kg N/ha/yr);
- W4 bog woodland (10kg N/ha/yr – 20kg N/ha/yr); and
- M18 mire (5kg N/ha/yr – 10kg N/ha/yr).

3.3.11 Given that bryophytes are considered to be an integral component of the qualifying wetland habitats, a critical level for NH_3 of 1µg/m^3 has been applied. As described above, the critical level for NOx is a constant (30µg/m^3).

3.3.12 Key outputs of the air pollution assessment are summarised below and in Annex A. The location of the modelled transect is shown on Figure 3.

Figure 3: Location of Oakhanger Moss and the modelled transect



Air pollution impacts

3.3.13 Table A5 of Annex A shows that predicted NOx concentrations with the AP2 revised scheme, are lower than the 2018 baseline rates at all modelled receptors (i.e. transect points). In addition, NOx concentrations are predicted to be within the air quality standard at all modelled receptors with or without the AP2 revised scheme. Further, there is a less than 1% exceedance of the NOx critical level brought about by the AP2 revised scheme. Therefore, likely significant effects can be ruled out.

3.3.14 Table A6 of Annex A shows that predicted NH_3 concentrations with the AP2 revised scheme, are higher than the 2018 baseline rates at all modelled receptors. In addition, NH_3 concentrations are predicted to be above the relevant air quality standard with or without the AP2 revised scheme. Further, there is a greater than 1% exceedance of the critical level at the edge of Oakhanger Moss where the transect intersects with the site at 122m from the road. This exceedance falls to below 1% at 155m from the road. Despite the rate of decline, likely significant effects cannot be ruled out.

3.3.15 Table A7 of Annex A shows that predicted nitrogen deposition rates with the AP2 revised scheme, are lower than the 2018 baseline rates at all modelled receptors. However, nitrogen deposition rates are predicted to be above the relevant air quality standard at all modelled receptors with or without the AP2 revised scheme. In addition, there is a greater than 1% exceedance of the lower critical load brought about by the AP2 revised scheme. The maximum change is 1.3% at 200m from the kerbside; where the transect intersects with more sensitive habitat. Therefore, likely significant effects cannot be ruled out.

3.3.16 Table A8 of Annex A shows that predicted acid deposition rates with the AP2 revised scheme, are the same as the 2018 baseline rates at all modelled receptors. However, acid deposition rates are predicted to be above the relevant air quality standard across all modelled receptors with or without the AP2 revised scheme. However, the changes brought about by the AP2 revised scheme do not exceed 1% of the critical load. Therefore, likely significant effects can be ruled out.

Assessment of traffic flows and air pollution during operation

3.3.17 The traffic analysis (see Section 7.1, Annex A) indicates that the AP2 revised scheme will not change traffic movements in the operational phase. Consequently, there are no air quality impacts and no assessment is required.

3.4 Mitigation measures

3.4.1 The likely significant effects identified above have been identified on a precautionary basis.

3.4.2 HS2 Ltd is continuing to seek to identify suitable measures to mitigate or compensate for potential significant effects identified on designated sites. In doing so HS2 Ltd will continue

to engage with stakeholders to fully understand the receptors and the suitability of the measures.

3.5 Summary of likely significant effects

3.5.1 The air quality assessment demonstrates that, in the absence of mitigation during construction, the relevant air quality standards are exceeded for NH_3 and nitrogen deposition and in addition, there is a greater than 1% exceedance of the critical level for NH_3 and the critical load for nitrogen deposition. Therefore, likely significant effects cannot be ruled out.

3.5.2 During operation there are no changes identified to traffic flows and therefore, there are no air quality impacts. Likely significant effects as a result of the AP2 revised scheme during operation can be ruled out.

4 Ongoing work

4.1 Introduction

4.1.1 A further and separate assessment is being carried out to meet the needs of Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) ('Habitats Regulations')[5]. This section provides the emerging results at this current stage of design and assessment, which will be finalised as part of the further and separate assessment.

4.1.2 This section uses language that will be applicable to the further assessment carried out under the Habitats Regulations.

4.1.3 This section considers the AP2 revised scheme in combination with other plans and projects that fall within a 10km radius of the designated site. The other plans and projects relevant to this assessment have been identified in Section 2 of Annex A.

4.2 Air quality assessment of traffic flows in combination

Methodology

4.2.1 The same transects and critical loads and levels, as described in Section 3, were utilised.

4.2.2 The scope of the in combination assessment has been limited to those plans or projects that could contribute to a cumulative increase in air pollution at Oakhanger Moss.

4.2.3 In combination effects are taken into account in the traffic and the non-traffic related emission sources used for the assessment, which incorporate likely changes brought about by other proposed and committed developments. The approach to this assessment, which has been agreed with Natural England, is provided in Section 2 of Annex A.

Construction phase impacts in combination

4.2.4 Table A12 of Annex A shows that predicted NOx concentrations with the AP2 revised scheme are lower than the 2018 baseline at all modelled receptors. In addition, NOx concentrations are predicted to be within the air quality standard at all modelled receptors with or without the AP2 revised scheme. However, there is a greater than 1% exceedance of the NOx critical level brought about by the AP2 revised scheme in combination. The maximum change is 3.3% where the transect intercepts with Oakhanger Moss, falling to 2.1% at 200m. Although all values lie below the 30µg/m^3 air quality standard, likely significant effects in combination cannot be ruled out.

4.2.5 Table A13 of Annex A shows that predicted NH_3 concentrations with the AP2 revised scheme are higher than the 2018 baseline rates at all modelled receptors. In addition, NH_3

concentrations are predicted to be above the air quality standard across the transect with or without the AP2 revised scheme. Further, the changes in NH_3 concentrations brought about as a result of the AP2 revised scheme in combination are greater than 1% of the critical level. The maximum change is 9.2% where the transect intercepts with Oakhanger Moss, falling to 5.9% at 200m from the road. Likely significant effects therefore cannot be ruled out in combination.

4.2.6 Table A14 of Annex A shows that predicted nitrogen deposition rates with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. However, nitrogen deposition rates are predicted to be above the air quality standard at all points on the transect with or without the AP2 revised scheme. In addition, the changes in nitrogen deposition brought about by the AP2 revised scheme in combination are greater than 1% of the critical load. The data show that the maximum change on the transect is 11.1% at 200m from the roadside. Likely significant effects therefore cannot be ruled out in combination.

4.2.7 Table A15 of Annex A shows that predicted acid deposition rates with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. However, acid deposition rates are predicted to be above the air quality standard at all modelled receptors with or without the AP2 revised scheme. Further, the changes in acid deposition brought about by the AP2 revised scheme in combination are greater than 1% of the maximum critical load with a maximum of 6.9% above the critical load recorded at 200m from the roadside where the transect intercepts with more sensitive habitat. Therefore, likely significant effects cannot be ruled out in combination.

Operational phase impacts in combination

4.2.8 As described in Section 3.3, the traffic analysis predicted that the AP2 revised scheme would not change traffic movements during the operational phase. Consequently, no air quality assessment was required, and likely significant effects were ruled out without any non-significant air quality impacts. Therefore, no in combination assessment is required.

4.3 Current status of the ongoing work

4.3.1 At this current stage of design and assessment, it is considered that likely significant effects cannot be ruled out as a result of the construction of the AP2 revised scheme in combination with other plans or projects.

4.3.2 Therefore, further and separate assessment of the AP2 revised scheme is being carried out to meet the needs of Regulation 63 of the Habitats Regulations. This will confirm the assessment conclusions at that stage of the design and assessment.

Annex A: Additional air quality information

1 Purpose

This annex provides additional air quality information in relation to impacts from vehicle emissions to support the assessment of the Midland Meres and Mosses Phase 2 Ramsar site (Oakhanger Moss SSSI).

This annex assesses the impact of air pollution on the Oakhanger Moss SSSI component of the Midland Meres and Mosses Phase 2 Ramsar site (Oakhanger Moss). For simplicity, it is referred to as Oakhanger Moss throughout the rest of this annex except where specific mention is required of the Ramsar site.

2 Scope, assumptions and limitations

The scope, assumptions and limitations for the air quality assessment are set out in full in Volume 1 (Section 8) of the SMR (see Volume 5, Appendix: CT-001-00001) and accompanying SMR Technical note – Air quality: Guidance on the assessment methodology[22] and the SES2 and AP2 ES Volume 5, Appendix: CT-001-00003 Air quality –Technical note – Updated guidance on the assessment methodology for Phase 2b SES2 and AP2 ES.

Key elements in relation to the assessment of vehicle emissions on ecologically sensitive sites are:

- screening of traffic data using the criteria set out in the SMR, which is based on the DMRB criteria[13] to identify where assessment is required;
- these criteria are the following for assessing the impacts of the scheme:
  - change in road alignment by 5m or more;
  - change in daily traffic flows by 1,000 vehicles or more as AADT;
  - change in daily flows of HDV by 200 AADT or more;
  - change in daily average speed by 10kph or more; or
  - change in peak hour speed by 20kph or more.
- the following criteria are used for assessing the impacts of the scheme in combination with other plans and projects:
  - change in daily traffic flows by 1,000 vehicles or more as AADT; or
  - change in daily flows of HDV by 200 AADT or more.
- ecological receptors included in the air quality assessment are designated sites with habitats sensitive to nitrogen. These could include SAC, Special Protection Area (SPA) and Ramsar sites;
- transects have been used within a designated site with modelled points at 0m, 10m, 20m, 30m, 40m, 50m, 75m, 100m, 150m and 200m from the edge of the road unless the shape of the site and potential impacts require different distances to characterise the impacts;
- a deposition velocity relevant to the habitat of each site has been used, as detailed in the IAQM ecological guidance[17]. Data on ammonia, nitrogen deposition and acid deposition has been taken from the most recent information available on the APIS[23] website. No plume depletion for ammonia dispersion modelling has been included. No reduction in future background deposition rates or background pollutant concentrations has been applied to the APIS data;

[23] Air Pollution Information System (2016). *Critical Loads and Critical Levels – a guide to the data provided in APIS*. Available online at: https://www.apis.ac.uk/critical-loads-and-critical-levels-guide-data-provided-apis#_Toc279788054.

The following scenarios were assessed:

- baseline;
- selected year(s) within the construction period for the assessment of the effects of construction. The year(s) of assessment were selected based on the worse case annual average traffic data, refined from the peak period traffic data, during the construction programme and when significant effects might be expected, and
- a scenario for the first full operational year after construction is completed.

The baseline scenario represents 2018 including when temporary construction works associated with the M6 Junction 16 to Junction 19 smart motorway were underway.

For the construction assessments, emission factors and backgrounds (with the exception of the APIS data) used the earliest construction year (i.e. 2028). This is a worst case assumption as emissions from road vehicles are improving year-on-year (e.g. due to increasing numbers of electric vehicles) and the worst case construction period may not fall in the first year of construction.

For each assessment year, both the scenario without the AP2 revised scheme in place and the scenario with the AP2 revised scheme in place have been modelled, with background pollutant concentrations, deposition rates and emission factors representing the future year being assessed (with the exception of the APIS data). This comparison was used to assess the impacts of the AP2 revised scheme.

For the assessment of the AP2 revised scheme in combination with other plans and projects, a different 'without' scheme scenario was used and described as the 'do nothing' scenario. This uses traffic data from the 2018 baseline, but background pollutant concentrations, deposition rates and emission factors representing the future year being assessed (with the exception of the APIS data). This uses traffic data from a baseline proxy scenario representing the M6 Junction 16 to Junction 19 smart motorway and traffic demand for 2018. This is considered to be more appropriate for the do-nothing scenario than using the 2018 baseline traffic data because traffic flows were temporarily affected by construction works associated with the smart motorway. The 'do nothing' scenario uses background pollutant concentrations and emission factors representing the future year being assessed which in this area is 2028.

The assessment incorporated HS2 Ltd's policy on construction vehicle emissions standards. These standards are published in Information Paper E14[24]; Air Quality and include Euro VI for HGVs, and Euro 6 and Euro 4 for diesel and petrol Light Duty Vehicles respectively.

The traffic forecasts that underpin the assessment were derived from strategic traffic models that have been sourced from key stakeholders, including Local Highway Authorities

[24] High Speed Two Ltd (2022), *High Speed Two Phase 2b Information Paper E14: Air Quality.* Version 2. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1084183/E14_Air_quality_v2.pdf.

and National Highways. In combination, these models cover the areas that are expected to be affected by the AP2 revised scheme and have been used as the basis of assessment for traffic flow analysis. The models have been developed by the relevant stakeholders in accordance with Transport Analysis Guidance (TAG) provided by the Department for Transport, with each model representing a base year position between 2016 and 2018. It is understood that the strategic traffic models supplied to HS2 Ltd take account of the core development growth scenarios set out in the relevant local plan documents, transport strategy documents and model forecasting reports published at that time. Information about these development growth scenarios can be found in the following documents:

- Cheshire East Local Plan Strategy 2010-2030, July 2017[25];
- Cheshire West and Chester Local Plan (Part Two) Land Allocations and Detailed Policies, November 2017[26];
- Winsford Transport Strategy Recommendations Report, June 2016[27];
- Northwich Transport Strategy Recommendations Report, April 2018[28];
- Regional Investment Programme (RIP) M6 Junction 19 Improvement PCF Stage 3 Transport Forecasting Report, January 2019[29]; and
- GMVDM4A Uncertainty Log for NTEM GMSF Full Scenario, Version 2, November 2018[30].

In all cases, the traffic growth forecasts have been constrained to TEMPro version 7.2 which uses the National Trip End Model (NTEM 7.2 (2017))[31] dataset and the National Transport Model (NTM) 2015. TEMPro inherently incorporates future planned development, being based on approved plans, irrespective of whether it is approved, committed, or simply included in approved plans.

Consideration was also given to relevant non-road plans and projects that could contribute to a cumulative increase in air pollution. Searches were carried out for the following non-

[25] Cheshire East Council (2022), *Local Plan Strategy 2010 – 2030*. Adopted 17 July 2017. Available online at: https://www.cheshireeast.gov.uk/pdf/planning/local-plan/local-plan-strategy-web-version-1.pdf.

[26] Cheshire West and Chester Council (2019), *Local Plan (Part Two) Land Allocations and Detailed Policies*. Adopted 18 July 2019. Available online at: https://consult.cheshirewestandchester.gov.uk/kse/.

[27] Mott MacDonald (2016), *Winsford Transport Strategy: Recommendations Report*. Available online at: https://cmttpublic.cheshirewestandchester.gov.uk/documents/s48945/Appendix B Winsford Transport Strategy.pdf.

[28] Mott MacDonald (2018), *Northwich Transport Strategy: Recommendations Report*. Available online at: https://www.cheshirewestandchester.gov.uk/documents/parking-roads-and-travel/public-transport/transport-strategies/northwich-transport-strategy/northwich-transport-strategy-recommendation-report-130318.pdf.

[29] Highways England (2019), *Regional Investment Programme (RIP) M6 Junction 19 Improvement*. Issue Number 1.0. Available online at: https://assets.highwaysengland.co.uk/roads/road-projects/M6+junction+19/Statement+of+Reasons.pdf.

[30] TfGM (2018), *GMVDM4A Uncertainty Log for NTEM GMSF Full Scenario, Version 2*, November 2018, provided by personal communication to Mott MacDonalds in December 2018.

[31] TEMPro version 7.2. Available online at: https://www.data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem.

traffic related emission sources (which were also included in the air quality model) within a 10km radius (unless stated otherwise below). This is considered to be reasonable and proportionate and meets the expectations in Section 4.48 of Natural England's guidance[15]:

- combustion and energy less than 20MW (within 5km);
- combustion and energy more than 20MW;
- farming, livestock and poultry;
- waste, e.g. landfill gas; and
- minerals activities.

3 Air quality standards

Air quality limit values and objectives are quality standards for clean air and to protect human health or harm to vegetation. The term 'air quality standards' has been used to refer to both the English air quality objectives and the air quality limit values and critical levels introduced in the UK based on EU Directives. Table A1 sets out the air quality standard for NOx.

Table A1: Air quality standards

Pollutant	Averaging period	Standard
NOx (for protection of vegetation)	Annual mean	30µg/m^3

In the context of air pollution impacts on ecological sites (e.g. in this case SAC, SPA and Ramsar sites), road traffic emits NOx and ammonia, which both contribute to nitrogen and acid deposition. Therefore, this assessment considers changes in NOx and ammonia as well as changes in nitrogen and acid deposition. Comparisons have been made against the applicable critical loads[32], critical level or relevant standard for the site, as above or as provided by APIS.

[32] The critical loads for deposition vary and are specific to each qualifying feature. These are presented as a range of values (expressed as a rate, e.g. 10kg N/ha/yr – 20 kg N/ha/yr) and typically, as a precautionary approach, only the lowest value is used (unless there are compelling reasons to do otherwise) as this will emphasise any negative outcomes.

4 How significance is assessed

For the assessment of NOx concentrations, if the change is predicted to be less than 1% of the air quality standard then the effect is considered to be not significant. However, should the NOx concentration change by more than 1% then the assessment of significance will be undertaken by an ecologist and reported within the main report.

For the assessment of ammonia (NH_3), if the change is predicted to be less than 1% of the air quality critical level[33], then the effect is considered to be not significant. However, should the concentration change by more than 1%, then the assessment of significance will be undertaken by an ecologist and reported within the main report.

For the assessment of nitrogen deposition, if the change is predicted to be less than 1% of the lower critical load[32], then the effect is considered to be not significant. However, should the deposition change by more than 1%, then the assessment of significance will be undertaken by an ecologist and reported within the main report.

For the assessment of acid deposition, if the total concentration is predicted to be less than the lower critical load, then the effect is considered to be not significant. If the change in concentration is more than 1% of the maximum critical load and the total for acid deposition is greater than the maximum critical load, then the assessment of significance will be undertaken by an ecologist and reported within the main report.

[33] The critical level for NH_3 is 3µg/m^3 for low level vegetation and 1µg/m^3 high vegetation (e.g., trees).

5 Assessment of construction traffic effects – AP2 revised scheme

5.1 Screening of traffic data

The assessment of construction traffic impacts has used traffic data based on an estimate of the average daily flows in the peak year during the construction period (2026 – 2039). Traffic data is presented in Table A2.

The screening process identified one road in the area exceeding the screening thresholds:

- the M6 Junction 16 to Junction 17.

Further roads have been included in the assessment to account for their emissions at nearby receptors.

Figure A1 presents a detailed map of the modelled area including assessed roads (Modelled Road Links in red) and modelling transect points (yellow dots).

Table A2: Traffic data summary (construction phase, AP2 revised scheme)

Road ID	Road names	Annual Average Daily Traffic (AADT)				Heavy Duty Vehicles (HDV)			
		2018 baseline	2028 without the AP2 revised scheme	2028 with the AP2 revised scheme	AP2 revised scheme change (2028 with AP2 revised scheme – 2028 without AP2 revised scheme)	2018 baseline	2028 without the AP2 revised scheme	2028 with the AP2 revised scheme	AP2 revised scheme change (2028 with AP2 revised scheme – 2028 without AP2 revised scheme)
15041_9308	M6 (SB)	38,820	50,760	51,674	914	7,702	8,009	8,826	817
9176_9305	Holmshaw Lane	1,652	2,319	2,301	-18	4	5	5	0
9191_9192	Nursery Road	697	733	732	-1	19	19	19	0
9192_9305	Nursery Road	2,142	2,902	2,878	-24	23	24	24	0
9293_9211	Nursery Road	1,445	2,169	2,146	-23	4	5	5	0
9306_9192	Nursery Road	1,445	2,169	2,147	-22	4	5	5	0
9306_9293	Nursery Road	1,445	2,169	2,147	-22	4	5	5	0
9308_9351	M6 (SB)	38,820	50,760	51,674	914	7,702	8,009	8,826	817
9309_9213	M6 (NB)	34,403	45,165	45,827	662	7,035	7,237	8,032	795
9330_9309	M6 (NB)	34,403	45,165	45,827	662	7,035	7,237	8,032	795

Note: Values in bold indicate change in traffic flow triggering for assessment.

5.2 Receptors assessed and background concentrations

Table A3 presents the details of the receptor assessed, background concentrations, background deposition and relevant critical loads. Table A4 shows the background information for acid deposition. The yellow modelled receptors in Figure A1 represent the closest point to the road for each of the two sensitive habitat types.

Figure A1: Map of Oakhanger Moss, including modelled road links and modelled transect points

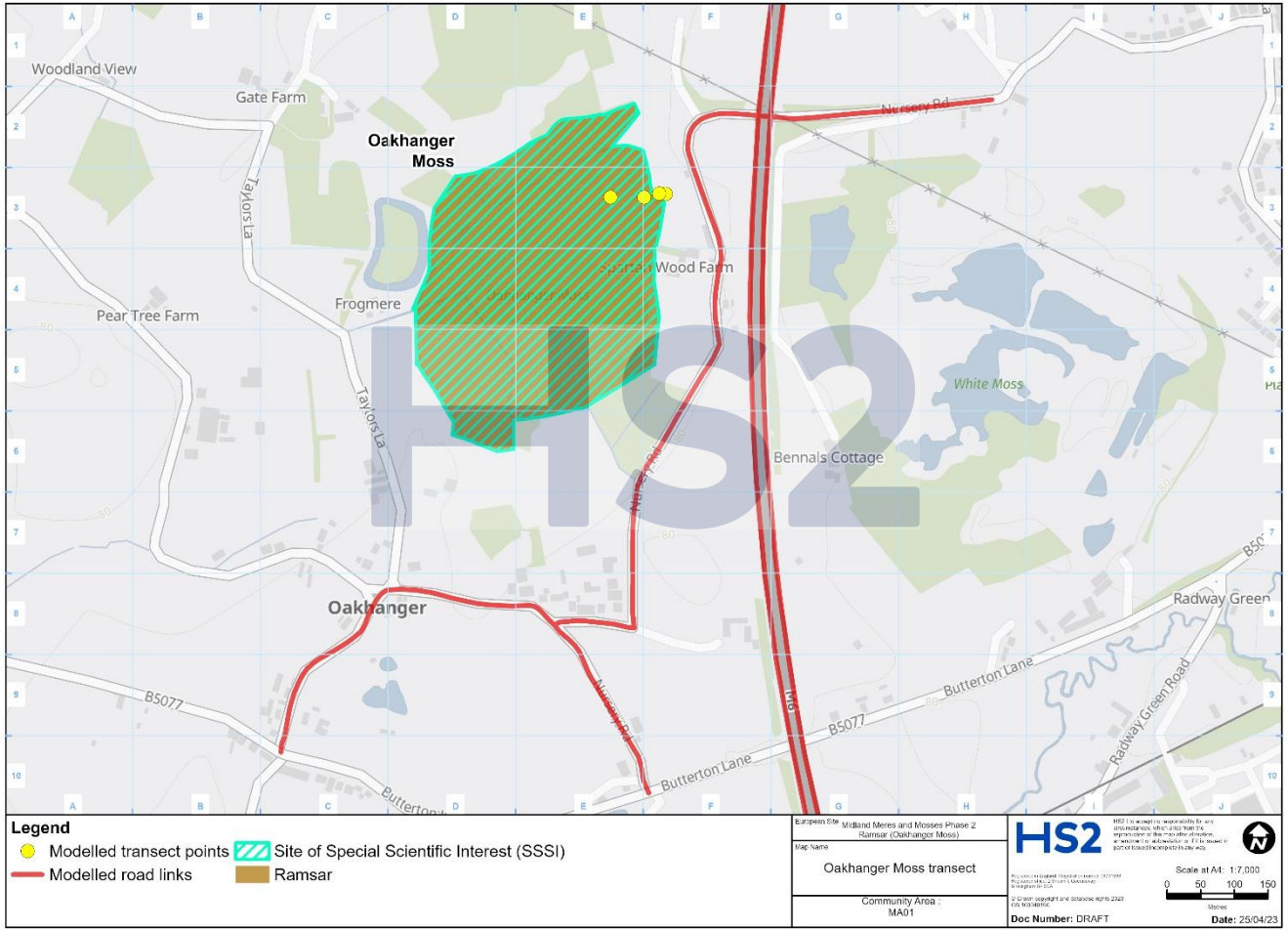


Table A3: Modelled ecological receptor NOx and nitrogen deposition backgrounds, APIS data and critical loads (construction phase)

Receptor	Sensitive habitat	2018 NOx background concentration (µg/m^3)	2028 NOx background concentration (µg/m^3)	APIS data[21] of average total nitrogen deposition	Critical load (kg N/ha/yr)
Oakhanger Moss	Hydrological buffer woodland	12.7	8.7	56.5	10
	Lowland raised bog	12.7	8.7	56.5[34]	5

Table A4: Modelled ecological receptor acid deposition backgrounds, APIS data and critical loads (construction phase)

Receptor	Sensitive habitat	APIS data[21] of average total acid deposition (k eq/ha/yr)	Critical load (k eq/ha/yr) (min)	Critical load (k eq/ha/yr) (max)	APIS Ammonia background concentration (µg/m^3)
Oakhanger Moss	Hydrological buffer woodland	4.2	0.1	1.0	4.5
	Lowland raised bog	4.2	0.3	0.6	4.5

5.3 Assessment results

Table A5 presents a summary of the modelled NOx concentrations for the ecological site, the change in concentration and a comparison against the air quality standard (30µg/m^3).

Table A6 presents a summary of the ammonia concentration results taken from the National Highways Ammonia N Deposition Tool[14], change in concentration and percentage change in relation to the critical level.

Table A7 presents a summary of the modelled nitrogen deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool, change in deposition and percentage change in relation to the lower critical load.

Table A8 presents a summary of the modelled acid deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool, and percentage change in deposition and percentage change in relation to the critical load.

[34] Habitat site is bog covered by woodland, worst case deposition value of woodland used.

Table A5: Assessment of NOx concentrations at ecological sites (construction phase, AP2 revised scheme)

Ecological site	Sensitive habitat	Distance to road (m)	NOx concentrations (µg/m³)			Change in NOx concentrations (µg/m³)	Comparison against air quality standard (30µg/m³)	Percent change in relation to air quality standard
			2018 baseline	2028 without the AP2 revised scheme	2028 with the AP2 revised scheme			
Oakhanger Moss	Hydrological buffer woodland	122	26.11	15.33	15.43	0.11	Within standard	0.4%
	Hydrological buffer woodland	155	23.75	14.14	14.22	0.09	Within standard	0.3%
	Lowland raised bog	200	21.39	12.95	13.02	0.07	Within standard	0.2%

Table A6: Assessment of NH_3 concentrations at ecological sites (construction phase, AP2 revised scheme)

Ecological site	Sensitive habitat	Distance to road (m)	NH_3 concentrations (µg/m³)			Change in NH_3 concentrations (µg/m³)	Comparison against critical level (3µg/m³ for low and 1µg/m³ high vegetation)	Percent change in relation to critical level
			2018 baseline	2028 without the AP2 revised scheme	2028 with the AP2 revised scheme			
Oakhanger Moss	Hydrological buffer woodland	122	4.96	5.08	5.09	0.01	Above standard	1.0%
	Hydrological buffer woodland	155	4.87	4.97	4.98	0.01	Above standard	0.9%
	Lowland raised bog	200	4.78	4.86	4.86	< 0.01	Above standard	0.7%

Table A7: Assessment of nitrogen deposition with ammonia at ecological sites (construction phase, AP2 revised scheme)

Ecological site	Sensitive habitat	Distance to road (m)	Dry deposition (kg N/ha/yr)			Change in nitrogen deposition (kg N/ha/yr)	Lower critical load (kg N/ha/yr)	Percent Change in relation to lower critical load
			2018 baseline	2028 without the AP2 revised scheme	2028 with the AP2 revised scheme			
Oakhanger Moss	Hydrological buffer woodland	122	62.47	62.35	62.45	0.10	10	1.0%
	Hydrological buffer woodland	155	61.42	61.30	61.38	0.08	10	0.8%
	Lowland raised bog	200	60.36	60.26	60.32	0.06	5	1.3%

Table A8: Assessment of acid deposition with ammonia at ecological sites (construction phase, AP2 revised scheme)

Ecological Site	Sensitive habitat	Distance to road (m)	Acid deposition (k eq/ha/yr)			Change in acid deposition (k eq/ha/yr)	Change in acid deposition as percent of CLmax	Total with AP2 revised scheme acid deposition as percent of CLmax
			2018 baseline	2028 without the AP2 revised scheme	2028 with the AP2 revised scheme			
Oakhanger Moss	Hydrological buffer woodland	122	4.58	4.58	4.58	< 0.01	0.7%	464.2%
	Hydrological buffer woodland	155	4.51	4.50	4.51	0.01	0.6%	456.6%
	Lowland raised bog	200	4.43	4.43	4.43	< 0.01	0.8%	774.6%

5.4 Assessment of significance (construction phase, AP2 revised scheme)

NOx concentrations at the Oakhanger Moss are predicted to be within the air quality standard in all scenarios. Changes in NOx concentrations are less than 1% of the air quality standard and therefore not significant.

NH_3 concentrations at the Oakhanger Moss are predicted to be above the air quality critical level in all scenarios. Changes in NH_3 concentrations are greater than 1% of the air quality standard just above 122m from the road. Potentially significant effects are therefore predicted, and this is addressed further in Section 3.3 of the main report.

Nitrogen deposition rates are predicted to be above the lower critical load at all modelled receptors in the baseline and future scenarios with or without the AP2 revised scheme. The change in nitrogen deposition due to the AP2 revised scheme is predicted to be greater than 1% of the lower critical load at 200m from the road. Potentially significant effects are therefore predicted, and this is addressed further in Section 3.3 of the main report.

Acid deposition rates are predicted to be above the lower critical load at all modelled receptors in all scenarios with or without the AP2 revised scheme. The changes in acid deposition due to the AP2 revised scheme are less than 1% of the critical load and therefore not significant.

6 Assessment of construction traffic effects – AP2 revised scheme in combination with other plans and projects

6.1 Screening of traffic data

The screening process identified one road in the area exceeding the screening thresholds:

- the M6 Junction 16 to 17.

Further roads have been included in the assessment to account for their emissions at nearby receptors.

Table A9 presents the traffic data used in the assessment.

Table A9: Traffic data summary (construction phase, AP2 revised scheme in combination)

Road ID	Road names	Annual Average Daily Traffic (AADT)				Heavy Duty Vehicles (HDV)			
		2018 baseline	2018 baseline with smart motorway	2028 with the AP2 revised scheme	In combination change (2028 with the AP2 revised scheme – 2018 baseline with smart motorway)	2018 baseline	2018 baseline with smart motorway	2028 with the AP2 revised scheme	In combination change (2028 with the AP2 revised scheme – 2018 baseline with smart motorway)
15041_9308	M6 (SB)	38,820	44,676	51,674	6,998	7,702	8,003	8,826	823
9176_9305	Holmshaw Lane	1,652	1,647	2,301	654	4	4	5	1
9191_9192	Nursery Road	697	699	732	33	19	19	19	0
9192_9305	Nursery Road	2,142	2,140	2,878	738	23	23	24	1
9293_9211	Nursery Road	1,445	1,441	2,146	705	4	4	5	1
9306_9192	Nursery Road	1,445	1,441	2,147	706	4	4	5	1
9306_9293	Nursery Road	1,445	1,441	2,147	706	4	4	5	1
9308_9351	M6 (SB)	38,820	44,676	51,674	6,998	7,702	8,003	8,826	823
9309_9213	M6 (NB)	34,403	39,443	45,827	6,384	7,035	7,262	8,032	770
9330_9309	M6 (NB)	34,403	39,443	45,827	6,384	7,035	7,262	8,032	770

Note: Values in bold indicate change in traffic flow triggering for assessment.

6.2 Non-road plans and projects

No non-road plans or projects have been identified that require further consideration within the in combination assessment.

6.3 Receptors assessed and background concentrations

Figure A1 presents a detailed map of the modelled area including assessed roads (road network in green) and modelled receptors which represent the closest point to the road for each of the three sensitive habitat types.

Table A10 presents the details of the receptor assessed, background concentrations, background deposition and relevant critical loads. Table A11 shows the background information for acid deposition.

Table A10: Modelled ecological receptor NOx and nitrogen deposition backgrounds, APIS data and critical loads (construction phase, AP2 revised scheme in combination)

Receptor	Sensitive habitat	2018 NOx background concentration (µg/m^3)	2028 NOx background concentration (µg/m^3)	APIS data[20] of average total nitrogen deposition	Critical load (kg N/ha/yr)
Oakhanger Moss	Hydrological buffer woodland[35]	12.7	8.7	56.5	10
	Lowland raised bog	12.7	8.7	56.5[36]	5

Table A11: Modelled ecological receptor acid deposition backgrounds, APIS data and critical loads (construction phase, AP2 revised scheme in combination)

Receptor	Sensitive habitat	APIS data[20] of average total acid deposition (k eq/ha/yr)	Critical load (k eq/ha/yr) (min)	Critical load (k eq/ha/yr) (max)	APIS Ammonia back ground concentration (µg/m^3)
Oakhanger Moss	Hydrological buffer woodland	4.2	0.1	1.00	4.5
	Lowland raised bog	4.2	0.3	0.6	4.5

[35] As described in Section 3 of the report, this covers the woodland communities W4, W5 and W10.

[36] Habitat site is bog covered by woodland; worst case deposition value of bog used.

6.4 Assessment results

Table A12 presents a summary of the modelled NOx concentrations for the ecological site, the change in concentration and a comparison against the air quality standard (30µg/m^3).

Table A13 presents a summary of the ammonia concentration results taken from the National Highways Ammonia N Deposition Tool[14], change in concentration and percentage change in relation to the critical level.

Table A14 presents a summary of the modelled nitrogen deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool, change in deposition and percentage change in relation to the lower critical load.

Table A15 presents a summary of the modelled acid deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool, and percentage change in deposition and percentage change in relation to the critical load.

Table A12: Assessment of NOx concentrations at ecological sites (construction phase, AP2 revised scheme in combination)

Ecological site	Sensitive habitat	Distance to road (m)	NOx concentrations (µg/m³)			Change in NOx concentrations (µg/m³)	Comparison against air quality standard (30µg/m³)	Percent change in relation to air quality standard
			2018 baseline	2028 do nothing	2028 with the AP2 revised scheme			
Oakhanger Moss	Hydrological buffer woodland	122	26.11	14.44	15.43	0.99	Within standard	3.3%
	Hydrological buffer woodland	155	23.75	13.41	14.22	0.81	Within standard	2.7%
	Lowland raised bog	200	21.39	12.39	13.02	0.63	Within standard	2.1%

Table A13: Assessment of NH_3 concentrations at ecological sites (construction phase, AP2 revised scheme in combination)

Ecological site	Sensitive habitat	Distance to road (m)	NH_3 concentrations (µg/m³)			Change in NH_3 concentrations (µg/m³)	Comparison against critical level (3µg/m³ for low and 1µg/m³ high vegetation)	Percent change in relation to critical level
			2018 baseline	2028 do nothing	2028 with the AP2 revised scheme			
Oakhanger Moss	Hydrological buffer woodland	122	4.96	5.00	5.09	0.09	Above standard	9.2%
	Hydrological buffer woodland	155	4.87	4.90	4.98	0.08	Above standard	7.5%
	Lowland raised bog	200	4.78	4.81	4.86	0.05	Above standard	5.9%

Table A14: Assessment of nitrogen deposition with ammonia at ecological sites (construction phase, AP2 revised scheme in combination)

Ecological site	Sensitive habitat	Distance to road (m)	Dry deposition (kg N/ha/yr)			Change in nitrogen deposition (kg N/ha/yr)	Lower critical load (kg N/ha/yr)	Percent Change in relation to lower critical load
			2018 baseline	2028 do nothing	2028 with the AP2 revised scheme			
Oakhanger Moss	Hydrological buffer woodland	122	62.47	61.58	62.45	0.87	10	8.7%
	Hydrological buffer woodland	155	61.42	60.67	61.38	0.71	10	7.1%
	Lowland raised bog	200	60.36	59.76	60.32	0.56	5	11.1%

Table A15: Assessment of acid deposition at ecological sites (construction phase, AP2 revised scheme in combination)

Ecological site	Sensitive habitat	Distance to road (m)	Acid deposition (k eq/ha/yr)			Change in acid deposition (k eq/ha/yr)	Change in acid deposition as percent of CLmax	Total with AP2 revised scheme acid deposition as percent of CLmax
			2018 baseline	2028 do nothing	2028 with the AP2 revised scheme			
Oakhanger Moss	Hydrological buffer woodland	122	4.58	4.52	4.58	0.06	6.3%	464.2%
	Hydrological buffer woodland	155	4.51	4.46	4.51	0.05	5.1%	456.6%
	Lowland raised bog	200	4.43	4.39	4.43	0.04	6.9%	774.6%

6.5 Assessment of significance

NOx concentrations at the Oakhanger Moss are predicted to be within the air quality standard in all scenarios. The changes in NOx concentrations between the 2028 do nothing scenario and with the AP2 revised scheme in combination scenario are greater than 1% of the air quality standard. Potentially significant effects are therefore predicted, and this is addressed further in Section 4.2 of the main report.

NH_3 concentrations at the Oakhanger Moss are predicted to be above the air quality critical level in all scenarios. The changes in NH_3 concentrations between the 2028 do nothing scenario and with the AP2 revised scheme in combination scenario are greater than 1% of the air quality standard. Potentially significant effects are therefore predicted, and this is addressed further in Section 4.2 of the main report.

Nitrogen deposition rates are predicted to be above the relevant critical load at all modelled receptors in the baseline and future scenarios with or without the AP2 revised scheme in combination. Predicted nitrogen deposition rates in 2028, with the AP2 revised scheme in combination, are lower than the 2018 baseline rates at all modelled locations. The changes in nitrogen deposition between the 2028 do nothing scenario and with the AP2 revised scheme in combination scenario are greater than 1% of the relevant critical load. Potentially significant effects are therefore predicted, and this is addressed further in Section 4.2 of the main report.

Acid deposition rates are predicted to be above the critical load at all modelled receptors in all scenarios with or without the AP2 revised scheme in combination. The changes in acid deposition between the 2028 do nothing scenario and with the AP2 revised scheme in combination scenario are greater than 1% of the maximum critical load. Potentially significant effects are therefore predicted, and this is addressed further in Section 4.2 of the main report.

7 Assessment of operational traffic effects – AP2 revised scheme

7.1 Screening of traffic data

The AP2 revised scheme will not change traffic movements on roads within 200m of Oakhanger Moss in the operation phase and therefore no further assessment is required.

8 Assessment of operational traffic effects – AP2 revised scheme in combination with other plans and projects

8.1 Screening of traffic data

The screening process identified no roads in the area, around Oakhanger, exceeding the screening thresholds in the operation phase and therefore no further assessment is required.

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