



MORGAN AND MORECAMBE OFFSHORE WIND FARMS: TRANSMISSION ASSETS

Environmental Statement

Volume 3, Annex 9.1: Air quality impacts on ecologically designated sites



September 2024
Rev: ES Issue

MOR001-FLO-CON-ENV-RPT-0110
MRCNS-J3303-RPS-10157

PINS Reference: EN020028
APFP Regulations: 5(2)(a)
Document reference: F3.9.1

Document status					
Version	Purpose of document	Approved by	Date	Approved by	Date
ES	For issue	AS	September 2024	IM	September 2024

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Prepared by:

RPS

Prepared for:

**Morgan Offshore Wind Limited,
Morecambe Offshore Windfarm Ltd**

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Glossary

Term	Meaning
Biological Heritage Site	A well-defined area that is a unique and ecologically fragile ecosystem that is rich in biodiversity.
Local Nature Reserve	A protected area of land that is designated for its special natural interest or educational value.
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	The offshore and onshore infrastructure connecting the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm to the national grid. This includes the offshore export cables, landfall site, onshore export cables, onshore substations, 400 kV grid connection cables and associated grid connection infrastructure such as circuit breaker compounds. Also referred to in this report as the Transmission Assets, for ease of reading.
Special Protection Areas	A site designation specified in the Conservation of Habitats and Species Regulations 2017, classified for rare and vulnerable birds, and for regularly occurring migratory species. Special Protection Areas contribute to the national site network.
Site of Special Scientific Interest	A formal conservation designation for an area that's of particular interest to science due to the rare species of fauna or flora it contains.

Acronyms

Acronym	Meaning
AADT	Annual Average Daily Traffic
BHS	Biological Heritage Site
CL	Critical Load
HGV	Heavy Goods Vehicle
LNR	Local Nature Reserve
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxides
NH ₃	Ammonia
PC	Process Contribution
PEC	Predicted Environmental Concentration
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest

Units

Unit	Description
%	Percentage
km ²	Square kilometres
nm	Nautical mile
m	Metre

1 Air quality impacts on ecologically designated sites

1.1 Introduction

- 1.1.1.1 This document forms Volume 3, Annex 9.1: Air quality impacts on ecologically designated sites of the Environmental Statement (ES) prepared for the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (referred to hereafter as ‘the Transmission Assets’). The ES presents the findings of the Environmental Impact Assessment (EIA) process for the Transmission Assets.
- 1.1.1.2 The purpose of this technical report is to present the results of the air quality impacts screening to inform Volume 3, Chapter 9: Air quality of the ES and Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES.
- 1.1.1.3 The Institute of Air Quality Management (IAQM) guidance document *A guide to the assessment of air quality impacts on designated nature conservation sites guidance* (IAQM, 2020) states that:
- ‘The DMRB provides a series of traffic screening criteria. These include the change in Annual Average Daily Traffic (AADT) flows on a given road of 1000 vehicles or 200 heavy duty vehicles (HDVs). These thresholds have been widely used to screen out the need for quantitative assessment of projects/plans in the absence of any other thresholds recognised as being applicable in this context.’*
- 1.1.1.4 As the Transmission Assets generates traffic during the construction phase and exceeds these thresholds on multiple road links (see Volume 3, Chapter 7: Traffic and transport of the ES), this annex considers the impact of the of NO_x (Nitrogen Oxides) and NH₃ (Ammonia) concentrations, nutrient nitrogen deposition and acid deposition from constructions traffic emissions at ecological designated sites in proximity to link roads where these AADT thresholds are exceeded. The sites are as follows.
- Lancaster Canal Biological Heritage Site (BHS).
 - Bartle Wetland BHS.
 - Haighton Park & Fulwood Park Woods Ancient and Semi-Natural Woodland.
 - Brockholes Quarry BHS.
 - Pope Lane Ponds BHS and Local Nature Reserve (LNR).
 - Brockholes Wood Ancient Woodland.
 - Red Scar and Tun Brook Wood Site of Special Scientific Interest (SSSI) and Ancient Woodland.
 - Cuerdale Woods & Walmsley Fold Woods Ancient Woodland and BHS.

- Mosney Wood Ancient Woodland.
- Laund Wood and Ollerton Wood Ancient Woodland and BHS.
- Leeds/Liverpool Canal (Walton Summit Branch) BHS.
- Denham Wood BHS.
- Cuerden Valley Park and River Lostock BHS.
- Holt Brow Wood and Foxholes Wood BHS.
- Lucas Lane Pasture BHS.
- Haddock Park Wood Ancient Woodland and BHS.
- River Ribble BHS.
- Grange Valley LNR.
- Fishwick Bottoms & Pope Open Space LNR.

1.1.1.5 Refer to Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES for a baseline description of the above designated sites.

1.2 Methodology

1.2.1.1 Concentrations of NO_x and NH₃ have been predicted using the same model as used in the assessment of human-health receptors (see Volume 3, Chapter 9: Air quality of the ES). Modelling has been undertaken at the receptors listed in **paragraph 1.1.1.4** and shown in **Figure 1.1**. The receptor points have been modelled at ground level.

1.2.1.2 The process contribution (PC), i.e. the difference between the with and without development concentrations and, if appropriate, the predicted environmental concentration (PECs) of NO_x and NH₃ have been calculated for comparison with the relevant critical level/load. The PEC has been calculated by adding the PC to the background concentrations at each designated site which have been derived from the UK Air Pollution Information System (APIS) database (APIS, 2024).

1.2.2 Critical levels

1.2.2.1 Critical levels are maximum atmospheric concentrations of pollutants for the protection of vegetation and ecosystems and are specified within relevant European air quality directives and corresponding UK air quality regulations.

1.2.3 Critical loads

1.2.3.1 Critical loads (CL) refer to the quantity of pollutant deposited, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Nutrient nitrogen deposition and acid deposition are considered in this annex.

1.2.4 Critical loads - total nutrient N deposition

1.2.4.1 Percentage contributions to total nutrient nitrogen deposition have been derived from the modelled NO_x and NH₃ concentrations. Deposition rates have been calculated using empirical methods recommended by the Environment Agency, as follows.

- The NO₂ dry deposition flux ($\mu\text{g}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$) has been calculated by multiplying the ground level NO₂ concentrations ($\mu\text{g}\cdot\text{m}^{-3}$) by the deposition velocity of 0.003 $\text{m}\cdot\text{s}^{-1}$ for forests/tall habitats and 0.0015 $\text{m}\cdot\text{s}^{-1}$ for grassland/short habitats. Units of $\mu\text{g}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ have been converted to units of $\text{kg}\cdot\text{ha}^{-1}\cdot\text{year}^{-1}$ by multiplying the dry deposition flux by the standard conversion factor of 96 for NO_x.
- The NH₃ dry deposition flux ($\mu\text{g}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$) has been calculated by multiplying the ground level NH₃ concentrations ($\mu\text{g}\cdot\text{m}^{-3}$) by the deposition velocity of 0.03 $\text{m}\cdot\text{s}^{-1}$ for forests/tall habitats and 0.02 $\text{m}\cdot\text{s}^{-1}$ for grassland/short habitats. Units of $\mu\text{g}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ have been converted to units of $\text{kg}\cdot\text{ha}^{-1}\cdot\text{year}^{-1}$ by multiplying the dry deposition flux by the standard conversion factor of 260 for NH₃.
- Predicted contributions to nitrogen deposition have been calculated from the sum of the NO_x and NH₃ contributions and compared with the relevant critical load range for the habitat types associated with the designated site. These have been derived from the APIS database.

1.2.5 Critical loads - acidification

1.2.5.1 The acid deposition rate, in equivalents $\text{keq}\cdot\text{ha}^{-1}\cdot\text{year}^{-1}$, has been calculated by multiplying the total dry deposition flux ($\text{kg}\cdot\text{ha}^{-1}\cdot\text{year}^{-1}$) by a conversion factor of 0.071428 for N. This takes into account the degree to which a chemical species is acidifying, calculated as the proportion of N within the molecule.

1.2.5.2 Wet deposition in the near field is not significant compared with dry deposition for N (Hertel *et al*, 2009) and therefore for the purposes of this assessment, wet deposition has not been considered.

1.2.5.3 Predicted contributions to acid deposition have been calculated and compared with the minimum critical load function for the habitat types associated with the designated site as derived from the APIS database (APIS, 2024).

1.2.6 Significance criterial

1.2.6.1 Maximum PCs and PECs of NO_x, NH₃ and N/acid deposition have been compared against the relevant critical levels/loads for the relevant habitat type/interest feature. The Environment Agency guidelines (Environment Agency, 2024) state that:

‘To screen out a PC for any substance so that you don’t need to do any further assessment of it, the PC must meet both of the following criteria:

- *the short-term PC is less than 10% of the short-term environmental standard*
- *the long-term PC is less than 1% of the long-term environmental standard*

If you meet both of these criteria you don't need to do any further assessment of the substance.

If you don't meet them you need to carry out a second stage of screening to determine the impact of the PEC."

1.2.6.2 It continues by stating that:

'If your long-term PC is greater than 1% and your PEC is less than 70% of the long-term environmental standard, the emissions are insignificant – you don't need to assess them any further.'

1.2.6.3 For local nature sites (i.e. for all sites assessed in this annex except Red Scar & Tun Brook Woods SSSI), it states:

'If your emissions meet both of the following criteria they're insignificant – you don't need to assess them any further:

- *the short-term PC is less than 100% of the short-term environmental standard*
- *the long-term PC is less than 100% of the long-term environmental standard*

You don't need to calculate PEC for local nature sites. If your PC exceeds the screening criteria you need to do detailed modelling.'

1.3 Results

1.3.1.1 The ambient concentrations and existing deposition rates have been provided by ecologists at Sylvan Biodiversity.

1.3.1.2 The maximum predicted annual and daily mean NO_x concentrations are compared with the critical level in **Table 1.1**. The maximum predicted annual-mean NH₃ concentrations are compared with the critical level in **Table 1.2**.

1.3.1.3 **Table 1.3** displays the total predicted nutrient N deposition rates compared with the critical load.

1.3.1.4 The maximum predicted acid deposition rates are compared with the critical load function in **Table 1.4**.

Table 1.1: Predicted NOx concentrations at designated sites

Designated site	Annual mean CL($\mu\text{g.m}^{-3}$)	Annual mean NOx PC ($\mu\text{g.m}^{-3}$)	Annual mean NOx PC as % of CL	Daily mean CL($\mu\text{g.m}^{-3}$)	Daily mean NOx($\mu\text{g.m}^{-3}$)	Daily mean NOx PC as % of CL
Lancaster Canal (BHS)	30	0.20	1	75	0.65	1
Bartle Wetland West (BHS)	30	0.14	0	75	0.52	1
Bartle Wetland East (BHS)	30	0.09	0	75	0.36	0
Haighton Park & Fulwood Park Woods (Ancient & Semi-Natural Woodland)	30	0.05	0	75	0.25	0
Brockholes Quarry (BHS)	30	0.06	0	75	0.26	0
Pope Lane Ponds (BHS & LNR)	30	0.46	2	75	1.58	2
Brockholes Wood (Ancient Woodland)	30	0.39	1	75	1.73	2
Red Scar & Tun Brook Woods (Ancient Woodland & SSSI)	30	0.28	1	75	0.99	1
Cuerdale Wood West (Ancient Woodland & BHS)	30	0.33	1	75	1.50	2
Cuerdale Wood East & Walmsley Fold Woods (Ancient Woodland & BHS)	30	0.29	1	75	1.08	1
Mosney Wood (Ancient Woodland)	30	0.35	1	75	1.65	2
Laund Wood and Ollerton Wood (Ancient Woodland & BHS)	30	0.04	0	75	0.16	0
Leeds/Liverpool Canal (Walton Summit Branch) (BHS)	30	0.03	0	75	0.16	0
Denham Wood (BHS)	30	0.18	1	75	0.68	1
Cuerden Valley Park and River Lostock (BHS)	30	0.07	0	75	0.26	0
Holt Brow Wood and Foxholes Wood (BHS)	30	0.28	1	75	1.32	2

Designated site	Annual mean CL($\mu\text{g.m}^{-3}$)	Annual mean NOx PC ($\mu\text{g.m}^{-3}$)	Annual mean NOx PC as % of CL	Daily mean CL($\mu\text{g.m}^{-3}$)	Daily mean NOx($\mu\text{g.m}^{-3}$)	Daily mean NOx PC as % of CL
Lucas Lane Pastures (BHS)	30	0.02	0	75	0.12	0
Haddock Park Wood (Ancient Woodland & BHS)	30	0.03	0	75	0.13	0
River Ribble (BHS)	30	0.41	1	75	1.48	2
Fishwick Bottoms & Pope Open Space (LNR)	30	0.24	1	75	0.86	1
Grange Valley (LNR)	30	0.36	1	75	1.61	2

Note: Consistent with IAQM (2020), the PC as a % of the CL has been rounded to the nearest integer.

Table 1.2: Predicted NH₃ concentrations at designated sites

Designated site	Annual mean CL ($\mu\text{g.m}^{-3}$)	Annual mean NH ₃ PC ($\mu\text{g.m}^{-3}$)	Annual mean NH ₃ PC as % of CL
Lancaster Canal (BHS)	1	0.07	7
Bartle Wetland West (BHS)	1	0.04	4
Bartle Wetland East (BHS)	1	0.02	2
Haighton Park & Fulwood Park Woods (Ancient & Semi-Natural Woodland)	1	0.02	2
Brockholes Quarry (BHS)	1	0.02	2
Pope Lane Ponds (BHS & LNR)	1	0.16	16
Brockholes Wood (Ancient Woodland)	1	0.14	14
Red Scar & Tun Brook Woods (Ancient Woodland & SSSI)	1	0.10	10
Cuerdale Wood West (Ancient Woodland & BHS)	1	0.12	12

Designated site	Annual mean CL ($\mu\text{g.m}^{-3}$)	Annual mean NH ₃ PC ($\mu\text{g.m}^{-3}$)	Annual mean NH ₃ PC as % of CL
Cuerdale Wood East & Walmsley Fold Woods (Ancient Woodland & BHS)	1	0.10	10
Mosney Wood (Ancient Woodland)	1	0.12	12
Laund Wood and Ollerton Wood (Ancient Woodland & BHS)	1	0.02	2
Leeds/Liverpool Canal (Walton Summit Branch) (BHS)	1	0.01	1
Denham Wood (BHS)	1	0.07	7
Cuerden Valley Park and River Lostock (BHS)	1	0.04	4
Holt Brow Wood and Foxholes Wood (BHS)	1	0.11	11
Lucas Lane Pastures (BHS)	1	0.01	1
Haddock Park Wood (Ancient Woodland & BHS)	1	0.01	1
River Ribble (BHS)	1	0.14	14
Fishwick Bottoms & Pope Open Space (LNR)	1	0.08	8
Grange Valley (LNR)	1	0.13	13

Note: Consistent with IAQM (2020), the PC as a % of the CL has been rounded to the nearest integer.

Table 1.3: Predicted nutrient N deposition at designated sites

Designated site	CL (lower) (kgN.ha ⁻¹ .yr ⁻¹)	PC (kgN.ha ⁻¹ .yr ⁻¹)	PC/CL (%)
Lancaster Canal (BHS)	15	0.36	2
Bartle Wetland West (BHS)	15	0.24	2
Bartle Wetland East (BHS)	15	0.13	1
Haighton Park & Fulwood Park Woods (Ancient & Semi-Natural Woodland)	10	0.10	1
Brockholes Quarry (BHS)	20	0.19	1
Pope Lane Ponds (BHS & LNR)	20	0.89	4
Brockholes Wood (Ancient Woodland)	10	0.75	8
Red Scar & Tun Brook Woods (Ancient Woodland & SSSI)	15	0.82	5
Cuerdale Wood West (Ancient Woodland & BHS)	10	0.97	10
Cuerdale Wood East & Walmsley Fold Woods (Ancient Woodland & BHS)	10	0.84	8
Mosney Wood (Ancient Woodland)	10	0.99	10
Laund Wood and Ollerton Wood (Ancient Woodland & BHS)	10	0.17	2
Leeds/Liverpool Canal (Walton Summit Branch) (BHS)	15	0.06	0
Denham Wood (BHS)	10	0.61	6
Cuerden Valley Park and River Lostock (BHS)	15	0.23	2
Holt Brow Wood and Foxholes Wood (BHS)	10	0.94	9
Lucas Lane Pastures (BHS)	10	0.07	1
Haddock Park Wood (Ancient Woodland & BHS)	10	0.10	1

Designated site	CL (lower) (kgN.ha ⁻¹ .yr ⁻¹)	PC (kgN.ha ⁻¹ .yr ⁻¹)	PC/CL (%)
River Ribble (BHS)	15	0.79	5
Fishwick Bottoms & Pope Open Space (LNR)	15	0.71	4
Grange Valley (LNR)	15	1.05	5

Table 1.4: Predicted acid deposition at designated sites

Designated site	CL max S (keq.ha ⁻¹ .yr ⁻¹)	CL min N (keq.ha ⁻¹ .yr ⁻¹)	CL max N (keq.ha ⁻¹ .yr ⁻¹)	PC (keq.ha ⁻¹ .yr ⁻¹)	PC/CL (%)
Lancaster Canal (BHS)	Habitat is not sensitive to acidity				
Bartle Wetland West (BHS)	Habitat is not sensitive to acidity				
Bartle Wetland East (BHS)	Habitat is not sensitive to acidity				
Haighton Park & Fulwood Park Woods (Ancient & Semi-Natural Woodland)	0.357	1.454	1.811	0.01	0
Brockholes Quarry (BHS)	0.856	4	4.856	0.01	0
Pope Lane Ponds (BHS & LNR)	0.856	4	4.856	0.06	1
Brockholes Wood (Ancient Woodland)	0.142	2.549	2.691	0.05	2
Red Scar & Tun Brook Woods (Ancient Woodland & SSSI)	0.357	1.446	1.803	0.06	3
Cuerdale Wood West (Ancient Woodland & BHS)	0.142	2.559	2.701	0.07	3
Cuerdale Wood East & Walmsley Fold Woods (Ancient Woodland & BHS)	0.142	2.559	2.701	0.06	2
Mosney Wood (Ancient Woodland)	0.357	1.449	1.806	0.07	4
Laund Wood and Ollerton Wood (Ancient Woodland & BHS)	0.357	2.696	3.053	0.01	0
Leeds/Liverpool Canal (Walton Summit Branch) (BHS)	Habitat is not sensitive to acidity				

Designated site	CL max S (keq.ha ⁻¹ .yr ⁻¹)	CL min N (keq.ha ⁻¹ .yr ⁻¹)	CL max N (keq.ha ⁻¹ .yr ⁻¹)	PC (keq.ha ⁻¹ .yr ⁻¹)	PC/CL (%)
Denham Wood (BHS)	0.142	2.598	2.74	0.04	2
Cuerden Valley Park and River Lostock (BHS)	Habitat is not sensitive to acidity				
Holt Brow Wood and Foxholes Wood (BHS)	0.357	1.428	1.785	0.07	4
Lucas Lane Pastures (BHS)	0.856	4	4.856	0.01	0
Haddock Park Wood (Ancient Woodland & BHS)	0.142	2.597	2.739	0.01	0
River Ribble (BHS)	Habitat is not sensitive to acidity				
Fishwick Bottoms & Pope Open Space (LNR)	0.856	4	4.856	0.05	1
Grange Valley (LNR)	0.856	4	4.856	0.08	2

1.3.2 Annual mean NO_x

- 1.3.2.1 The maximum annual mean NO_x PC does not exceed 100% of the critical level at local sites and does not exceed 1% of the critical level at the SSSI and the impacts can be screened out as insignificant.

1.3.3 Daily mean NO_x

- 1.3.3.1 The maximum daily mean NO_x PC does not exceed 100% of the critical level at local sites and does not exceed 10% of the critical level at the SSSI and the impacts can be screened out as insignificant.

1.3.4 Annual mean NH₃

- 1.3.4.1 The maximum annual mean NH₃ PC does not exceed 100% of the critical level and the impacts can be screened out as insignificant for all BHS, LNR and Ancient Woodland sites.
- 1.3.4.2 At the Red Scar & Tun Brook Woods SSSI the PC exceeds 1% of the critical level. When the PC is added to the background concentrations of 2.08 µg.m⁻³, the resulting PEC is 2.2 µg.m⁻³ and the PEC exceeds the critical level of 1 µg.m⁻³. On that basis, the impacts cannot be screened out as insignificant. As such, further assessment has been provided in section 3.11.5 of Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES, with regard to the impact of air quality on Red Scar & Tun Brook Woods SSSI.

1.3.5 Nutrient N deposition

- 1.3.5.1 The maximum nitrogen deposition PC does not exceed 100% of the critical load and the impacts can be screened out as insignificant for all BHS, LNR and Ancient Woodland sites.
- 1.3.5.2 At the Red Scar & Tun Brook Woods SSSI the PC exceeds 1% of the critical load. When the PC is added to the background deposition rate of 34.87 kgN.ha⁻¹.yr⁻¹, the resulting PEC of 35.7 kgN.ha⁻¹.yr⁻¹ exceeds the critical level of 15 kgN.ha⁻¹.yr⁻¹. On that basis, the impacts cannot be screened out as insignificant. As such, further assessment has been provided in section 3.11.5 of Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES, with regard to the impact of air quality on Red Scar & Tun Brook Woods SSSI.

1.3.6 Acid deposition

- 1.3.6.1 The maximum acid deposition PC does not exceed 100% of the critical load the impacts can be screened out as insignificant for all BHS, LNR and Ancient Woodland sites.
- 1.3.6.2 At the Red Scar & Tun Brook Woods SSSI the PC exceeds 1% of the critical load. When the PC is added to the background deposition rate of 2.54 keq.ha⁻¹.yr⁻¹ the resulting PEC of 2.6 keq.ha⁻¹.yr⁻¹ exceeds the critical level of 1.803 keq.ha⁻¹.yr⁻¹. On that basis, the impacts cannot be screened

out as insignificant. As such, further assessment has been provided in section 3.11.5 of Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES, with regard to the impact of air quality on Red Scar & Tun Brook Woods SSSI.

1.4 References

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