MORGAN AND MORECAMBE OFFSHORE WIND FARMS: TRANSMISSION ASSETS

Environmental Statement

Volume 3, Annex 3.4: Onshore ecology and nature conservation survey methodologies

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Glossary

Term	Meaning
400 kV grid connection cables	Cables that will connect the proposed onshore substations to the existing National Grid Penwortham substation.
Applicants	Morgan Offshore Wind Limited (Morgan OWL) and Morecambe Offshore Windfarm Ltd (Morecambe OWL).
Baseline	The status of the environment without the Transmission Assets in place.
Development Consent Order	An order made under the Planning Act 2008, as amended, granting development consent.
eDNA	Environmental Deoxyribonucleic Acid is DNA that is collected from soil, water, or air rather than directly from and individual organism.
EIA Scoping Report	A report setting out the proposed scope of the Environmental Impact Assessment process. The Transmission Assets Scoping Report was submitted to The Planning Inspectorate (on behalf of the Secretary of State) for the Morgan and Morecambe Offshore Windfarms Transmission Assets on 28 October 2022.
Environmental Impact Assessment	The process of identifying and assessing the significant effects likely to arise from a project. This requires consideration of the likely changes to the environment, where these arise as a consequence of a project, through comparison with the existing and projected future baseline conditions.
Environmental Statement	The document presenting the results of the Environmental Impact Assessment process.
Expert Working Group	A forum for targeted engagement with regulators and interested stakeholders through the Evidence Plan process.
Intertidal area	The area between Mean High Water Springs and Mean Low Water Springs.
Habitats of Principal Importance	List of priority habitats and species in England listed under Section 41 of the Natural Environment and Rural Communities Act 2006 as being of principal importance for the purpose of conserving or enhancing biodiversity.
Landfall	The area in which the offshore export cables make landfall (come on shore) and the transitional area between the offshore cabling and the onshore cabling. This term applies to the entire landfall area at Lytham St. Annes between Mean Low Water Springs and the transition joint bay inclusive of all construction works, including the offshore and onshore cable routes, intertidal working area and landfall compound(s).
Mean High Water Springs	The height of mean high water during spring tides in a year.
Mean Low Water Springs	The height of mean low water during spring tides in a year.
Morecambe Offshore Windfarm: Transmission Assets	The offshore export cables, landfall and onshore infrastructure required to connect the Morecambe Offshore Windfarm to the National Grid.
Morgan Offshore Wind Project: Transmission Assets	The offshore export cables, landfall and onshore infrastructure required to connect the Morgan Offshore Wind Project to the National Grid.

Term	Meaning
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.
National Site Network	The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 have created a National Site Network on land and at sea, including both the inshore and offshore marine areas in the UK. The National Site Network includes existing Special Areas of Conservation and Special Protection Areas alongside new Special Areas of Conservation and Special Protection Areas designated under these Regulations.
Onshore export cables	The cables which would bring electricity from landfall to the onshore substations.
Onshore substations	The onshore substations will include a substation for the Morgan Offshore Wind Project: Transmission Assets and a substation for the Morecambe Offshore Windfarm: Transmission Assets. These will each comprise a compound containing the electrical components for transforming the power supplied from the generation assets to 400 kV and to adjust the power quality and power factor, as required to meet the UK Grid Code for supply to the National Grid.
Onshore Order Limits	See Transmission Assets Order Limits: Onshore (below).
Preliminary Environmental Information Report	A report that provides preliminary environmental information in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. This is information that enables consultees to understand the likely significant environmental effects of a project and which helps to inform consultation responses.
Protected species	A species of animal or plant which it is forbidden by law to harm or destroy.
Special Areas of Conservation	A site designation specified in the Conservation of Habitats and Species Regulations 2017. Each site is designated for one or more of the habitats and species listed in the Regulations. The legislation requires a management plan to be prepared and implemented for each SAC to ensure the favourable conservation status of the habitats or species for which it was designated. In combination with Special Protection Areas and Ramsar sites, these sites contribute to the national site network.
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.
Study area	This is an area which is defined for each environmental topic which includes the Transmission Assets Order Limits as well as potential spatial and temporal considerations of the impacts on relevant receptors. The study area for each topic is intended to cover the area within which an impact can be reasonably expected.

Term	Meaning
Survey area	The area within which each survey has been undertaken. This may differ from the Study Area as a Survey Area will be based on species or survey-specific guidance on the extent of survey required, which may be limited by, for example, habitat conditions, or be defined in terms of buffer areas around an area of potential impact.
Transmission Assets	See Morgan and Morecambe Offshore Wind Farms: Transmission Assets (above).
Transmission Assets Order Limits	The area within which all components of the Transmission Assets will be located, including areas required on a temporary basis during construction and/or decommissioning
Transmission Assets Order Limits: Onshore	The area within which all components of the Transmission Assets landward of Mean High Water Springs will be located, including areas required on a temporary basis during construction and/or decommissioning (such as construction compounds). Also referred to in this report as the Onshore Order Limits, for ease of reading.

Acronyms

Acronym	Meaning
ARG	Amphibian and Reptile Group
BMWP	Biological Monitoring Working Party
BTO AP	British Trust for Ornithology's Acoustic Pipeline
DLL	District Level Licensing
Defra	Department for Environment, Food and Rural Affairs
eDNA	Environmental DNA
EIA	Environmental Impact Assessment
ES	Environmental Statement
EU	European Union
EWG	Expert Working Group
GCN	Great Crested Newt
GLTA	Ground Level Tree Assessment
HSI	Habitat Suitability Index
INNS	Invasive Non-native Species
MoRPh	Modular River Physical
NVC	National Vegetation Classification
PRA	Preliminary Roost Assessment
PRF	Potential Roost Feature
RCA	River Condition Assessment

Acronym	Meaning
RDB	Red Book Data
SFCC	Scottish Fisheries Co-Ordination Centre
WCC	White Clawed Crayfish
WHPT	Walley Hawkes Paisley Trigg

Units

Unit	Description
%	Percentage
cm	Centimetres
cm/s	Centimetres per second
GW	Gigawatt
ha	Hectares
km	Kilometres
m	Metres
ml	Millilitres
mph	Mile per hour
MW	Megawatt

1 Onshore ecology and nature conservation survey methodologies

1.1 Introduction

1.1.1.1 This document forms Volume 3, Annex 3.2: Onshore ecology and nature conservation survey methodologies of the Environmental Statement (ES) prepared for the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (hereafter referred to as the Transmission Assets).

1.1.1.2 This annex presents the onshore ecology survey methodologies that were used to collect baseline data to inform Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES. These methodologies have been issued and agreed with stakeholders. The methodologies form **Appendix A** to **Appendix M** of this annex.

1.1.1.3 **Appendix A** presents a summary of the methodologies proposed, including where surveys for a species have been scoped out, with justification. Species scoped out of species-specific surveys include:

- red squirrel *Sciurus vulgaris*;
- hazel dormouse *Muscardinus avellanarius*; and
- brown hare *Lepus europaeus*.

1.1.1.4 **Appendix B to M** present the methodologies used for species-specific surveys.

1.2 Consultation and engagement

1.2.1.1 On 28 October 2022, the Applicants submitted an EIA Scoping Report to the Planning Inspectorate, which described the scope and methodology for the technical studies being undertaken to provide an assessment of any likely significant effects for the construction, operation and maintenance and decommissioning phases of the Transmission Assets.

1.2.1.2 Following scoping, consultation and engagement with interested parties specific to onshore ecology and nature conservation continued. The first onshore ecology and onshore and intertidal ornithology Expert Working Group (EWG) was held in March 2023 where high level findings and the proposed onshore ecology survey methodologies were presented for agreement. Detail on this can be found within Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES.

1.2.1.3 Proposed survey methodologies were subsequently sent to the EWG for comment on 15 August 2023. Comments from Natural England were received on 18 September 2023 relevant to the bat and reptile survey methodologies. Amendments were subsequently made to the bat and reptile methodologies originally presented. **Appendix D** and **Appendix K** reflect the updated bat and reptile methodologies. Comments from the Environment Agency were received on 29 August 2023 relevant to fish, European eel *Anguilla anguilla*, otter *Lutra lutra*, water vole *Arvicola amphibius* and White-

Clawed Crayfish (WCC) *Austropotamobius pallipes* methodologies. Amendments have subsequently been made to the otter and water vole methodologies originally presented. **Appendix J** reflects the updated otter and water vole methodologies.

1.2.1.4 In addition, amendments to a number of methodologies were made following the first issue of the methodologies, in order to provide more detail on the specific methodologies used and based on a fuller understanding of the baseline conditions. The updated methodologies are the following.

- Aquatic invertebrate methodologies (see **Appendix B**) and terrestrial invertebrate surveys (**Appendix M**) were updated based on a fuller understanding of baseline conditions and following expert professional advice to increase the required level of survey.
- Bat activity and bat roost methodologies (**Appendix D**) were updated due to an update in the Bat Conservation Trust's Good Practice Guidelines (Collins, 2023).
- National vegetation classification methodologies (**Appendix I**) and river habitat survey methodologies (**Appendix L**) were updated to provide more information around post-survey data processing.
- Hedgerow survey methodologies (**Appendix G**) were updated to provide more information around the hedgerow attributes recorded to assess importance.

1.2.1.5 Remaining appendices reflect the original survey methodologies sent to the EWG for comment on 15 August 2023.

1.2.1.6 Updated methodologies were submitted in the Preliminary Environmental Information Report (PEIR) and any subsequent amendments were discussed at EWG 5 in May 2024.

1.2.1.7 Further details regarding consultation relevant to onshore ecology and nature conservation can be found in Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES.

1.3 Survey area

1.3.1.1 The onshore ecology survey areas focus on ecological receptors landward of Mean High Water Springs where potential impacts are more likely to occur on onshore ecological receptors. The survey areas cover the Transmission Assets Order Limits, and a buffer which varies depending on the ecological resource. The survey areas cover:

- Onshore Order Limits, used for aquatic invertebrate (pond), terrestrial invertebrate surveys and great-crested newt (GCN) eDNA surveys. In addition, aquatic invertebrate surveys were undertaken in main watercourses that cross the Onshore Order Limits;
- Onshore Order Limits and a 250 m buffer, used for aquatic invertebrate, terrestrial invertebrate and GCN Habitat Suitability Index (HSI) surveys;

- Onshore Order Limits and a 150 m buffer, used for phase 1 habitat surveys, hedgerow, National Vegetation Classification (NVC), Invasive Non-Native Species (INNS) fish and otter surveys;
- Onshore Order Limits and a 50 m buffer, used for water vole surveys;
- Onshore Order Limits and a 30 m buffer, used for badger and bat roost surveys;
- Onshore Order Limits and a 10 m buffer, used for river condition assessment surveys; and
- Onshore Order Limits, used for reptile and bat activity surveys.

1.3.1.2 Owing to the iterative design process of the Transmission Assets, some surveys undertaken in 2022 and 2023 were undertaken in areas that are now outside of the survey areas specified in **paragraph 1.3.1.1**. Information from these surveys has been included in the relevant Annexes where data were considered useful to provide more context regarding the ecological sensitivity of the wider area and to inform Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES. Contextual survey data is clearly identified in the relevant annexes and associated figures,

1.3.2 Phase 1 and 2 surveys

1.3.2.1 In order to inform the baseline and the existing environmental conditions to be reported within the ES, as well as to inform any identified mitigation, Phase 1 habitat surveys have been completed for the Transmission Assets (see Volume 3, Annex 3.3: Phase 1 habitat, hedgerow and national vegetation classification survey technical report of the ES). Where these have been completed, the need for Phase 2 surveys have been identified.

1.3.2.2 The requirement for the different survey types identified through desktop and Phase 1 surveys is detailed in **Appendix A**. The methodologies, extent of survey area, survey effort and any potential perceived constraints are set out in **Appendix B** to **M**.

Appendix A: Summary of methodologies

Table 1.1 below details the species or habitat surveys that have been scoped in or scoped out, and the justification for each.

Table 1.1: Scoping status for phase 2 surveys

Common name	Scientific name	Scoped in	Justification
Aquatic invertebrates	N/A	Yes	Watercourses and waterbodies are present on site that have the potential to support a wide range of aquatic invertebrates, including rare species. These watercourses/waterbodies may be impacted by the works. Therefore, **this group has been scoped in for further surveys.** Aquatic invertebrate surveys were undertaken of main watercourses that cross the Onshore Order Limits. Aquatic invertebrate surveys scoping surveys were undertaken of ponds within the Onshore Order Limits, and further surveys undertaken of ponds considered likely to support assemblages of interest.
Badger	*Meles meles*	Yes	Habitats suitable for badger are present on site, and setts may be impacted by the proposed works. Therefore, **this species has been scoped in for further surveys**.
Bats	N/A	Yes	Habitats suitable for roosting and hibernating (trees and structures) are present on site, as well as suitable foraging and commuting habitat. Suitable roosting features may be lost as part of the proposed works where the cabling works require tree felling or the removal of buildings. Foraging and commuting habitat is only likely to be temporarily impacted along the cable route but may be permanently impacted around the proposed substations. Therefore, **this species group has been scoped in for further surveys**.
Brown hare	*Lepus europaeus*	**No**	This species is likely to be present in the area. However, as habitat loss will be temporary it is considered that there will be no significant adverse impact. A precautionary approach to work will be adopted during construction and will be supervised by an ecological clerk of works (ECoW). Any pits created during works will be covered or have mammal ramps positioned within them for animals to escape. Therefore, no further surveys are considered necessary, and **this species has been scoped out for further surveys**.
Fish	N/A	Yes	Watercourses and waterbodies are present on site that have the potential to support a wide range of fish, including eel. These watercourses/waterbodies may be

Common name	Scientific name	Scoped in	Justification
			impacted by the works. Therefore, **this group has been scoped in for further surveys.**
Great crested newt	*Triturus cristatus*	Yes	Waterbodies are present on site that have the potential to support GCN. These waterbodies and associated suitable terrestrial habitat may be impacted by the proposed works. Therefore, **this species has been scoped in**. A pond assessment via HSI was undertaken for ponds within the Onshore Order Limits and up to 250 m from the Onshore Order Limits. eDNA surveys were undertaken, including, in 2024, ponds within the Onshore Order Limits. We are proposing to use the District Level Licensing (DLL) scheme, in agreement with NE **which negates the requirement for population size class assessment surveys**.
Hazel dormouse	*Muscardinus avellanarius*	**No**	Suitable habitat for this species is very limited throughout the Phase 1 ecology survey area. Only one parcel was identified as containing suitable habitat for hazel dormice, which is within St Annes's Old Links Golf Club adjacent and south-west of Blackpool Airport, and is fragmented and separated from other suitable habitat nearby which could support a viable population.. Therefore, **this species has been scoped out for further surveys.**
Hedgerow	N/A	Yes	Hedgerows are present throughout site. Surveys are required on the hedgerows to determine whether they are defined as 'important' under the Hedgerows Regulations 1997, and to undertake condition assessments of any hedgerows present. Therefore, **this habitat has been scoped in for further surveys including condition assessments to support BNG assessment**.
Invasive Non-Native Species (INNS)	N/A	Yes	There is the potential for invasive non-native species to be present on site, and the proposed works have the potential to cause the spread of these species should they be present with an additional focus on *Rosa rogosa*. Therefore, **this group has been scoped in**to the assessment, but specific surveys of INNS were not undertaken. They were incorporated with the habitat surveys. Data search results for INNS were also used to provide an initial assessment.
National Vegetation Classification (NVC)	N/A	Yes	Habitats are present on site that may comprise plant communities of importance and/or be Habitats of Principal Importance. Therefore, this **survey type has been scoped in for further surveys** but in a small number of locations only.
Otter	*Lutra lutra*	Yes	Watercourses are present on site that have the potential to support otters and evidence of otters including direct observations and field signs have been recorded

Common name	Scientific name	Scoped in	Justification
			on site. These watercourses may be impacted by the works. Therefore, **this species has been scoped in for further surveys.**
Red squirrel	*Sciurus vulgaris*	**No**	This species' known distribution in Lancashire is confined to an area between Crosby and Southport (Lancashire Wildlife Trust, 2023). There is a lack of suitable habitat for this species within the site boundary. It is, therefore considered unlikely that the species will be present within the area associated with the Scheme. Therefore, **this species has been scoped out for further surveys.**
Reptile	N/A	Yes	Habitats are present on site that have the potential to support reptiles. These habitats may be impacted by the works. Therefore, **this group has been scoped in for further surveys.** Sand lizard surveys on the dunes were not undertaken, refer to Annex 3.8 Great crested newt and reptile survey technical report.
River habitat	N/A	Yes	Rivers are present on site that require further survey to identify habitat features for wildlife. Therefore, **this survey type has been scoped in for further surveys.**
Terrestrial invertebrates	N/A	Yes	Habitats are present on site that have the potential to support a wide range of terrestrial invertebrates, including rare species. These habitats may be impacted by the works. Therefore, **this group has been scoped in for further surveys.**
Water vole	*Arvicola amphibius*	Yes	Watercourses are present on site that have the potential to support water vole. These watercourses may be impacted by the works. Therefore, **this species has been scoped in for further surveys.**
White-clawed crayfish (WCC)	*Austropotamobius pallipes*	No	This species is not considered likely to occur in the survey area. Therefore, **this species has been scoped out for further surveys.**

Appendix B: Aquatic invertebrates survey methodology

B.1.1 Introduction

The main objectives of the aquatic invertebrates surveys were to:

- sample and identify invertebrate species in the waterbodies and watercourses on site; and
- classify the sites importance in relation to the invertebrate community present.

B.1.2 Survey methodology

The aquatic invertebrate surveys have broadly followed the guidelines set out in '*Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation*' (English Nature, 2007).

B.1.2.1 Qualifications and experience

All surveyors involved in surveying invertebrates were experienced in:

- field identification of widespread invertebrate species and life stages (e.g., adults, larvae, eggs and exuviae);
- assessing the potential suitability of on-site habitats for widespread aquatic invertebrate species;
- determining appropriate spatial scope for survey; and
- identifying appropriate survey techniques to achieve a robust survey in a variety of habitat types.

Surveys only involved widespread invertebrate species, as such no survey licence is required.

B.1.2.2 Aquatic invertebrate survey

Scoping surveys

In order to inform the baseline and the existing environmental conditions to be reported within the ES, as well as to inform any necessary mitigation, an extended phase 1 survey has been carried out for the Transmission Assets. Extended phase 1 habitat surveys undertaken between September 2022 and August 2023 identified 31 waterbodies and eleven watercourses within the phase 1 habitat survey area potentially required for further assessment (see Volume 3, Annex 3.3: Phase 1 habitat, NVC and hedgerow survey technical report of the ES).

Six waterbodies were scoped out on initial desk based assessment and two were dry at the time of survey.

Twenty-five waterbodies and nine watercourses were subsequently visited and assessed in the field by an experienced aquatic invertebrate survey specialist. The field visit by the aquatic invertebrate specialist scoped each waterbody and watercourse either in or out for further detailed aquatic invertebrate assessment. The scoping determination was informed by the waterbody or watercourse's extent, structure, ability to hold water and macrophyte cover.

All surveyed waterbodies and watercourses were assigned a unique identification number. Watercourses were labelled A-Q. Due to the length of some of the watercourse and variation in structure, water quality and water depth, any watercourses scoped in for further, detailed surveys were sub-divided into two or three survey locations. Each survey location was assigned a number.

Waterbodies were scoped in for further survey using professional judgement and if they received a Biological Monitoring Working Party (BMWP) score of over 30 during the rapid assessment.

Each waterbody or watercourse scoped in for further survey was subsequently assessed to determine its suitability to support protected and notable aquatic invertebrates at specific survey locations. All waterbodies and watercourses that were dry or ephemeral were assessed as unsuitable for protected or notable aquatic invertebrates and were not subject to a rapid assessment.

Rapid assessments

Site-specific surveys comprised a series of rapid assessments that involved sampling watercourses and waterbodies for aquatic invertebrates to identify the presence or likely absence of protected and notable species.

Aquatic invertebrate surveys were undertaken between July 2023 and August 2024.

The rapid assessment method was used for both waterbodies and watercourses. The method is designed to identify aquatic invertebrate species present and to assess the aquatic invertebrate diversity. Aquatic invertebrate diversity was used as an indicator to assess biological water quality and naturalness of watercourses and waterbodies and was based on the BMWP system (BMWP, 1997).

Watercourses were subject to one survey. Waterbodies scoped in for detailed assessment were recommended to have two surveys across different seasons. The first set of surveys were completed in July. However, following detailed survey all waterbodies were scoped out of requiring a second survey, given the assemblages recorded.

Waterbodies

The rapid assessment methodology for waterbodies comprised sweep netting and visual searches of the waterbody perimeter, to sample aquatic invertebrate diversity. A rectangular net, with a net depth of 30 cm and a 1 mm mesh was used. Standing at the waters' edge the surveyor netted the

vegetation by making short jabbing thrusts into dense emergent and raft forming plants (where present), making occasional longer strokes into submerged plants and over bare substrate in deeper water. The number of netting jabs varied between waterbodies, but each netting jab was no longer than three minutes in duration.

The diversity of the aquatic invertebrate assemblage was then analysed at the bankside. If large numbers of different invertebrate families were present, samples were sent for laboratory analysis.

Watercourses

The rapid assessment methodology for watercourses comprised the sampling of aquatic invertebrates using a three-minute kick sampling technique. Kick sampling was undertaken on all habitat features within each suitable and accessible watercourse. The surveyor stood in the water facing downstream with a 1 mm mesh net in front of them. The surveyor then disturbed sediment immediately upstream of the net, upturning stones, and displacing gravel with their feet to dislodge invertebrates so disturbed organisms were collected in the net.

The surveyor then moved backwards, upstream, from one side of the watercourse to the other so that the banks were sampled as well as midstream. Pools and shallower riffle were included where possible.

This kick sampling method was undertaken in accordance with ISO 10870:2012 Water Quality – Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in freshwater (British Standards Institution, 2012) and Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation (Natural England, 2007).

As part of the assessment of watercourses, habitat suitability was also assessed for white-clawed crayfish. Suitable habitat for white-clawed crayfish includes slow flowing watercourses and quarry pools, which comprise a mosaic of features, such as stones, rocks and tree roots. If a watercourse was dry or did not comprise suitable habitat features for white-clawed crayfish refuge, white-clawed crayfish surveys were scoped out. The white clawed-crayfish habitat assessments were undertaken in accordance with Guidance on Habitat for White-Clawed Crayfish (Peay, 2003).

Identification

1.3.2.1 Where possible and practical, invertebrates were identified in the field, but wherever doubt exists, one or more specimens were collected for more detailed inspection. Where the surveyor was unable to identify any specimens, they were submitted to relevant experts.

1.3.2.2 It is desirable that as wide a taxonomic range as possible is identified, in order to sample numerous ecological types, i.e. invertebrates with widely differing natural histories. Where possible, the following orders and families of invertebrates were named to species.

- *Araneae* – Spiders.

- *Clitellata* – Leeches.
- *Coleoptera* – Beetles (all except small *Aleocharine* rove beetles and other very small obscure families).
- *Crustacea* – Shrimps, water fleas, water louse.
- *Diptera* - True flies (except, *Cecidomyiidae*, *Chironomidae*, *Ceratopogonidae*, *Simulidae*, *Phoridae*, *Sphaeroceridae*, and females of some groups which are not identifiable).
- *Ephemeroptera* – Mayflies.
- *Hemiptera, Heteroptera* - True bugs (excluding smaller *Miridae*).
- *Hemiptera*, *Aphididae* - Aphids (few conspicuous species only).
- *Odonata* – Dragonflies and damselflies.
- *Plecoptera* – Stoneflies.
- *Trichoptera* – Caddisflies.
- *Mollusca* – Slugs and snails.

Aquatic invertebrate sample analysis

Aquatic invertebrate samples obtained from sweep netting and kick sampling were analysed at the bankside to determine the presence or likely absence of protected or notable species. The samples were also analysed to identify the aquatic invertebrate families present within the sample. The samples were identified to family level (and to species level, where possible). The sample data was used to determine the importance of each survey location and to generate the Biological Monitoring Working Party (BMWP) scores and Average Score Per Taxon (ASPT) values.

The BMWP system assigns numerical values (between 1 and 10) to more than 50 different aquatic invertebrate taxa according to their sensitivity to pollution. The larger the numerical value of the family, the more sensitive the family is to pollution. The sum of the values in each population provides an indication of the ecological status of a waterbody or watercourse and how polluted they are likely to be. A higher score indicates a waterbody supports animals typical of high quality waterbodies, and lower scores indicate a waterbody is in poorer condition.

To supplement the biological quality of a watercourse or waterbody the BMWP scores are averaged to generate the ASPT. Lower ASPT numbers indicate a waterbody or watercourse is likely to be in poorer condition. The BMWP and the ASPT results are useful when assessed together as they provide an index of how polluted a waterbody or watercourse may be.

The standard method for collecting and sampling invertebrates in rivers support Walley, Hakes, Paisley and Trigg (WHPT) metric calculations (British Standard, 1994; UKTAG 2021). This method assessed the condition of the quality element using parameters number of taxa (NTAXA) and average score per taxon (ASPT). The parameters are indicative or the impact of

organic enrichment on the quality element. This is calculated on family level data and not species level data. Watercourse results include WHPT scores.

A watercourse or waterbody with good water quality is indicated by a diverse variety of taxa, especially those that are sensitive to pollution (such as mayflies, stoneflies and dragonflies). Poorer quality is indicated by a smaller than expected number of taxa, particularly those that are less sensitive to pollution (worms and midges). BMWP scores and ASPT values are listed in **Table 1.2** below (as per Armitage *et al.,* 1983; Chapman, 1996; and Mason, 2002). The individual BMWP numerical values for aquatic invertebrate families are listed in **Appendix B.1.4**.

Table 1.2: BMWP and ASPT scores

BMWP Score	ASPT Value	Interpretation of Biological Water Quality
Over 100	Over 5.4	Very good biological quality
71-100	4.8 – 5.4	Good biological quality
41 – 70	4.3 – 4.8	Fair biological quality
11 – 40	3 – 4.3	Poor biological quality
0 – 10	3.0 or less	Very poor biological quality

Data analysis

The quality of the site for invertebrates was assessed with reference to the species found which are considered to be nationally scarce or rare by the various Natural England Commissioned Reports published by JNCC (e.g., Falk 1991a; Falk 1991b; Hyman, 1992) and subsequently Natural England. These reviews place all nationally scarce species into categories according to their degree of rarity and their vulnerability to extinction and are accepted as the 'official' JNCC/Natural England designations, as detailed in **Appendix B.1.4**. The more recent ones also assess taxa with reference to IUCN threat categories.

As a simple and readily comparable indication of quality, the proportion of Nationally Scarce and Red Data Book (RDB) species of the total diversity has been calculated. The same calculation will be done for the rarest taxa with RDB status. Depending on the habitat type, a proportion of 3-5% Nationally Scarce/RDB species needs to be exceeded before it can be safely concluded that the site has some conservation significance. Very high quality sites of national importance will have a proportion close to or exceeding 10% Nationally Scarce/RDB species.

The surveyor compared the habitats present at each waterbody or watercourse survey location with other sites of similar habitat and nature, and classified each waterbody or watercourse as:

- little/no importance;
- local/county importance;
- regional importance;

- national importance; or
- European importance.

As well as describing the communities present, any species of high interest are reported. These could include:

- species of principal importance for nature conservation;
- Schedule 5 species; or
- threatened species.

Where these species occurred, their locations and the locations of suitable habitat were recorded.

B.1.2.3 Incidental records

Any sightings of non-target species (or evidence of) recorded during surveys were reported in the separate incidental records form on the ArcGIS Field Maps application.

B.1.3 References

Armitage, P. D., Moss, D., Wright, J. F and Furse, M. T. (1983) The performance of a new biological water quality score system based on macroinvertebrates over a wide range of unpolluted running-water sites, Water Research, Volume 17, Issue 3,1983, Pages 333-347, ISSN 0043-1354,

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B.1.4 British conservation status categories - definitions

The following definitions are those used by the Joint Nature Conservation Committee review of the status of scarce invertebrates of Great Britain.

Red Data Book Category 1. RDB1-ENDANGERED

- Taxa in danger of extinction if causal factors continue unabated. Includes species occurring as a single colony or only in habitats which are much reduced and highly threatened, or which have shown a rapid and continuous decline.

Red Data Book Category 2. RDB2-VULNERABLE

- Taxa believed likely to move into the endangered category in the near future if the causal factors continue operating. Includes species of which most or all populations are decreasing and those which are confined to vulnerable habitats.

Red Data Book Category 3. RDB3-RARE

- Taxa with small populations that are not at present endangered or vulnerable but are at risk; usually localised within restricted geographical areas or habitats or are thinly scattered over a wider range. Includes species estimated to exist in only fifteen or less post 1970 10km squares or, if more, then in vulnerable habitat.

Red Data Book Category 4. RDBK – Data deficient

- Taxa that are suspected, but not definitely known, to belong to any of the above categories, because of lack of information. Includes taxa recently discovered or recognised in Great Britain which may prove to be more widespread in the future; taxa with very few or perhaps only a single known locality but which belong to poorly recorded or taxonomically difficult groups; species known from very few localities but which occur in inaccessible habitats or habitats which are seldom sampled; species with very few or perhaps only a single known locality and of questionable native status, but not clearly falling into the category of recent colonist, vagrant or introduction.

Nationally Scarce Category a. Na

- Taxa which do not fall within the RDB categories, but which are uncommon in Great Britain and are known to occur in 30 or fewer 10km squares or, in less well recorded groups, within seven or fewer vice-counties.

Nationally Scarce Category b. Nb

- Taxa which do not fall within the RDB categories, but which are uncommon in Great Britain and are known to occur in between 31 and 100 10km squares or, in less well recorded groups, between eight and twenty vice-counties.

Appendix C: Badger survey methodology

C.1.1 Introduction

The main objectives of the badger surveys were to:

- identify evidence of badger and confirm sett locations;
- determine sett type; and
- monitor any setts present that may be impacted by works.

C.1.2 Survey methodology

Badger bait marking was not considered necessary for this project due to the lack of permanent severance/fragmentation of territories as a result of the Transmission Assets.

C.1.2.1 Qualifications and experience

All personnel conducting detailed badger surveys were competent and experienced in the identification of the full range of badger field signs including setts, latrines, hairs, badger paths and foraging signs, such as 'snuffle' holes. In addition, they will be competent in identifying field signs of other species, such as foxes, rabbits, otters, dogs and cats.

All personnel conducting badger survey were familiar with the definitions of sett type detailed by Harris *et al.* (1989), and the classification of setts utilising this methodology in the field.

C.1.2.2 Detailed survey for field signs

For all areas subject to survey, a systematic walkover was conducted of all suitable habitat to obtain records of:

- setts;
- hairs;
- badger paths/runs;
- mammal paths (possible badger);
- foraging signs;
- latrines;
- footprints;
- bedding material; and
- evidence of rabbit and fox.

If any setts were identified during the walkover survey, entrances and the orientation of entrance holes were mapped. Badger setts are classified

against the criteria laid out in Harris *et al* (1989) as either a 'main', 'annexe', 'subsidiary' or 'outlying' sett. The level of use for each entrance was classified as either 'active', 'partially active', or 'disused'.

Data was recorded using the ArcGIS Field Maps application.

C.1.2.3 Incidental records

Any sightings of non-target species (or evidence of) recorded during surveys were reported in the separate incidental records form on the ArcGIS Field Maps application.

C.1.3 References

Harris, S., Cresswell, P., and Jefferies, D. (1989) Surveying Badgers. The Mammal Society, London.

Appendix D: Bat survey methodology

D.1.1 Introduction

Land parcels have been scoped out for bat roost assessment where relevant habitats are not present i.e., structures or trees. Parcels have been scoped out for bat activity surveys where suitable habitats such as woodland and hedgerows are not present.

The main objectives of the bat surveys were to:

- assess trees and structures for bat roost suitability;
- confirm presence/likely absence; and
- determine species and roost type present.

D.1.2 Survey methodology

Survey methodologies undertaken in 2023 were principally based on the Bat Survey Guidelines (Collins, 2016), with methods adapted for surveys undertaken in 2024 in accordance with updated Bat Survey Guidelines (Collins, 2023).

D.1.2.1 Qualifications and experience

All bat survey work undertaken was conducted by suitably qualified persons. All work considered likely to result in disturbance of bats or their roosts will be conducted by holders of Class 2 Natural England licences (or Accredited Agents under these licences).

D.1.2.2 Scoping surveys

Phase 1 habitat surveys undertaken between May 2022 and May 2024 were used to identify the requirement for bat roost surveys within the survey area (see Volume 3, Annex 3.3: Phase 1 habitat, national vegetation classification and hedgerow survey technical report of the ES).

The following bat roost surveys were undertaken, where appropriate.

- Ground Level Tree Assessments (GLTA).
- Potential Roost Feature (PRF) inspections including aerial inspections, and hibernation surveys.
- Preliminary Roost Assessments (PRAs) of buildings.
- Dusk emergence surveys.

Survey methodologies were informed by the Bat Surveys for Professional Ecologists: Good Practice Guidelines 3rd edition (Collins, 2016) and 4th edition (Collins, 2023).

D.1.2.3 Ground Level Tree Assessments

The requirement for GLTA was scoped in if trees having been subject to phase 1 habitat surveys (see Volume 3, Annex 3.3: Phase 1 habitat, national vegetation classification and hedgerow survey technical report of the ES) offered potential value for bats in the form of PRFs, or if the trees were of a size and age where PRFs may be present. PRAs were considered necessary if structures were identified as present within the phase 1 habitat surveys.

All trees of diameter at breast height of 0.25 m or above were subject to survey from ground level by a suitably experienced ecologist. Trees subject to survey were recorded using the application ArcGIS Fieldmaps, hereafter referred to as Fieldmaps. Any trees with a diameter at breast height smaller than 0.25 m were subject to checks but only added to Fieldmaps if features suitable for bats were identified.

Trees were fully inspected using binoculars, high powered torches, and an endoscope (if licenced to do so and considered necessary). The inspections were undertaken systematically and consistently around all accessible aspects of the tree. Trees were graded based on their suitability for roosting bats.

For surveys undertaken in 2023 this was negligible, low, moderate or high in accordance with Collins (2016). However, due to an update in the Bat Conservation Trust's Good Practice Guidelines (Collins, 2023) the results of the surveys undertaken in 2023 were transposed into the updated format, as shown in **Table 1.3.** Although the methodology for GLTA in the updated guidance (Collins, 2023) states that each PRF on a tree can be detailed and categorised during a GLTA, a precautionary approach for categorising trees was chosen to combine the results of the 2023 and 2024 surveys. This included the categorisation of the trees (in accordance with Table 4.2 in Collins, 2023) rather than the categorisation of each feature on a tree (as per Table 6.2 in Collins, 2023).

Table 1.3: Suitability of trees for roosting bats (Collins, 2023)

Suitability (Collins, 2023)	Suitability (Collins, 2016)	Description (Collins, 2023)
None	Negligible	Either no PRFs in the tree, or highly unlikely to be any present.
Further Assessment Required (FAR)	Low	Further assessment required to establish if PRFs are present in the tree.
PRF	Moderate	A tree with at least one PRF present.
	High	

D.1.2.4 PRF inspection

PRF inspections comprised aerial tree inspections or inspections from the ground using an endoscope and/or torch.

All inspections were conducted either by a trained tree climber who is also a Natural England licensed bat worker or accredited agent, or by a tree climber under the direct supervision of a licensed bat worker. To minimise the risk of disturbance during inspections, all tree climbers who are not licensed bat workers were briefed by a licenced bat worker.

PRF inspections involve accessing any PRFs using a harness and ropes to carry out a detailed internal inspection using torches, mirrors, and endoscopes to determine the presence/likely absence of bats, and to obtain information on the suitability of the PRF for bats.

Where PRFs are at a low height on the tree and can be reached from the ground or ladder, an aerial tree inspection was not undertaken. Instead, surveyors used a torch and/or endoscope to fully inspect the PRF from the ground or a ladder.

A technical review of all the trees within the survey area was undertaken to determine whether all trees required a survey. Professional judgement was used to determine the nature and extent of works in the locality of each tree, including whether trenchless techniques were proposed. If the tree was not likely to be impacted by the works, then further surveys were not deemed necessary. For example, trees along proposed temporary access roads that are currently located in an area that already operates as an access track would not be subject to significant changes in disturbance. Trees within residential gardens at the edge of the survey area would not be lost or directly impacted by works. Therefore, the requirement for PRF inspections on some trees was scoped out, and subsequently not all trees within the survey area were surveyed.

Any trees categorised as FAR or PRF during the GLTA that were considered safe to climb and that may be impacted by works, were subject to a PRF inspection. When trees were not considered safe to climb, those categorised as FAR or PRF instead progressed directly to emergence survey, unless all PRFs present could be inspected from the ground.

Trees that were not suitable (as defined by Collins (2023)) were not subject to further survey.

Each PRF identified during the PRF inspection was categorised in accordance with Bat Conservation Trust's Good Practice Guidelines. For surveys undertaken in 2023 this included negligible, low, moderate and high categories. Since the introduction of updated guidelines in 2023, these categories have since been transposed into the new classifications of PRFs, as shown in **Table 1.4** below.

Table 1.4: Categorisation of PRFs for both old guidelines (Collins, 2016) and current guidelines (Collins, 2023)

Suitability (Collins, 2023)	Suitability (Collins, 2016)	Description (Collins, 2023)
None	Negligible	No PRFs present.
PRF-I	Low	PRF is only suitable for individual bats or very small numbers of bats either due to size or lack of suitable surrounding habitats.
PRF-M	Moderate	PRF is suitable for multiple bats and may therefore be used by a maternity colony.
	High	

Any features identified as PRF-I did not require further survey, as per Collins (2023). Any features identified as PRF-M, required three PRF inspection visits between May and September, with at least two undertaken in the period May to August.

D.1.2.5 PRF inspection - hibernation

A PRF inspection in winter was undertaken on trees likely to be impacted by works.

Surveys were undertaken to determine the presence or likely absence of hibernating bats, using the methods detailed above.

Surveys were undertaken during the bat hibernation season. Hibernation surveys are typically undertaken in January and February. However, surveys extended into March 2024 due to the cold temperatures and likelihood that bats were still hibernating at this time (see Volume 3, Annex 3.11: Bat roost survey technical report of the ES).

D.1.2.6 Preliminary Roost Assessment

Buildings/structures (including natural structures such as caves or adits) identified as requiring a survey during the extended phase 1 habitat surveys were assessed for their potential to support bat roosts.

Wherever possible and safe to do so, surveyors accessed all areas including cellars/underground structures and loft spaces. High-powered torches with red filters, binoculars and endoscopes were used to investigate all accessible areas. Where there were any constraints to the survey, these were clearly identified in the survey notes and consideration was given to the effect these constraints may have had on the results obtained.

Each building/structure was classified according to its suitability for roosting bats during the active season confirmed as: high; moderate; low or negligible and illustrated in **Table 1.5**.

Table 1.5: Suitability of structures for roosting bats (Collins, 2023)

Suitability	Description
Negligible	No habitat features on site likely to be used by any roosting bats; however, a small element of uncertainty remains as bats can use small and unsuitable features on occasion.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically at any time of the year. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats.
Moderate	A structure with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions, and surrounding habitat but unlikely to support a roost of high conservation status.
High	A structure with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat. These structures have the potential to support high conservation status roosts e.g., maternity or classic cool/stable hibernation sites.

D.1.2.7 Dusk emergence surveys

No further survey is required for structures/trees assessed to have no/negligible suitability as informed by GLTA, PRF inspections and/or PRA.

A technical review of all the structures within the survey area was undertaken to determine whether the structures required further survey. One complex of buildings was identified as requiring survey due to its proximity to the proposed Morecambe onshore substation.

Where trees have confirmed roosts or where a PRF inspection could not be undertaken due to access restrictions (e.g., unsafe structure/unsafe to climb the tree), subsequent dusk emergence and dawn re-entry surveys were undertaken. This comprised of three dusk emergence surveys.

Surveys were undertaken between May and September, with at least two surveys undertaken between May and August, and with at least three weeks between surveys. Dusk emergence surveys commenced 15 minutes prior to sunset and continued for two hours. Surveys were undertaken in appropriate weather conditions as defined in Collins (2023).

All surveyors were equipped with night vision aids (infrared or thermal imaging cameras) during dusk emergence surveys, as per the recommendations set out in Collins (2023).

Surveyors used full spectrum echolocation detectors. Following survey work, all recordings were analysed by an experienced ecologist using call analysis software to confirm species (where possible) and a number of passes made. All recordings were retained for future reference.

Surveyors were positioned in sufficient numbers that all PRF could be seen by at least one surveyor. All surveyors were briefed prior to the start of survey as to the findings of the preliminary assessment and shown the presence of any

potential access/egress points. Surveyors remained at their survey station throughout the emergence survey period.

D.1.2.8 Bat activity surveys

There is deliberation about the value of the effectiveness of walked activity transects in determining bat activity levels and determining potential impacts of proposed schemes as studies have found that transects underrepresented bat species richness compared to stationary surveys across all major vegetation communities. For schemes where long-term permanent impacts are likely activity transects may be recommended.

As the majority of impacts for the proposed works on the Transmission Assets are short-term and temporary (excluding the onshore substations), it is considered that the survey effort in undertaking activity transects is not proportional to the impact of the Transmission Assets. As such, activity transects were not proposed to be undertaken for the Transmission Assets.

However, automatic static bat detector surveys were proposed at 43 strategic locations, specifically in areas of suitable habitat such as woodland and hedgerows, within the bat activity survey area and where the impacts are likely to be greatest, for example, suitable habitats located around the onshore substations and temporary construction compounds. Due to changes to the design of the onshore substations and temporary construction compounds during the bat activity surveys, and the subsequent changes to expected areas of impacts, the locations of the automated static detectors varied slightly through the survey period. Due to access restrictions, surveys were undertaken at 34 of the 43 proposed locations.

One automatic static bat detector, Elekon Batlogger S2, was placed at each survey location. Detectors were deployed for a minimum of five nights, once a month between May and October 2023, inclusive and April and July 2024. The detectors were set to record overnight and programmed to commence recording approximately 15 minutes before sunset and terminate recording 15 minutes after sunrise. Detectors were set to record a maximum length of five seconds per detection event, i.e., when bats passed. Surveys will continue until October 2024.

Bat sound analysis

Auto-identification analysis was undertaken by running the sound data through the British Trust for Ornithology's Acoustic Pipeline which provides the infrastructure to allow audio recordings to be uploaded to a secure remote server, to be processed to find and identify bat calls, and to return results back. This program automatically analyses any calls within the sound files and provides a level of confidence for the calls recorded. The recommendation is that identifications with an accuracy probability of less than 0.5 (50%) will be discarded.

A verification and quality assurance of the auto-identification was then undertaken. Manual checks prioritised unexpected and unlikely species (i.e., species not regularly recorded in the area). A random sample of 10% of the

recordings with a probability of more than 0.5 was also checked. If this check recorded an error rate of more than 10% then the checks were increased.

Species identification was automatically assigned by BTO AP. However, any *Myotis* or *Plecotus* species were subsequently grouped into genus post-analysis due to the uncertainty associated with identifying these genera to species level due to overlapping call parameters. Where any uncertainty was present during analysis, species were grouped into genus (e.g., pipistrelle *Pipistrellus* sp.).

D.1.2.9 Incidental records

Any sightings of non-target species (or evidence of) recorded during surveys were reported in the separate incidental records form on the ArcGIS Field Maps application.

D.1.3 References

Collins, J. (ed) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). Bat Conservation Trust, London.

Collins, J. (ed) (2023) Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th edition). Bat Conservation Trust, London.

Reason, P. and Wray, S. (2023) UK Bat Mitigation Guidelines: a guide to impact assessment, mitigation and compensation for developments affecting bats. Chartered Institute of Ecology and Environmental Management, Ampfield.

Appendix E: Fish and eel survey methodology

E.1.1 Introduction

The main objectives of the freshwater fish and eel habitat survey methodology is to identify habitats that could support freshwater fish.

E.1.2 Survey methodology

E.1.2.1 Qualifications and experience

All surveyors involved in screening and scoping for fish and eels were experienced in:

- field identification of all widespread fish and eel species and field signs;
- assessing the potential suitability of on-site habitats for widespread freshwater fish species;
- determining appropriate spatial scope for survey; and
- identifying appropriate survey techniques to achieve a robust survey in a variety of habitat types.

E.1.2.2 Freshwater fish habitat survey

Fish habitat surveys consisted of a walkover survey undertaken on watercourses within the Onshore Order Limits. This was undertaken to classify aquatic and riparian habitats that are utilised by priority species.

During the survey, habitat characteristics such as the watercourse's width, water depth, substrate composition and stability, flow types, availability of fish/eel cover and complexity, land use and other significant features (e.g., outfalls, road crossings, obstacles to migration, other significant physical alterations) were recorded. These characteristics were selected as they are typically used to describe general habitat suitability for freshwater fish species of conservation interest and to identify any critical or limiting habitats (e.g., spawning habitat, silt beds for juvenile lamprey) (Scottish Fisheries Co-Ordination Centre (SFCC), 2007).

Habitat preferences for fish species of conservation interest are summarised in **Table 1.6** and are based on descriptions in Hendry and Cragg-Hine (2003), Maitland (2003), Maitland (2007) and SFCC (2007).

Table 1.6: Fish species habitat descriptions

Species	Life stage	Habitat preferences
Atlantic salmon	Spawning/eggs	Channel width generally at least 3 m, with a gradient 3% or less. Water depth 17-76 centimetres (cm) with current velocity 25-90 cm/ second (s). Substrates for redds (nests) mainly pebble and cobble with little to no silt. Often found at the transition between pool and riffle.

Species	Life stage	Habitat preferences
	Juveniles (fry and parr)	Shallow, fast-flowing water with coarse (cobble/boulder) substates and adequate cover (e.g., boulders, aquatic vegetation, undercut banks, overhanging vegetation, tree roots).
	Adults	River should be free from obstacles to migration. Suitably deep pools to allow for resting when migrating upstream, cover for fish when migrating (e.g., undercut banks, tree roots, submerged vegetation and objects, large woody debris).
Brown/sea trout	Spawning/egg	May spawn in smaller channels than Atlantic salmon. Sea trout use similar substates to Atlantic salmon for redds, resident brown trout often spawn in smaller substrates (e.g., gravel to pebble).
	Juveniles (fry and parr)	Shallow, flowing (slow to fast) water, often at stream margins using suitable cover.
	Adults	Same as Atlantic salmon. Although resident brown trout do not migrate to sea, they do migrate within freshwaters.
Lamprey (brook, river and sea lamprey)	Spawning/egg	Gravel substrates with some sand in areas of flowing water, little to no fine sediments.
	Ammocoetes (juveniles)	Deposits of fine substrates (mud, silt, sand) with a high organic matter content to depths of a few centimetres to >30 cm. Often in slow-flowing areas of the watercourse. Deposits must be stable, as ammocoetes live within them for several years.
	Adults	For river and sea lamprey, a migratory path with no obstacles to upstream or downstream migration is required. Adult brook lamprey remain in freshwaters and do not feed but after metamorphosis will migrate from silt beds to suitable spawning habitats.
European eel	Adults/elvers (juveniles)	Arrive in freshwater as elvers and occur in all types of freshwaters that are accessible from the sea. Eels require a route free from obstacles to migration but are able to ascend some obstacles that are barriers to other fish (e.g., salmon, trout, lamprey).

E.1.2.3 Electric fishing

Where a watercourse was considered suitable for fish and eel, electric fishing was undertaken to determine their presence or likely absence. Electric fishing was undertaken in accordance with British Standard (BS) EN 14011:2003 'Water Quality: Sampling of fish with electricity'.

Electric fishing involved passing an electric current into each watercourse causing the temporary incapacitation of fish, thus rendering the fish easier to catch, identify and analyse.

At each suitable watercourse, the electric fishing methodology was used to survey a 100 m stretch of waterbody (where possible), utilising stop nets to prevent fish from moving away from the watercourse, where necessary. All field surveyors were suitably competent, certified and experienced in undertaking the survey methodology for fish and eel surveys. Approval from the relevant statutory bodies to undertake electric fishing was received before any electric fishing surveys commenced.

Surveys of each suitable watercourse were undertaken as per Giles *et al*. (2005) and Environment Agency's electric fishing operations: equipment and working

practices (Environment Agency, 2019). All surveys were undertaken in the optimal survey period for fish and eel (between June and October).

E.1.2.4 Incidental records

Any sightings of non-target species (or evidence of) recorded during surveys was reported in the separate incidental records form on the Arc GIS Field Maps application.

E.1.3 References

British Standards Institution (2003) BS EN 14011:2003, BS 6068-5.32:2003: Water quality. Sampling of fish with electricity, London: BSI. Beaumont, C., Taylor, Britain., G., Lee, M.J., Welton, J.S. and Fish, C. (2001). Guidelines for Electric Fishing Best Practice. R&D Technical Report W2-054/TR.

Environment Agency (2019). Electric fishing operations: equipment and working practices. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/806271/EA_electrofishing_SOP.pdf. Accessed: July 2024.

Giles N, Sands R and Fasham M (2005). *Fish* in: Hill D, Fasham M, Tucker P, Shewry M and Shaw P (eds) Handbook of Biodiversity Methods: Survey, Evaluation and Monitoring, 368-386. Cambridge University Press, Cambridge.

Hendry, K., and Cragg-Hine, D. (2003). Ecology of the Atlantic salmon. Conserving Natura 2000 Rivers Ecology Series No. 7. English Nature, Peterborough.

Maitland, P.S. (2003). Ecology of the river, brook and sea lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

Maitland, P.S. (2007). Scotland's freshwater fish. Ecology, conservation and folklore. Trafford Publishing, Oxford, UK.

Scottish Fisheries Co-Ordination Centre (2007). Habitat surveys training course manual.

Appendix F: Great crested newt survey methodology

F.1.1 Introduction

The main objectives of this Great Crested Newt (GCN) methodology are to:

- assess habitat suitability and condition;
- confirm presence/absence; and
- estimate population class sizes.

F.1.2 Survey methodology

F.1.2.1 District level licensing

An agreement was reached with Natural England and other stakeholders that the Transmission Assets would be accepted as part of the District Level Licensing (DLL) scheme in Lancashire.

The Transmission Assets Great Crested Newt (GCN) survey area lies within both amber and green zones for DLL as can be seen in Figure 1.3 of Volume 3, Annex 3.8: Great crested newt and reptile survey technical report. Amber zones are those that contain suitable habitat and GCN are likely to be present. Green zones are those that contain moderate habitat suitability and therefore GCN may be present.

The following methodologies were used to provide up-to-date information on presence/absence of GCN within the Onshore Order Limits. This will be used to inform the DLL application and to assist Natural England in estimating the contribution required from the Project to join the DLL scheme.

F.1.2.2 GCN surveys

The following two GCN survey methods are proposed. Where these survey methods would be carried out is discussed in the following section. The methodology is largely based on that provided in the Amphibian and Reptile Group (ARG) UK (2010), Biggs *et al* (2014), and English Nature (2001).

F.1.2.3 Habitat Suitability Index assessment

The suitability of a pond to support GCN has been assessed following the Habitat Suitability Assessment (HSI) assessment methodology described in the UK Amphibian and Reptile Group's Advice Note 5 (ARG UK, 2010). This method is a modified version of the original HSI methodology described in Oldham et al, 2000.The method uses ten indices recorded for each pond to give a score in terms of suitability of the pond for GCN, refer to Table 1.8 below.

The HSI method involves the assessment of ten key habitat parameters, listed in **Table 1.7** below, which are typically associated with ponds used by

GCNs. Each parameter is given a score from 0-1 based on the descriptions and HSI scoring system provided in Advice Note 5 (ARG UK, 2010).

Table 1.7: HSI indices

Suitability index	Topic	Description
SI1	Location	Sites scored according to UK zone in which they occur.
SI2	Pond area	Surface area of the pond when water is at its highest level (excluding flooding events); usually in the spring. For ponds smaller than 50 m^2 a score of 0.05 is used. For ponds larger than 2000 m^2 this factor is omitted. Index score measured from a correlation graph.
SI3	Permanence	Local knowledge and personal judgement. Four category scale: never dries, rarely dries, sometimes dries, dries annually.
SI4	Water quality	Based on invertebrate diversity, presence of submerged plants, knowledge of the water sources. Not to be confused with water clarity. Four point scale: good, moderate, poor, bad.
SI5	Shade	Estimate % pond perimeter shaded, to at least 1 m from shore, excluding emergent vegetation. May – September inclusive. Score taken from correlation graph.
SI6	Waterfowl	Three point scale of impact: absent, minor, major.
SI7	Fish	Local knowledge and site observations. Four point scale: absent, possible, minor, major.
SI8	Pond count	Number of ponds within 1 km. Score taken from correlation graph.
SI9	Terrestrial habitat	Require understanding of newt requirements. Habitat within 250m of a pond, not separated by a significant barrier to newt movement. Four point scale: good, moderate, poor, none.
SI10	Macrophytes	Estimate of % pond surface area covered by macrophytes (including emergent, floating (not duckweed) and submerged plants reaching the surface). May – September inclusive. Score taken from correlation graph.

An overall HSI score is calculated from the scores for each habitat parameter listed in **Table 1.7**, using the following equation:

HSI Score = (SI1 x SI2 x SI3 x SI4 x SI5 x SI6 x SI7 x SI8 x SI9 x SI10)1/10

The overall HSI score is then translated into a classification of habitat suitability, as listed in **Table 1.8** below.

Table 1.8: HSI classification

HSI Score	Suitability for GCN
>0.8	Excellent
0.7 – 0.79	Good
0.6 – 0.69	Average
0.5 – 0.59	Below average
<0.5	Poor

Data for HSI surveys was recorded using the Arc GIS Field Maps application. The results of the HSI surveys were used to target the ponds requiring further surveys.

F.1.2.4 eDNA analysis

An eDNA analysis of water samples collected from the ponds was undertaken following the method set out in the document Analytical and Methodological Development for Improved Surveillance of the Great Crested Newt (Biggs *et al.*, 2014). This method has been developed for standing waterbodies only, due to the potential for eDNA to be washed downstream from a sample location before samples can be collected in flowing waterbodies/watercourses.

Collection of eDNA can be undertaken between 15 April and 30 June. Water samples were collected by GCN licensed ecologists using sampling kits provided by a laboratory approved in the use of this survey method. Samples were not collected in heavy rain to avoid potential risk of contamination. Water samples were collected using sampling kits provided by a laboratory approved in the use of this survey method.

Surveyors collected 30 millilitres (ml) of water samples from 20 locations along the margins of a waterbody, using a sterile ladle. The samples were collected from the bank edge without entering or touching the water to prevent contamination of samples. Where access allows, water samples were collected from points evenly spaced along the banks. When collecting the water samples, the surveyors used a ladle to gently agitate the water and mix the water column before collecting each sample, whilst taking care not to disturb any sediment.

The 20 samples collected from each waterbody were emptied into a sterile plastic bag and homogenised by gently shaking the bag to ensure eDNA is evenly mixed through the sample. A pipette was then used to transfer six 15 ml sub-samples of the water from the bag into sterile tubes containing 35 ml of ethanol to preserve the eDNA samples.

The samples were then stored in a refrigerator before being couriered to the lab for analysis to confirm presence or absence of GCN eDNA.

F.1.2.5 Incidental records

1.3.2.3 Any sightings of non-target species (or evidence of) recorded during surveys were reported in the separate incidental records form on the Arc GIS Field Maps application. These were then included in the relevant annexes to help inform the impact assessment.

F.1.3 References

ARG UK (2010) Great Crested Newt Habitat Suitability Index. Amphibian and Reptile Group UK.

Biggs, J., Ewald, N., Valentini, A., and Gaboriaud, C. (2014) Using eDNA to develop a national citizen science-based monitoring programme for great crested newt. Biological Conservation 183(153).

English Nature (2001) Great Crested Newt Mitigation Guidelines. English Nature, Peterborough.

Odham R.S., Keeble J., Swan M.J.S., and Jeffcote M. (2000). Evaluating the suitability of habitat for the Great Crested Newt (Triturus cristatus). Herpetological Journal 10(4), 143-155.

Appendix G: Hedgerow survey methodology

G.1.1 Introduction

The main objective of the hedgerow survey methodology was to:

- determine whether the hedgerows are of importance as per the Hedgerow Regulations (1997).

G.1.2 Survey methodology

The proposed approach broadly followed the Hedgerows Regulations 1997 and survey methods within the Defra Hedgerow Survey Handbook (Defra, 2007) to determine whether hedgerows are classed as important, and using the methodology detailed in the most up to date Natural England Biodiversity Metric (4.0 at the time of writing) to undertake a condition assessment of hedgerows. The following hedgerow survey methods were undertaken.

G.1.2.1 Qualifications and experience

All surveyors involved in hedgerow surveys will be competent botanists, experienced in undertaking hedgerow surveys. Where surveys were undertaken in suboptimal conditions these were done by a botanist holding at least a Level 4 Field Identification Skills Certificate .

Those who demonstrate level 4 or above should be able to collect the quality of habitat data required and be able to identify the full list of positive indicator species, which includes identifying bryophytes.

G.1.2.2 Hedgerow Regulations survey

All hedgerows in the hedgerow survey area with more than four woody species were scoped in for Hedgerow Regulations surveys.

The survey involved recording the ecological information along at least one 30 m section of each hedgerow. For hedgerows 30 m or less in length the whole hedgerow was surveyed. For hedgerows between 30 m and 100 m in length the central 30 m was surveyed. For hedgerows between 100 m to 200 m the hedgerow was divided in two and each central 30 m section surveyed. For hedgerows over 200 m in length the hedgerow was divided into three sections and the central 30 m of each section surveyed.

The information recorded for each survey, including a brief description of the information is presented in **Table 1.9** below.

Table 1.9: Hedgerow attributes recorded to assess importance

Information recorded	Description
Hedgerow type	The type of hedgerow that could include shrubby hedgerow, shrubby hedgerow with trees, line of trees.
Length	Length of the hedgerow in metres.
Connection with other hedgerows	The number of connections with other hedgerows to determine whether the hedgerow forms part of a hedgerow network.
Extent and location of survey	Details of the wider area that included either the whole hedgerow or the 30 m section(s).
Adjacent land use	Description of the adjacent land use e.g. arable, pasture, woodland, water, etc.
Associated features	Description of associated features including a bank or wall; if the bank or wall was at least half the length of the hedgerow; a ditch; if the ditch was at least half the length of the hedgerow; any gaps of no more than 10% of the length of the hedgerow; any standard tree per 50 m of the length of the hedgerow; whether at least three ground flora woodland species (as defined in Schedule 2 of the Hedgerow Regulations) were located within 1 m of the hedgerow; any connections scoring four or more points, where connection with a hedgerow counts as one, and a connection with broadleaved woodland or a pond counts as two; and any parallel hedge located within 15 m of the hedgerow.
Undisturbed ground and perennial herbaceous vegetation cover	Average width of undisturbed ground. Average width of perennial herbaceous vegetation.
Nutrient enrichment ground flora indicator species	Percentage of hedgerow per 30 m samples recorded with more than 20 % cover of nettle *Urtica sp.*, cleaver *Galium aparine*, or dock *Rumex sp.*
Recently introduced, non-native species	Percentage of hedgerow per 30 m samples with no more than 10% cover of recently introduced, non-native species.
Hedgerow shape	Percentage of total number of hedgerows surveyed in each shape category including trimmed and dense, intensively managed, untrimmed, tall and leggy, untrimmed with outgrowths, recently coppiced, or recently laid.
Dimensions	Average height and width of hedgerow, excluding any bank beneath the hedgerow, gaps, and any hedgerow trees and their height, and estimated at the widest point for the width.
Integrity (i.e. ‘gappiness’)	Percentage of hedgerow with gaps less than 10 % of the hedgerow length, no gap greater than 5 m, and base of leafy growth less than 0.5 m from the ground for a shrubby hedgerow.
Isolated hedgerow trees	Percentage of young trees with a diameter at breast height of 1-5 cm within the total number of trees in the sample, percentage of veteran trees with a diameter at breast height of 1 m or more within total number of trees in the sample, average number of isolated hedgerow trees per 100 m of hedgerow, total number of isolated hedgerow trees along the section of hedgerow being surveyed.
Woody species per 30 m	Number of woody species per 30 m length including structural species, not climbers (other than rose *Rosa sp.*) or bramble.

Information recorded	Description
Details of hedgerow management; ground flora species per 30 m; and veteran tree features	Details of both recent and older hedgerow management. Records of ground flora species and cover. Presence of veteran tree features including dead wood attached to the tree, loose, split, missing and dead bark, bark sap runs, tears, splits, scars, lightning strikes, hollow trunks or hollows in major limbs, or major rot sites.

Hedgerows were recorded and mapped using ArcGIS Fieldmaps.

Hedgerows have been considered to be ecologically 'important' if they are at least 30 years old and meet one of the following criteria.

- The hedgerow contains protected species listed in part 1 of Schedule 1, Schedule 5 or Schedule 8 of the Wildlife and Countryside Act 1981.
- The hedgerow contains species that are endangered, vulnerable and rare and identified in the British Red Data books.
- The hedgerow includes woody species, and associated features as specified in Schedule 1, Part II Criteria, paragraph 7(1) of the Hedgerows Regulations 1997. In summary, in Lancashire the hedgerow must include one or more of the following:
  - at least six woody species;
  - at least five woody species plus at least three associated features (detailed below);
  - at least five woody species including black poplar, large-leaved lime, small-leaved lime or wild service tree; or
  - at least four woody species and at least four associated features.

The aforementioned associated features include:

- a bank or wall for at least half the length;
- a ditch for at least half the length;
- gaps over no more than 10 % of the length;
- at least one standard tree per 50 m;
- at least three ground flora woodland species as defined in Schedule 2 of the Regulations within 1 m of the hedgerow;
- connections scoring four or more points, where connection with a hedgerow counts as one, and a connection with broadleaved woodland or a pond counts as two; or
- a parallel hedge within 15 m.

Neither connections or parallel hedges were counted as associated features if public rights of way are included within the criterion. Surveys were undertaken between April to October when ground flora is more likely to be identifiable, where practicable. When surveys were undertaken in suboptimal conditions these were done by a minimum FISC Level 4 botanist to reduce the risk associated with suboptimal conditions. Where hedgerows with four or

five woody species were identified in suboptimal conditions these were revisited at an optimal time of year.

G.1.2.3 Condition assessment

A condition assessment of any accessible hedgerows within areas of permanent land take was undertaken using the relevant Natural England condition assessment sheets and methodology for the most up to date Biodiversity Metric (4.0 at the time of writing).

G.1.2.4 Incidental records

Any sightings of non-target species (or evidence of) recorded during surveys were reported in the separate incidental records form on the ArcGIS Field Maps application. These were then included in the relevant annexes to help inform the impact assessment.

G.1.3 References

Department for Environment, Food and Rural Affairs (2007) Hedgerow Survey Handbook. A Standard Procedure for local surveys in the UK. Defra, London.

The Hedgerows Regulations (1997) Statutory Instrument 1997 No 1160. Her Majesty's Stationery Office.

Appendix H: Invasive Non-Native Species survey methodology

H.1.1 Introduction

At this stage of the project records of INNS have been obtained via desk study and via incidental records recorded during other surveys, as set out in Volume 3, Annex 3.14: Invasive non-native species survey technical report of the ES.

More detailed surveys of INNS are proposed to be undertaken prior to commencement to provide an up-to-date assessment of distribution of INNS, and to inform production of detailed control programmes for INNS based on the template information on INNS recorded within the Onshore Order Limits set out in the Outline Biosecurity Protocol (Document Reference J1.12).

This Appendix therefore sets out methods of survey proposed for those surveys to be undertaken prior to commencement, and do not comprise methods of surveys undertaken to date.

The main objectives of the INNS surveys will be to confirm presence/absence of INNS and assess distribution.

H.1.2 Survey methodology

H.1.2.1 Qualifications and experience

All personnel conducting detailed INNS surveys will be competent and experienced in the identification of INNS listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended).

H.1.2.2 Walkover survey

For all areas subject to survey, a systematic walkover will be conducted of all parcels scoped in for INNS to record any plants listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended).

The site walkover survey will be undertaken between April to September, ideally within the summer months. Results will be recoded and mapped using the ArcGIS Field Maps application.

H.1.2.3 Incidental records

Any sightings of non-target species (or evidence of) recorded during surveys will be reported in the separate incidental records form on the ArcGIS Field Maps application.

Appendix I: National Vegetation Classification survey methodology

I.1.1 Introduction

The main objectives of these NVC methodologies are to:

- produce a comprehensive classification and description of plant communities; and
- undertake a condition assessment of habitats present.

I.1.2 Survey methodology

The proposed approach broadly followed the guidelines set out in Rodwell (2006).

I.1.2.1 Qualifications and experience

All surveyors involved in NVC surveys are competent botanists experienced in undertaking NVC surveys across the range of habitats likely to be encountered. A minimum of FISC level 4 is required.

I.1.2.2 NVC survey

The NVC survey is a detailed botanical survey technique designed to identify plant communities. The preceding phase 1 habitat surveys are designed to identify habitats only. Habitats that could support notable plant communities, or diverse assemblages of plant species, including rare or scarce species associated with Sites of Special Scientific Interest (SSSI) were scoped in for NVC survey.

The woodland NVC surveys were undertaken in July 2023, with reference to the guidelines set out in National Vegetation Classification: Users' handbook (Rodwell, 2006). All surveys were undertaken by competent botanical surveyors with a level four Field Identification Skills Certificate (FISC) from the Botanical Society of Britain and Ireland (BSBI) at a minimum.

NVC surveys of the sand dunes at landfall were undertaken in 2016 for the Fylde Sand Dunes Project (Skelcher, 2016) and results from those surveys are referred to below. Refer to Skelcher (2016) for methods employed during those surveys.

Ground truthing NVC surveys of the sand dunes at landfall were undertaken in August 2024. These surveys sought to reconcile the data from the Skelcher (2016) report with direct observation in the field, with a focus on the hydrologically sensitive dune slack communities present. The survey followed the guidelines set out in Rodwell (2006), as above. As above, all surveys were undertaken by competent botanical surveyors with a level four FISC from the BSBI at a minimum.

Each habitat or contiguous or connected habitats potentially valuable for its plant communities was assigned a number for the purposes of undertaking

NVC surveys and referred to as a 'site' (e.g. site 1, site 2, site 3). At each site, a walkover was undertaken to select a sample location where vegetation could be recorded. A sample location within each site was chosen based on similar stands of vegetation. The vegetation was then sampled using quadrats distributed in the stand.

For woodland sites, a 50 m x 50 m quadrat was used to record the tree and shrub data. For woodland ground flora, 4 m x 4 m or 10 m x 10 m quadrats were used. Within small woodland blocks, where five 50 m x 50 m samples could not be taken due to the woodland's size (i.e. smaller than 50 m x 50 m), the whole woodland stand was used as the quadrat for canopy and the understorey. Within such areas 4 m x 4 m or 10 m x 10 m quadrats were recorded for the field and ground layers.

Within each quadrat, all species were recorded with an estimate of percentage cover and abundance using the Domin scale, which is a measure of percentage cover per plant species within a survey quadrat (see **Table 1.10** below).

Table 1.10: Domin scale

Percentage of quadrat (%)	Domin Value
91-100	10
76-90	9
51-75	8
34-50	7
26-33	6
11-25	5
4-10	4
<4 (many individuals)	3
<4 (several individuals)	2
<4 (few individuals)	1

A frequency value for each species, depending on the number of quadrats in which it was recorded, was calculated for each group of quadrats in a sample of similar vegetation, as per **Table 1.11** below.

Table 1.11: Frequency class of each species recorded (adapted from Rodwell, 2006)

Frequency value	Percentage of quadrats (%)	Measure of frequency
I	1-20	Scarce
II	21-40	Occasional
III	41-60	Frequent
IV	61-80	Constant

Frequency value	Percentage of quadrats (%)	Measure of frequency
V	81-100	Constant

Data collected from each site was reviewed to ascertain its vegetation type as defined in the five published British Plant Communities volumes (Rodwell, 1991a; 1991b; 1992; 1995; 2000). This was done manually through use of the keys and the floristic tables provided in the British Plant Communities volumes and by visual comparison of the collected data with the published data.

The computer program MAVIS (Modular Analysis of Vegetation Information System) was used to facilitate comparison of data collected from each site with published data and aid the assignment of sites to a plant community. The tabulated results of the NVC surveys were entered into MAVIS. Matching coefficients were computed between the published floristic tables and the NVC survey results. Both the output from MAVIS and the manual assignment of data were compared to ascertain the most appropriate plant community.

Each plant community is defined by an NVC name and code as listed within floristic tables within the British Plant Communities volumes. The code starts with one or two letters corresponding to their vegetation type, followed by a number starting with one and increasing sequentially for each different plant community, for example ‘MG7’, which is the rye grass leys and related grasslands plant community.

Each plant community also has their own sub-communities based on differences in species composition. Where a sub-community has been identified, these are defined by lower case letters. In the case of MG7, this could be MG7a, MG7b through to MG7f.

I.1.2.3 Incidental records

Any sightings of non-target species (or evidence of) recorded during surveys were reported in the separate incidental records form on the ArcGIS Field Maps application.

I.1.3 References

Kirby, K.J., Saunders, G.R. & Whitbread, A.M. 1991. The National Vegetation Classification in nature conservation surveys. British Wildlife, 3, 70–80.

Rodwell, J S (ed.) (1991a). British Plant Communities, Vol. 1: woodlands and scrub. Cambridge University Press, Cambridge.

Rodwell, J S (ed.) (1991b). British Plant Communities, Vol. 2: mires and heaths. Cambridge University Press, Cambridge.

Rodwell, J S (ed.) (1992). British Plant Communities, Vol. 3: grasslands and montane communities. Cambridge University Press, Cambridge.

Rodwell, J S (ed.) (1995). British Plant Communities, Vol. 4: aquatic communities, swamps and tall-herb fens. Cambridge University Press, Cambridge.

Rodwell, J S (ed.) (2000). British Plant Communities, Vol. 5: maritime communities and vegetation of open habitats. Cambridge University Press, Cambridge.

Rodwell, J.S. (2006) National Vegetation Classification: User's handbook. Joint Nature Conservation Committee. Peterborough.

Skelcher, G. (2016). A vegetation survey of the Fylde Sand Dunes and Saltmarshes 2016. Report for the Fylde Sand Dune Steering Group. G Skelcher, Carnforth.

Appendix J: Otter and water vole survey methodologies

J.1.1 Introduction

The main objective of the otter and water vole surveys is to determine presence/likely absence of these species.

J.1.2 Survey methodologies

J.1.2.1 Otter survey

Scoping survey

An initial habitat assessment was undertaken as part of the extended Phase 1 survey (see Volume 3, Annex 3.3: Phase 1 habitat, national vegetation classification and hedgerow survey technical report of the ES) and an understanding of where the greatest impacts would occur (based on the Onshore Order Limits, the Intertidal Infrastructure Area and Onshore Infrastructure Area at the time of the survey), were used to inform the location of otter surveys within the otter survey area.

Waterbodies, watercourses and minor ditches, or their adjacent habitat, identified as unsuitable for otters were scoped out during this process, with no further surveys required.

Otter survey

All scoped in waterbodies, watercourses and minor ditches, including their adjacent habitats, were assessed for their potential to support otter, where access permitted and where it was safe to do so. Any signs of otter activity were recorded.

Otter field signs are described in Bang and Dahlstrøm (2001) and include resting sites (e.g. holts and couches), spraints, prints and feeding remains. Descriptions of these and other field evidence terms are provided in **Table 1.12** below.

Table 1.12: Otter field signs (Bang and Dahlstrøm, 2001)

Field sign	Definition
Holt	These are underground features where otter live. They can be tunnels within bank-sides, underneath root-plates or boulder piles, and even man-made structures such as disused drains. Holts are used by otter to rest up during the day due to the crepuscular nature of their foraging activities and may be used as natal or breeding sites. Otter may use holts permanently or temporarily.
Couches	These are above ground resting sites. Couches can be very difficult to identify, sometimes consisting of no more than an area of flattened grass or earth and are best identified by the presence of other field signs (e.g. spraints).

Field sign	Definition
Hover	Temporary resting place for otter.
Prints	Otter have characteristic footprints that can be found in soft ground and muddy areas.
Spraints	Otter faeces can be used to mark territories, often on in-stream boulders. They can be present within or outside the entrances of holts and couches. Spraints have a characteristic smell and often contain fish remains.
Feeding remains	The remains of prey items may be found at preferred feeding stations. Remains of fish, crabs or skinned amphibians can indicate the presence of otter.
Paths	These are terrestrial routes that otter take when moving between resting-up sites and watercourses, or at high flow conditions when they will travel along bank sides in preference to swimming.
Slides	Slides are typically worn areas on steep slopes where otter slide on their bellies, often found between holts/couches and watercourses.

Any of these field signs are diagnostic of the presence of otter, although spraints are the most reliably identifiable evidence of the species' presence. Otter are active all year so there is no optimal time of year in which to undertake otter surveys. However, otter surveys should be timed to avoid periods of heavy rain or high water (following period of prolonged heavy rain), which might wash away field signs, thus potentially leading to under-recording or failing to confirm the species presence.

For all potential resting site identified during the walkover, entrances were mapped using the application ArcGIS Fieldmaps, (hereafter referred to as 'Fieldmaps'). The level of use of the resting site was classified as 'active, 'partially active', or 'disused'. The survey methodology was based on methods detailed in Chanin (2003) and Crawford (2003).

Where possible, both banks of each surveyed watercourse was surveyed. All evidence of otter and other notable species such as mink was recorded. This as a minimum included the number and location of the field signs, including:

- natal holts, holts and potential holt sites[1];
- couches;
- spraints;
- anal jelly;
- tracks/footprints;
- silt/sand heaps; and
- slides.

[1] Potential holts are defined as a tunnel with internal diameter of at least 250mm and extending 1m into the bank, or where the end is out of sight, or any cavity of similar dimensions e.g. drain pipe, log pile, under structures/bridges etc.

Information and results were recorded on ArcGIS Field Maps, including:

- a waterbody reference;
- signs of water vole/otter/other;
- a count of signs;
- the location; and
- photographs including a site plan showing the location of any of the field signs listed above.

Terrestrial habitat within 150 metres (m) of the watercourse were surveyed for suitable terrestrial habitat to identify potential otter breeding sites. These could include any single area of extensive concealing habitat such as woodland or scrub. These areas were surveyed for signs of breeding activity such as well used paths, play areas, or large accumulations of spraint. Any evidence, along with its location was included in the notes section of the otter and water vole results on ArcGIS Field Maps.

Where access restrictions allowed, a total of four survey visits were conducted at approximately three-monthly intervals (once per quarter).

Surveys were not conducted during or following periods of heavy rainfall, as field signs will have been washed away. In general, where possible survey visits were timed to avoid high water levels.

J.1.2.2 Water vole survey

Scoping

An initial habitat assessment was undertaken as part of the extended Phase 1 survey (see Volume 3, Annex 3.3: Phase 1 habitat, national vegetation classification and hedgerow survey technical report of the ES) and an understanding of where the greatest impacts would occur (based on the Onshore Order Limits, the Intertidal Infrastructure Area and Onshore Infrastructure Area at the time of the survey), were used to inform the location of water vole surveys within the otter survey area.

Waterbodies, watercourses and minor ditches, or their adjacent habitat, identified as unsuitable for water vole were scoped out during this process, with no further surveys required.

Water vole survey

Water vole surveys covered all watercourses within parcels scoped in for this species where access permitted. The proposed approach followed methodologies set out in the Water Vole mitigation handbook (Dean et al., 2016).

The surveys covered the Onshore Order Limits and 50 m upstream and downstream from the affected areas.

Surveys were carried out from within the edge of the embankments in order to allow for a close search for signs of water vole, however some surveys required wading within the watercourse or along the water's edge.

During each survey, the banks of each watercourse/water body (up to a distance of 2 m from the edge of the water) were inspected for field signs and evidence of water vole activity including:

- the presence of latrines, runs, footprints and feeding remains;
- the presence of burrows (both active and inactive);
- individual droppings; and
- sightings and/or sounds (characteristic sound entering the water) of individuals.

Information and results were recorded on ArcGIS Field Maps, including:

- a waterbody reference;
- signs of water vole/otter/other;
- a count of signs;
- a location; and
- photographs including a site plan showing the location of any of the field signs listed above.

The location of any use of habitats by non-target species e.g., bank vole, brown rat etc., was recorded within the notes section on ArcGIS Field Maps.

If any droppings were found that could not be definitively identified in the field, a small sample (considered to represent droppings from a single species) was collected and sealed in a plastic bag marked with the:

- date sample collected (day/month/year);
- survey location (parcel code);
- GPS coordinates;
- suspected species; and
- surveyor name.

The sample would be stored in a cool, dry place until the completion of the survey in that area. DNA analysis would subsequently be conducted if considered appropriate (i.e. on dropping samples where the survey had found no other definitive evidence of the presence of water vole within the respective survey area) in order to help determine presence/absence.

No droppings were found over the course of the surveys.

Two survey visits were conducted over the course of the breeding season, one during the period mid-April to the end of June, and the second during the period between July and September. Survey visits were spaced at least two months apart.

The second visit could be scoped out depending on the results of the first visit, which includes but is not limited to:

- confirmation of presence during the first survey; or
- presence ruled out due to poor habitat quality and/or significant barriers to dispersal.

Surveys were not conducted during or following periods of heavy rainfall, as field signs would have been washed away. In general, where possible survey visits were timed to avoid survey when water levels are high, or when any management works have recently taken place.

In the event of water vole populations being identified, population size would have been calculated based on the standard recognised method for estimating population size (as detailed in Morris *et al.* (1998)).

J.1.2.3 Incidental records

Any sightings of non-target species (or evidence of) recorded during surveys were reported in the separate incidental records form on the ArcGIS Field Maps application.

J.1.3 References

Bang, P and Dahlstrøm, P. (2001). Animal Tracks and Signs. Oxford University Press, Oxford.

Chanin P (2003) Monitoring the Otter Lutra lutra. Conserving Natura.

Crawford, A. (2003) Fourth otter survey of England. Technical Report WI-061/TR. Environment Agency, Bristol.

Dean, M., Strachan, R., Gow, D. & Andrews, R., 2016. The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series). The Mammal Society, London.

Morris, P., Morris, M., MacPhearson, D., Jefferies, D., Strachan, R., and Woodroff, G. (1998) Estimating numbers of water voles Arvicola terrestris: a correction to the published method. Journal of Zoology, 246, 61-62.

Appendix K: Reptile survey methodology

K.1.1 Introduction

The main objectives of the reptile survey methodology are to:

- confirm presence/absence; and
- estimate population sizes.

K.1.2 Survey Methodology

The proposed approach broadly followed the guidelines set out in Froglife (1999) and Gent and Gibson (2003).

K.1.2.1 Qualifications and experience

All surveyors involved in screening and scoping for reptiles are experienced in:

- field identification of all widespread reptile species and field signs (e.g., sloughs, burrows and eggs);
- assessing the potential suitability of on-site habitats for widespread reptile species;
- determining appropriate spatial scope for survey; and
- identifying appropriate survey techniques to achieve a robust survey in a variety of habitat types.

Surveys were not undertaken in the sand dunes where sand lizards are known to be present, and therefore surveyors did not require any Natural England licence to undertake reptile surveys.

K.1.2.2 Reptile survey

In order to inform the baseline and the existing environmental conditions to be reported within the ES, as well as to inform any identified mitigation, extended phase 1 surveys have been carried out for the Transmission Assets. Sites were scoped in for reptile surveys if they provided suitable habitat to support a breeding population of reptiles. This was based on guidance in the Reptile Habitat Management Handbook (Edgar, Foster, and Baker, 2010).

At each site selected for reptile survey, a combination of corrugated iron and roofing felt refugia measuring a minimum of 0.5 metres (m) x 0.5 m was placed in areas identified as suitable habitat. At sites where the habitat assessment has identified potential for grass snake to occur, surveyors deployed an appropriate number (based on extent of suitable habitat) of larger refugia, to increase the likelihood of detecting this species.

High quality habitats that are important for reptiles are usually surveyed at a density of 100 refugia per hectare (ha). However, for presence/absence surveys for common species, the recommended survey density is five to 10

refugia per hectare as per Froglife (1999). This could be further reduced to a density of 2.5 per ha upon inspection by the surveyor, if the majority of the site comprises intensively farmed arable fields and/or close-grazed pasture. As these habitats are unsuitable for reptiles, the actual density of refugia per hectare of suitable reptile habitat substantially would exceed the recommended density, and as such the number of refugia placed would be reduced accordingly.

All refugia were number marked using spray paint and their location recorded using the ArcGIS Field Maps application. Once placed, artificial refugia will be left to settle for seven to ten days prior to conducting the first check.

Each site containing refugia was then checked for reptiles on the required number of occasions (see **section K.1.2.3**). Binoculars were used to check for reptiles between refugia, as well as careful checks by lifting each refugium.

Each site containing refugia was checked for reptiles seven occasions during the optimal survey season (April to May, and September). Where any survey visits were conducted during the sub-optimal months of June and July, additional visits were required if surveys were undertaken during unsuitable conditions until at least seven visits under suitable conditions were conducted.

Each refugia check was conducted during the following conditions.

- Time: conducted between 07:00 and 18:00.
- Air temperature: 9 degrees Celsius (°c) - 20°c.
- Wind: still to moderate (equivalent to Beaufort 4; 13 – 17 miles per hour (mph)).
- Rain: no or light rain only at time of survey. Surveys between periods of heavy rain (when all other conditions are suitable) are also acceptable.

During each check the surveyor recorded details of all reptiles encountered during the survey, including refugia number, species, number, life stage (adult, subadult, juvenile) and when possible, sex.

All records of reptiles were recorded using the ArcGIS Field Maps application which links the results to the location of the reptile refugia.

K.1.2.3 Survey programme and effort

Presence/absence survey

At all locations selected for refugia survey initially, seven visits (during suitable weather conditions) were conducted to determine presence/absence.

Each visit adhered to the weather requirements detailed in **section K.1.2.2** and was conducted during the period April to September.

Where access allowed, surveys were programmed to maximise the number of visits conducted during April, May and September, when weather conditions are likely to be more favourable for survey. However, visits during June, July and August are not precluded assuming they are conducted according to the weather requirements detailed in **section K.1.2.2**.

There were at least 30 days between the first and last survey visits and there was a minimum of two days between each visit.

K.1.2.4 Incidental records

Any sightings of non-target species (or evidence of) recorded during surveys were reported in the separate incidental records form on the ArcGIS Field Maps application.

K.1.3 References

Froglife (1999) Reptile survey; an introduction to planning, conducting and interpreting surveys for snake and lizard conservation. Froglife Advice Sheet 10. Froglife, Halesworth.

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Herpetofauna Groups of Great Britain and Ireland (1998) Evaluating local mitigation/translocation programmes. Maintaining best practice and lawful standards. HGBI, Halesworth.

Appendix L: River habitat survey methodology

L.1.1 Introduction

The main objectives of the river habitat survey was to assess habitat condition of watercourses potentially affected by the scheme.

L.1.2 Survey methodology

The proposed approach broadly followed the guidelines set out in The Modular River Physical (MoRPh) Survey (Modular River Survey, 2022) and the Guide to Assessing River Condition (Gurnell *et al.*, 2022), which include many components of the Environment Agency's River Habitat Survey (2003).

L.1.2.1 Qualifications and experience

All surveyors involved in undertaking the river habitat surveys have experience in:

- undertaking MoRPh surveys;
- identifying invasive non-native plant species;
- determining appropriate spatial scope for survey; and
- identifying appropriate survey techniques to achieve a robust survey in a variety of river habitat types.
- Surveyors had River Condition Assessment (RCA) accreditation.

L.1.2.2 Scoping

Watercourses within 10 m of the Onshore Order Limits were assessed for RCA surveys. Watercourses were scoped in if they were a) designated main rivers, and b) following an approximately natural channel (i.e. not artificial main or side drains or ditches).

L.1.2.3 RCA survey

Assessments were carried out by an experienced surveyor with the RCA accreditation and followed the MoRPh survey guidelines outlined in The MoRPh Survey Technical Reference Manual (Gurnell and Shuker, 2022). The river type was also determined using the Guide to Assessing River Condition (Gurnell *et al.*, 2022).

The MoRPh survey is a river habitat survey that combines information gathered from three river units of different size (module, sub-reach, reach), based upon both primary field- based survey and secondary sources (such as map data and remotely sensed data).

Module (MoRPh) and *sub-reach* (Multi-MoRPh) surveys are conducted in the field using the MoRPh survey method, which focusses on a single river channel and its immediate margins (the banks and land within 10 metres (m) of the river bank).

The reach (river type) survey encompasses the entire length of a river reach (normally less than 500 m to 10 kilometres (km)) and includes the module and sub-reach surveys. The reach survey attempts to assess the geomorphological type of river that is being surveyed.

MoRPh surveys provide a sample of the physical character of the river reach within which they are located. Whilst a single MoRPh characterises the local physical structure of a river, MultiMoRPh surveys aim to record as much of the full range of physical habitats that are supported by the river.

RCA site specific surveys, along with post survey data processing is required to generate the river condition outputs for Natural England's Biodiversity Metric Calculation Tool (Natural England, 2024). The outputs would come under the on-site watercourse baseline in the metric. The methodology for the site-specific survey is set out below.

MoRPh field surveys

During the site-specific survey element of the RCA, surveyors carried out at least five consecutive MoRPh surveys (collectively termed a MoRPh5) along each watercourse scoped in for survey, assessing multiple aspects, including the habitats within 10 m of the channel, the bank face, channel margin, and channel bed. Within these aspects, the surveyor considered factors such as:

- ground cover;
- water surface flow types;
- materials and vegetation present;
- natural and artificial features; and
- bank face profile and reinforcement.

The RCA guidance (Gurnell and Shuker, 2022) requires at least 20% of the watercourse within the survey area to be surveyed, which may result in multiple MoRPh5 surveys.

The number of MoRPh5 surveys required was determined prior to completing the site-specific surveys.

MoRPh surveys recorded what can be seen from the riverbank edge, and recorded the physical features, vegetation structure, and human interventions and pressures on the bank tops and surrounding areas (up to 10 m from the bank edge). This includes measurements of the river channel dimensions.

The module conditions were then recorded on the MoRPh survey sheet. General information was recorded on sheet 1, with the remaining three sheets recording information on the bank tops/floodplain within 10 m of the bank edge, the bank faces and channel edges, and the channel bed.

The assessed characteristics of the watercourse were input into the Cartographer workspace during or after the field survey, and were used to calculate a value and preliminary condition score for the river based on positive and negative indicators.

This is known as MoRPh River Type Pro Surveys of the RCA. This element also determines the properties of the reach of the river that the MoRPh5 surveys lie within and overall, this determined the watercourse type and a condition class/score, from poor to good, for each surveyed section of watercourse.

L.1.3 References

Gurnell, A. and Shuker, L. (eds) (2022) The MoRPh Survey: Technical Reference Manual, 2022 Version. Available at: https://modularriversurvey.org/. Accessed June 2024.

Gurnell, A.M, England, J., Scott, S.J., and Shuker, L.J. (eds) (2022) A GUIDE TO ASSESSING RIVER CONDITION Part of the Rivers and Streams Component of the Biodiversity Net Gain Metric. Available at: https://modularriversurvey.org/. Accessed June 2024.

Modular River Survey (2022) The MoRPh Survey. Technical Reference Manual 2022 Version.

Environment Agency (2003) River Habitat Survey.

Appendix M: Terrestrial invertebrates survey methodology

M.1.1 Introduction

The main objectives of the terrestrial invertebrates survey methodology are to:

- Identify sites with potential for invertebrate communities of interest;
- sample invertebrate species in these locations and identify them; and
- classify the sites' importance in relation to the invertebrate community present.

M.1.2 Survey methodology

Terrestrial survey methods have been amended subsequent to distribution of methods to the EWG based on experience of the habitats present and professional judgment provided by the specialist invertebrate surveyor, to develop an approach to survey which was considered to be proportionate to the likely value of invertebrate assemblages present within the Onshore Order Limits.

The proposed approach broadly followed the guidelines set out in Organising surveys to Determine Site Quality for Invertebrates (English Nature, 2006).

M.1.2.1 Qualifications and experience

All surveyors involved in surveying invertebrates were experienced in:

- field identification of widespread Invertebrate species and life stages (e.g. adults, larvae, eggs and exuviae);
- assessing the potential suitability of on-site habitats for widespread invertebrate species;
- determining appropriate spatial scope for survey; and
- identifying appropriate survey techniques to achieve a robust survey in a variety of habitat types.

Surveys involved widespread invertebrate species, and as such no survey licence was required.

M.1.2.2 Terrestrial invertebrate survey

Scoping survey

In order to inform the baseline and the existing environmental conditions to be reported within the ES, as well as to inform any necessary mitigation, extended phase 1 surveys were carried out for the Transmission Assets. Extended phase 1 habitat surveys undertaken between September 2022 and May 2024 identified 15 sites within the phase 1 habitat survey area with the

potential to support protected or notable terrestrial invertebrates, and these were subject to scoping surveys.

Sites for terrestrial invertebrate surveys were scoped based on the quality of habitat present and whether connected habitats were associated with rare or scarce terrestrial invertebrates or important terrestrial invertebrate assemblages, e.g., woodland, saltmarsh or grazing pasture with scrub. The 15 sites subject to the initial scoping assessment were assigned a number from one to 15.

All sites with potential to support protected or notable terrestrial invertebrates were visited and assessed by an experienced and competent terrestrial invertebrate specialist. The assessment scoped each site in or out for further, detailed terrestrial invertebrate assemblage surveys.

Terrestrial invertebrate scoping surveys comprised a visual assessment of the diversity, extent and quality of the habitats present and professional judgement. For the Transmission Assets, the competent terrestrial invertebrate surveyor complemented the visual assessment with intermittent spot searching and sweep-netting assessments as described below. The additional spot and sweep assessments were not sufficient to constitute a full terrestrial invertebrate survey but were intended to better support the surveyor's assessment of the habitats.

Terrestrial invertebrate assemblage surveys

Site-specific field surveys utilised a variety of search techniques, including sweep-netting, hand searching, spot searching and netting of flying insects. The surveys will utilise timed samples that broadly followed methodologies defined in Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation (Drake *et al*., 2007) and Magurran (2004). Both the Drake *et al*. and Magurran methodologies were adapted to a time standardised sampling method, where each sample was collected in standardised way to ensure better replicability of samples both within and between different sites along the Transmission Assets Order Limits.

Sweep netting with a 40 centimetres (cm) diameter white bag net was the main technique used. The net was used to sweep from side to side as the surveyor paced steadily through the search area. The same net was used to sample the foliage of any shrubs or trees within the area being surveyed.

Specimens were extracted from the net with a pooter. When sampling is completed, or the pooter becomes too full, the contents were killed using ethyl acetate and transferred to 30 millilitres (ml) soda glass tubes together with a data label.

Additional ground searching was undertaken in areas of open, sparsely vegetated areas, by looking under rocks and other debris.

Three surveys are recommended between May to September to record emerging species across seasons.

Identification

Where practical, invertebrates were identified in the field but wherever doubt existed, one or more specimens were collected for more detailed inspection. Where the surveyor was unable to identify any specimens, they were submitted to relevant experts.

It is desirable that as wide a taxonomic range as possible is identified, in order to sample numerous ecological types, i.e., invertebrates with widely differing natural histories.

As there is a limited amount of time available for identification, it was important to name the more readily identified groups which do not require very time-consuming techniques for identification.

Where possible, the following orders and families of invertebrates were named to species.

- ***Isopoda*** – Woodlice;
- ***Araneae*** – Spiders;
- **Raphidiidae** – Snake flies;
- ***Neuroptera*** – Lacewings;
- ***Odonata*** - Dragonflies and Damselflies;
- ***Orthoptera*** – Grasshoppers and Crickets;
- ***Dermaptera*** – Earwigs;
- ***Hemiptera, Auchenorrhyncha*** - Froghoppers, Leafhoppers and Planthoppers (excluding females of difficult genera);
- ***Hemiptera, Heteroptera*** - True bugs (excluding smaller *Miridae*);
- ***Hemiptera, Aphididae*** – Aphids (conspicuous species only);
- ***Lepidoptera*** – Butterflies and Moths;
- ***Coleoptera*** – Beetles (all except small *Aleocharine* rove beetles and other very small obscure families);
- ***Diptera*** - True flies (except, *Cecidomyiidae*, *Chironomidae, Ceratopogonidae, Simulidae, Phoridae*, *Sphaeroceridae*, and females of some groups which are not identifiable);
- ***Hymenoptera, Aculeata –*** Sawflies, Ants, Wasps and Bees; and
- ***Mollusca –*** Slugs and Snails.

Selected specimens were retained as vouchers.

Data analysis

Collected invertebrate samples were time standardised (Drake *et al*., 2007) to allow analysis by Natural England's Pantheon System ('Pantheon') (Heaver *et al*., 2017; Webb *et al*., 2018). Natural England's Pantheon system is designed to analyse invertebrate sample data (Webb *et al*., 2018) and

determine the quality of the invertebrate assemblage in a national context. It assigns scores to each assemblage based on their rarity and site fidelity (i.e., how likely each assemblage is to occur only in one particular habitat or microhabitat).

Species recorded only in a particular habitat (habitat specialists forming part of a Specific Assemblage Type (SAT)) were also assessed as a percentage against the national pool of species that occur in that habitat. SAT are generated by Pantheon using the species composition obtained from field surveys and are coded with letters and numbers (e.g., F112 open short sward).

The Species Quality Index (SQI) is a measure of how many species are associated with a particular habitat. The higher the score the more likely it is that the assemblage is of high quality, as it contains a higher number of rare species associated with the habitat. The SQI is a numerical scoring system contained within Pantheon. Each species recorded from a sample will be assigned a Species Quality Score (SQS) based on their conservation status.

The SQI is the sum of all SQSs divided by the number of species in that sample. This score is multiplied by 100 to give a three figure value without decimal places (e.g. 100 rather than a 1.00). At present, there is no published guidance on the levels of importance related to SQI, however sites with a number of rare or scarce species with high habitat fidelity which are of high conservation importance are likely to score over 150.

For the purposes of habitat monitoring (and for condition assessment of protected sites such as Sites of Special Scientific Interest (SSSIs)), the number of species recorded, which are specific to a SAT, can also be used to assess the condition of the habitat for supporting higher quality assemblages, with degraded sites described as ‘unfavourable’ condition and habitats in good condition supporting high numbers of qualifying species described as ‘favourable’ condition. Several visits are however required in order to fully assess assemblage quality as different species are active during different parts of spring and summer.

Information on the status of each species was obtained from the most recent relevant species status reviews.

M.1.2.3 Incidental records

1.3.2.4 Any sightings of non-target species (or evidence of) recorded during surveys were reported in the separate incidental records form on the ArcGIS Field Maps application.

M.1.3 References

Buglife (2019) *Good Planning Practice for Invertebrates: Surveys*. Buglife, Peterborough.

English Nature (2006) *Organising surveys to determine site quality for invertebrates: A framework guide for ecologists (IN108)*. English Nature, Peterborough.

Heaver, D., Webb, J., Roy, D., Dean, H., Harvey, M., Macadam, C. & Curson, J. (2017). Pantheon: A New Resource for Invertebrate Survey Standards and Analysis. In Practice 98: 25-29.

Magurran, A.E. (2004) *Measuring Biological Diversity*. Blackwell Publishing, Oxford

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Webb, J., Heaver, D., Lott, D., Dean, H.J., van Breda, J., Curson, J., Harvey, M.C., Gurney, M., Roy, D.B., van Breda, A., Drake, M., Alexander, K.N.A. and Foster, G. (2018). Pantheon – database version 3.7.6