Vale of Leven Wind Farm Limited

Vale of Leven Wind Farm

Environmental Impact Assessment Report (Volume 1)

Chapter 6 - Ecology

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CONTENTS

TABLES

6 ECOLOGY

6.1 Introduction

6.1.1 This Chapter of the Environmental Impact Assessment Report ('EIA Report') evaluates the potential effects of the Vale of Leven Wind Farm (the 'Proposed Development') on non-avian ecology, including designated sites, terrestrial and aquatic habitats, and protected species. This ecological assessment was undertaken by MacArthur Green. All staff contributing to this Chapter have professional experience in ecological impact assessment and surveys.

6.1.2 This Chapter includes the following elements:

- Scope and Methodology;
- Consultation Undertaken;
- Statutory and Planning Context;
- Existing Environment;
- Predicted Impacts;
- Mitigation; and
- Summary of Residual Effects.

6.1.3 This Chapter of the EIA Report is supported by the following Technical Appendix documents provided in Volume 3 Technical Appendices:

- Appendix 6.1: National Vegetation Classification (NVC) and Habitats Survey Report;
- Appendix 6.2: Protected Species Survey Report[1];
- Appendix 6.3: Bat Survey Report;
- Appendix 6.4: Fisheries Survey Report;
- Appendix 6.5: Species Protection Plan; and
- Appendix 6.6: Outline Biodiversity Enhancement Management Plan.

6.1.4 This Chapter is supported by the following Figures provided in Volume 2 Figures:

- Figure 6.1: Ecological Designated Sites and Ancient Woodland within 5 km;
- Figure 6.2: Carbon and Peatland Map 2016;
- Figure 6.3: National Vegetation Classification Survey Area and Survey Results;
- Figure 6.4: Potential Groundwater Dependent Terrestrial Ecosystems Survey Area and Survey Results;
- Figure 6.5: Protected Species Survey Area and Survey Results;
- Figure 6.5C: Confidential Protected Species Survey Results;
- Figure 6.6: Bat Survey Area, Anabat Locations & Preliminary Bat Roost Assessment Results;
- Figure 6.7: Overall Risk Assessment 2020 (May – September) – Common pipistrelle;
- Figure 6.8: Overall Risk Assessment 2020 (May – September) – Soprano pipistrelle;

[1] Includes a confidential annex for sensitive protected species information.

- Figure 6.9: Overall Risk Assessment 2020 (May – September) – *Nyctalus* spp.;
- Figure 6.10: Electrofishing Locations & Survey Results; and
- Figure 6.11a and b : Outline Biodiversity Enhancement Management Plan Area.

6.1.5 The Confidential Annex of Appendix 6.2 and Figure 6.5C will not be published with the EIA Report due to the potential risk to protected species. However, they will be issued to the Scottish Ministers and NatureScot.

6.2 Scope and Methodology

Scope of Assessment

6.2.1 This chapter considers the potential effects of construction and operation (including cumulatively) of the Proposed Development upon those ecological features identified during the review of desk-based information and field surveys. Effects, both temporary and permanent, upon the following features are assessed:

- Designated nature conservation sites – effects include direct (i.e., derived from land-take or disturbance to habitats or protected species) and indirect (i.e., habitat fragmentation and modification, including through changes caused by effects to supporting systems such as groundwater or overland flow);
- Terrestrial habitats – effects include direct (i.e., derived from land-take) and indirect (i.e., habitat fragmentation and modification, including through changes caused by effects to supporting systems such as groundwater or overland flow);
- Aquatic habitats – effects are limited to the ecological impacts of changes in water conditions through potential pollution effects (hydrological effects are considered in **Chapter 8: Geology, Hydrogeology, Hydrology and Peat**); and
- Protected species and other notable species – effects considered include direct (i.e., loss of life; loss of key habitat; displacement from key habitat; barrier effects preventing movement to/from key habitats; and general disturbance) and indirect (i.e., loss/changes of/to food resources; population fragmentation; degradation of key habitat e.g., as a result of pollution).

Elements Scoped Out of Assessment

6.2.2 On the basis of the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, generally common and widely distributed habitats or species which do not fall within the following categories were scoped out of the detailed assessment:

- Habitats listed in Annex I to the Habitats Directive, and species listed in Annex II to the Habitats Directive (i.e. European Union Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora);
- Biodiversity Action Plan (UKBAP) or Scottish Biodiversity List (SBL) Priority Habitats; and
- Habitats or species protected by other legislation such as The Wildlife and Countryside Act 1981 (as amended), the Nature Conservation (Scotland) Act 2004 (as amended), or The Protection of Badgers Act 1992.

6.2.3 Further ecological features and potential effects have been scoped out of the detailed assessment based on the results of the desk-based study and survey work undertaken for the Proposed Development, due to a lack of potential significant effect at a relevant species population or habitat extent scale. Details of ecological features and effects

scoped out after further data searches and post-survey are provided in **paragraphs 6.6.3 - 6.6.19**.

Study Area/Survey Area

6.2.4 The area within which the desk-based research and field surveys were undertaken varies depending on the ecological features and its search/survey requirements. Details of the extents are described in the relevant sections in the 'Existing Environment' Section of this Chapter below and associated Technical Appendices and their respective Figures. Hereafter in this Chapter, the areas covered by field surveys are termed the 'survey area' and these same areas which are considered as part of the assessment process are then collectively referred to as the 'study area' (N.B. the study area generally equates to the Application Boundary and comprises the Site and Site Access, except for designated sites where the study area is a 5 km distance band around the Application Boundary (**Figure 8.1**)).

Baseline Survey Methodology

Desk Study

6.2.5 A desk study was undertaken to collate available ecological information in relation to the Proposed Development and surrounding environment. This comprised a search of available online datasets and desk study resources and consultation with other organisations. The following data sources were considered as part of the determination of scope of baseline surveys and assessment:

- National Biodiversity Network (NBN) Atlas Scotland for protected or notable species records within a 5 km buffer from the Application Boundary (i.e., comprising the Site and Site Access as defined in **Chapter 2: Proposed Development**) from the last 15 years (i.e., 2008 and onwards);
- NatureScot Sitelink for designated site information within 5 km of the Application Boundary;
- Scotland's Environment map for the Carbon and Peatland Map 2016 and Ancient Woodland Inventory (AWI) sites within 5 km of the Application Boundary;
- Saving Scotland's Red Squirrels website for local species records and Priority Areas for Red Squirrel Conservation;
- SEPA Water Environment Hub for watercourse classifications;
- Deer Distribution Survey results by the British Deer Society;
- Baseline information published in the course of previous, or other nearby, wind development applications; and
- Relevant scientific literature on protected species' distribution, habitats distribution and conservation status etc.

Field Surveys

6.2.6 The following field surveys were undertaken to further establish the baseline ecological conditions within the Application Boundary (plus appropriate buffers where relevant) to inform the assessment, and were undertaken in line with standard methodologies and best practice guidance (respective survey areas shown in **Figures 6.3** to **6.10**):

- National Vegetation Classification (NVC) surveys, incorporating Phase 1 habitat characterisation (June and July 2020 within the Site and wider survey area as per **Figure 6.3**; July 2022 for the Site Access and associated survey buffer);
- Protected species surveys (July 2020 and January 2021 within the Site and wider survey area; March 2022 for the Site Access and associated survey buffer) focusing on badger (*Meles meles*), red squirrel (*Sciurus vulgaris*), water vole (*Arvicola amphibius*), otter (*Lutra lutra*) and pine marten (*Martes martes*);
- Preliminary bat roost assessments (July 2020 within the Site and wider survey area; March 2022 for the Site Access and associated survey buffer);
- Bat automated activity surveys (May to September 2020);
- Licensed tree climbing and inspection surveys for potential bat roosts in trees identified as having Moderate or High bat roost potential and potentially impacted by the Proposed Development (November 2022);
- Electrofishing surveys (October 2022); and
- Incidental records of other protected species (e.g., reptiles or newt species), or potential hibernacula (for reptiles), notable species, or invasive non-native species (INNS), were also recorded during all field surveys.

6.2.7 The full details of survey methods, species-specific legislation and results are provided within **Appendices 6.1 - 6.4**.

6.2.8 Surveys for beaver (*Castor fiber*), wildcat (*Felis silvestris*) and great crested newt (*Triturus cristatus*) were scoped out due to species being outwith the known species range and/or a lack of suitable habitat.

Methodology for the Assessment of Effects

6.2.9 The significance of the potential effects has been assessed for the Proposed Development considering the spatial and temporal magnitude of the potential impacts and the sensitivity of important ecological features (IEFs).

6.2.10 The assessment method follows the process set out in The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, Chartered Institute of Ecology and Environmental Management (CIEEM) (2018), and guidance on the implementation of the EU Birds and Habitats Directive (SERAD, 2001).

6.2.11 The evaluation for wider countryside interests (i.e., unrelated to any Natura 2000 sites) involves the following process:

- Identification of the potential effects of the Proposed Development on ecological features, including both positive and negative;
- Considering the likelihood of occurrence of potential effects;
- Defining the nature conservation value of the ecological features present;
- Establishing the feature's conservation status;
- Establishing the magnitude of change associated with the potential effect (both spatial and temporal);
- Based on the above information, making a professional judgement as to whether or not the resultant effect is significant in terms of the EIA Regulations;
- If a potential effect is determined to be significant, measures to avoid, reduce, mitigate or compensate for the effect are suggested where required;
- Considering opportunities for enhancement where appropriate; and

- Confirming residual effects after mitigation, compensation or enhancement are considered.

Sensitivity of Ecological Features

6.2.12 The sensitivity of the baseline conditions, including the importance of environmental features on or near to the Proposed Development or the sensitivity of potentially affected receptors, will be assessed in line with best practice guidance, legislation, statutory designations and/or professional judgement.

6.2.13 Determination of the level of sensitivity of an IEF is based on a combination of the feature's nature conservation value and conservation status. Nature conservation value is defined on the basis of the geographic context given in **Table 6.1**, which follows the guidance as detailed within CIEEM (2018).

6.2.14 Determination of the level of importance of ecosystems, habitats and species is based on professional judgement and a combination of factors, such as level of protection, rarity, conservation status, population trends, and quality/extent of the feature onsite. Published evaluation criteria (e.g., the Scottish Biodiversity List (SBL), Joint Nature Conservation Committee (JNCC) on selection of biological Sites of Special Scientific Interest (SSSIs)) are used where relevant. Where appropriate, information regarding the particular ecological feature's conservation status is also considered to fully define its importance. This enables an appreciation of current population or habitat trends to be incorporated into the assessment.

6.2.15 Attributing a value to an ecological feature is generally straightforward in the case of designated sites, as the designations themselves are normally indicative of an importance level. For example, a Special Area of Conservation (SAC) designated under the Habitats Directive is implicitly of European (International) importance. In the case of species, assigning value is less straightforward as contextual information about distribution and abundance is fundamental, including trends which are based on historical records. This means that even though a species may be protected through legislation at a national or international level, the relative value of the population onsite may be quite different (e.g., the site population may consist of a single transitory animal, which within the context of a thriving local/regional/national population of a species, is therefore of local or regional value rather than national or international).

6.2.16 As per CIEEM (2018) guidance, it is not necessary to carry out detailed assessment on ecological features that are sufficiently widespread, unthreatened, and resilient to effects of the Proposed Development. Ecological features affected by the Proposed Development and deemed to be of at least Local importance are termed IEFs and are taken forward for assessment.

Table 6.1: Approach to valuing ecological features (Adapted from Hill *et al.*, 2005)

Value of Feature in Geographical Context	Description
International	An internationally designated site (e.g., SAC).

Value of Feature in Geographical Context	Description
	Site meeting criteria for international designations or qualifying species of an SAC where there is connectivity.
	Species present in internationally important numbers (>1% of biogeographic populations).
National (UK)	A nationally designated site (SSSI, or a National Nature Reserve (NNR)), or sites meeting the criterial for national designation or qualifying species where there is connectivity.
	Species present in nationally important numbers (>1% of UK population)
Regional (Natural Heritage Zone or Local Authority Area)	Species present in regionally important numbers (>1% of Natural Heritage Zone population.
	Areas of habitat falling below criteria for selection as a SSSI (e.g., areas of semi-natural ancient woodland larger than 0.25 hectares (ha)).
Local	Local Nature Reserves (LNR).
	Areas of semi-natural ancient woodland smaller than 0.25 ha.
	Areas of habitat or species considered to appreciably enrich the ecological resource within the local context, e.g., species-rich flushes or hedgerows
Negligible	Usually widespread and common habitats and species that do not meet the above criteria. Features falling below local value are not normally considered in detail in the assessment process.

Magnitude of Change

6.2.17 Magnitude of change refers to the level of change in the extent and integrity of an ecological feature. A suitable definition of ecological 'integrity' is found within Scottish Executive circular 6/1995 updated by Scottish Executive (2000) which states that "*The integrity of a site is the coherence of its ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified*". Although this definition is used specifically regarding European level designated sites (SACs and SPAs), it is applied to wider countryside habitats and species for the purposes of this assessment.

6.2.18 The magnitude of potential change will be identified through consideration of the Proposed Development, the degree of change to baseline conditions predicted as a result of the Proposed Development, how the ecological features are likely to respond to the Proposed Development, the duration and reversibility of an effect and the application of professional judgement, best practice guidance and legislation. This change can occur during construction or operation of the Development, and effects can be positive, neutral or negative.

6.2.19 The magnitude of change is measured in space and time. There are five levels of spatial effects and five levels of temporal effects as described in **Table 6.2** and **Table 6.3**.

Table 6.2: Definition of spatial change magnitude upon the IEFs

Magnitude of Change	Definition
Very High	Would cause the loss of the majority of a feature (>80%) or would be sufficient to damage a feature sufficient to immediately affect its viability.
High	Would have a major effect on the feature or its viability. For example, more than 20% habitat loss or damage.
Moderate	Would have a moderate effect on the feature or its viability. For example, between 10 – 20% habitat loss or damage.
Low	Would have a minor effect upon the feature or its viability. For example, less than 10% habitat loss or damage.
Negligible	Minimal change on a very small scale; effects not dissimilar to those expected within a 'do nothing' scenario.

Table 6.3: Definition of temporal change magnitude upon the IEFs

Magnitude of Change	Description
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as 26+ years), except where there is likely to be substantial improvement after this period in which case the category Long Term may be more appropriate.
Long term	Between 15 years up to (and including) 25 years.
Medium term	Between 5 years up to (but not including) 15 years.
Short term	Up to (but not including) 5 years.
Negligible	No effect.

Significance of Effect

6.2.20 The significance of potential effects is determined through a standard method of assessment based on professional judgement and available evidence, considering the sensitivity (nature conservation value and conservation status) of the IEF and the nature and magnitude of change, in a reasoned way.

6.2.21 A significant effect may either support or undermine biodiversity conservation objectives. Significant effects include those which result from impacts on the structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution) (CIEEM, 2018).

6.2.22 **Table 6.4** details the significance criteria that have been used in assessing the effects of the Proposed Development.

Table 6.4: Significance Criteria

Significance of Effect	Description
Major	The effect is likely to result in a long term adverse effect on the structure and function of defined sites, habitats or ecosystems or on the conservation status of habitat and species.
Moderate	The effect is likely to result in a medium term or partially adverse effect on the structure and function of defined sites, habitats or ecosystems or on the conservation status of habitats and species.
Minor	The effect is likely to adversely affect the feature at a low level by virtue of its limited duration and/or extent, but there will probably be no effect on the structure and function of defined sites, habitats or ecosystems or on the conservation status of habitats and species. The level of effect would be Minor and Not Significant.
Negligible	No material effect. The effect is assessed to be Not Significant.

6.2.23 Using these definitions, it must be decided whether there will be any effects which will be sufficient to adversely affect the IEF to the extent that its conservation status deteriorates above and beyond that which would be expected should baseline conditions remain (i.e., the 'do nothing' scenario).

6.2.24 Effects predicted to be of major or moderate significance are considered to be 'significant' in the context of the EIA Regulations.

6.2.25 Where adverse effects are identified, mitigation and/or compensation is considered to reduce or offset effects where possible including avoidance or reduction through implementation of and compliance with best practice guidance and protected species legislation.

6.2.26 Residual effects are characterised as either adverse, neutral or beneficial and either significant or not significant, taking account of mitigation proposals.

Cumulative Assessment

6.2.27 NatureScot (2021) cumulative assessment guidance is used to inform the cumulative assessment in this Chapter. Cumulative effects require the assessment of effects of the Proposed Development in combination with other developments, projects or activities. In the interests of focusing on the potential for significant effects, this assessment considers the potential for cumulative effects with other onshore wind farm EIA developments. The context in which these effects are considered is heavily dependent on the ecology of the feature assessed. For example, for water voles it may be appropriate to consider effects specific to individual catchments, should the distance between neighbouring catchments be sufficient to assume no movement of animals between them, whereas for blanket bog the region/Natural Heritage Zone (NHZ) may be the relevant spatial scale. Therefore, where it is considered necessary, an assessment of cumulative effects will be made for each feature, appropriate to its ecology.

Limitations and Assumptions

6.2.28 Limitations exist regarding the knowledge base on how some species, and the populations to which they belong, react to impacts. A precautionary approach is taken in these circumstances, and as such it is considered that these limitations do not affect the robustness of this assessment.

6.2.29 Ecological surveys are limited by factors which affect the presence of plants and animals such as the time of year, migration patterns and behaviour. The ecological surveys undertaken for the Proposed Development have not therefore produced a complete list of plants and animals and the absence of evidence of any particular species should not be taken as conclusive proof that the species is not present or that it will not be present in the future.

6.2.30 No notable limitations were experienced with regards to habitats, protected species, bats or fisheries field surveys (see **Appendices 6.1 - 6.4**).

6.2.31 Whilst some limitations have been identified, it is considered that there is sufficient information to enable a robust assessment to be taken in relation to the identification and assessment of potential significant effects on ecological features.

Embedded Mitigation

Iterative Design Process

6.2.32 As part of the iterative design process for the Proposed Development, ecological constraints identified through baseline survey results were considered to avoid or reduce negative effects on ecological features where possible (see **Chapter 3: Environmental Impact Assessment Process**). This involves:

- A minimum 50 m buffer for any infrastructure or construction activity around all watercourses, except where a minimum number of watercourse crossings are required. This will minimise effects on associated habitats and species;
- The track length and alignment has been designed to minimise the extent of new track and number of watercourse crossings required, where feasible considering the topography of the Site;
- Avoidance of deeper peatland (>1 m) and potential high GWDTEs for the location of turbines and other infrastructure as far as practicable;
- A minimum 30 m buffer for any infrastructure or construction activity (100 m for piling and blasting works) around the entrance to any badger sett; and
- A minimum 200 m buffer for any infrastructure or construction activity from any potential otter holt.

Pre-construction & Construction

6.2.33 The assessment in this EIA Report has been carried out on the basis that all works would be carried out in accordance with industry good practice construction measures, guidance and legislation.

6.2.34 A suitably qualified Ecological Clerk of Works (ECoW) will be appointed prior to the commencement of construction to advise the applicant and the Principal Contractor on all ecological matters. The ECoW will be required to be present onsite during the construction phase and will carry out monitoring of works and briefings with regards to

any ecological sensitivities on the Site to the relevant staff of the Principal Contractor and subcontractors.

6.2.35 A Species Protection Plan (SPP) following the principles contained in the draft SPP provided in **Appendix 6.5** will be finalised and then implemented during the construction phase. The SPP details measures to safeguard protected species known or likely to be in the area. The SPP includes pre-construction surveys and good practice measures during construction. Pre-construction surveys will be undertaken to check for any new protected species in the vicinity of the construction works. The results of the pre-construction surveys will be used to update the draft SPP ahead of construction starting. The SPP will remain a live document to be updated as required and in agreement with the ECoW where changes to the distribution and status of protected species and features are recorded.

6.2.36 Any micrositing of infrastructure will be based on a review of existing ecological data and the completion of pre-construction surveys, to take into consideration the potential for direct encroachment onto protected species features, sensitive habitats or GWDTEs, or indirect alteration of hydrological flows supporting sensitive habitats or GWDTEs. Any micrositing will also take consideration of any buffer distances on protected features identified, as detailed within the SPP (**Appendix 6.5**).

6.2.37 There would be a contractual management requirement for the successful Principal Contractor to develop and implement a comprehensive and Site-specific robust Construction Environmental Management Plan (CEMP) in consultation with the SEPA and the planning authority. This document will detail how the successful Principal Contractor would manage the works in accordance with all commitments and mitigation detailed in the EIA Report, the SPP, statutory consents and authorisations, and industry good practice and guidance for environmental management, including implementation of appropriate pollution prevention measures (particularly in relation to watercourses).

Operation

6.2.38 In line with best practice guidance on bats (NatureScot *et al.* 2021), the Proposed Development will utilise the method of reduced rotation speed whilst idling by feathering, at all turbines, to reduce collision risks to bats during the bat active period (April to October). The guidance notes that, "*The reduction in speed resulting from feathering compared with normal idling may reduce fatality rates by up to 50%*". Given the known presence of high collision risk bat species onsite (see **Appendix 6.3** and Existing Environment section beow), this measure will be put in place from the start of the operational period of the Proposed Development. This mitigation measure does not result in any loss of output for the Proposed Development.

6.2.39 Operational phase environmental management plans following relevant best practice and guidance will be in place during operation of the Proposed Development, these will for example include provisions for, but not limited to, ongoing pollution prevenstion control measures.

6.3 Consultation Undertaken

Scoping Responses and Consultations

6.3.1 Consultation for this EIA Report topic was undertaken with the organisations shown in **Table 6.5**.

Table 6.5: Summary of Scoping Responses

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
West Dunbartonshire Council	Scoping Opinion 10 June 2022	The Planning Authority is satisfied that the Scoping Report submitted by the applicant covers the potential issues that should be addressed in the EIA, i.e., potential impact upon Ancient Woodland, Dumbarton Muir SSSI, Auchenreoch Glen SSSI, other designated sites, protected species. The Planning Authority is also satisfied that the methodologies suggested are satisfactory.	Noted.
Scottish Government Energy Consents Unit and Marine Scotland Science (MSS)	Scoping Opinion June 2022	Follow MSS standing advice for onshore wind farms. The Scottish Ministers recommend that the Company discuss and agree Baseline Fish Surveys with the local District Salmon Fishery Board and Fisheries Trust.	MSS guidance has been followed and Loch Lomond Fisheries Trust (LLFT) have undertaken fisheries surveys for the Proposed Development (see **Appendix 6.4**).
NatureScot	Scoping Opinion 26 May 2022	The applicant will need to demonstrate in the EIA Report that any significant effects on the qualities of [deep peat and priority peatland habitat] can be substantially overcome by siting, design or other mitigation.	Contemporary Site-specific habitat surveys (see **Appendix 6.1**) and peat surveys (see **Chapter 8: Geology, Hydrogeology, Hydrology and Peat**) have been undertaken to inform the siting, design and mitigation proposals for the Proposed Development, as presented and assessed within this Chapter and also **Chapter 8: Geology, Hydrogeology, Hydrology and Peat**.
		The Carbon and Peatland Map 2016 is a strategic tool based on historical habitat and peat depth information. It is for the applicant to carry out relevant surveys to provide contemporary, site-specific information on the location of the different peat classes to inform site management.	
		Dumbarton Muir SSSI: The EIA Report should assess any potential for loss of habitat as a result of either construction/decommissioning or	There will be no direct loss of habitat within Dumbarton Muir SSSI as a result of the Proposed Development, and the

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
		operation of the wind farm. The EIA Report should assess potential impacts on blanket bog within the SSSI, and appropriate mitigation measures. Blanket bog is sensitive to hydrological changes in surrounding areas, therefore surface disruption or excavations for the wind farm could have indirect adverse effects on the SSSI by altering the sub-surface hydrology that underpins its scientific interest. Additional changes to the quantity and quality of surface flow downhill into the SSSI, such as sediment runoff during construction, could have direct adverse effects on the blanket bog. We therefore welcome the applicant's proposal to include Dumbarton Muir SSSI in the Ecological Impact Assessment. The EIA Report should assess potential impacts on the SSSI, and appropriate mitigation measures.	Application Boundary maintains a 75 m buffer from the SSSI, with the closest proposed infrastructure being the turning head to T4 located 94 m away (**Figure 6.1**). There are also no predicted indirect ecological effects on the SSSI, see **paragraph 6.6.4** for further discussion. Potential hydrological effects on the SSSI are discussed in **Chapter 8: Geology, Hydrogeology, Hydrology and Peat**.
		Auchenreoch Glen SSSI: Although the current proposed layout of turbines does not include any turbines inside the SSSI boundary, any potential for loss of habitat as a result of either construction/decommissioning or operation of the wind farm must be assessed in the EIA Report, and appropriate mitigation devised.	There will be no direct or indirect loss of habitat within Auchenreoch Glen SSSI as a result of the Proposed Development, and the Application Boundary maintains a 68 m buffer from the SSSI, and the SSSI is 98 m from the nearest proposed infrastructure (**Figure 6.1**); see **paragraph 6.6.3** for further discussion. In addition, measures are proposed as part of the Proposed Development's Outline Biodiversity Enhancement Management Plan (OBEMP) (**Appendix 6.6**) to enhance the habitats within the SSSI through management of bracken which has taken over large areas of the SSSI and reduced the extent of

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
			SSSI qualifying habitats (see **Appendix 6.6** for more detail).
		A draft of the Species Protection Plan (SPP) should be provided as a technical appendix to the EIA Report and should provide details of the survey work carried out, measures proposed to minimise impacts on [otter and badger], a summary of any residual impacts and details of any licensing requirements.	Full details of protected species surveys and the results are provided in **Appendix 6.2** and **Figures 6.5** and **6.5C**. A draft SPP is included as **Appendix 6.5**.
		The Scoping Report outlines the ecology baseline surveys initiated in 2020 and planned for 2022, and we are content that the survey effort described is suitable for describing the baseline and considering potential impacts of development. We are content with the methodology and scope of assessment	Noted.
Fisheries Management Scotland	Scoping Opinion 30 May 2022	The proposed development falls within the catchment relating to the River Leven. It is important that the proposals are conducted in full consultation with the Loch Lomond Fisheries Trust, and I should be grateful if they could be involved in the project proposals.	LLFT have undertaken fisheries surveys for the Proposed Development (see **Appendix 6.4**).
John Muir Trust	Scoping Response, 24 May 2022	Nine of the proposed turbines would be sited on peat (2 turbines on class 1 peatland and 7 on class 2 peatland) and peatland covers about a third of the site. We would welcome a thorough assessment of the peatland impacts of the proposed development with a peatland management plan that includes habitat restoration plans.	The Proposed Development layout has reduced significantly since Scoping (from 19 to 10 turbines). Peat is considered in **Chapter 8: Geology, Hydrogeology, Hydrology and Peat** and peatland habitats are considered within this Chapter. The Proposed Developments OBEMP (**Appendix 6.6**) includes proposals for habitat creation and restoration, including peatland.
Scottish Forestry	Scoping Response,	Whilst we do not anticipate proposals to fell the native woodland, in terms of wider	Very limited woodland removal is anticipated for the Proposed

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
	16 May 2022	mitigation for the development, we'd like to highlight the potential opportunity, which should be assessed, to expand the native woodland components with an aim of connecting fragmented woodland to form crucial habitat linkages.	Development; see **Annex A, Table 6.12**. The Proposed Developments OBEMP (**Appendix 6.6**) includes extensive proposals for native woodland expansion, addresses and compensates for the 0.06 ha of AWI woodland to be felled, and provides for increased connectivity between fragmented woodland areas.

6.4 Statutory and Planning Context

Legislation

6.4.1 The following legislation have been considered in carrying out this assessment:

- European Union Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora ('Habitats Directive');
- European Union Council Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy ('Water Framework Directive');
- Environmental Impact Assessment Directive 85/337/EEC, as amended ('EIA Directive') (as subsequently codified by Directive 2011/92/EU, as amended by Directive 2014/52/EU);
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- The Electricity Act 1989;
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) ('the Habitats Regulations');
- The Water Environment and Water Services (Scotland) Act 2003 (WEWS);
- Nature Conservation (Scotland) Act 2004 (as amended);
- Wildlife and Natural Environment (Scotland) Act 2011 (WANE);
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011;
- Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003;
- Wildlife and Countryside Act 1981 (as amended); and
- Protection of Badgers Act 1992.

Planning Policy

6.4.2 **Chapter 4: Planning Policy** sets out NPF4 and the planning policy framework that is relevant to this EIA Report. The following planning policy of relevance to ecology have been considered in carrying out this assessment:

- Joint Nature Conservation Committee (JNCC) and Department for Environment, Food and Rural Affairs (DEFRA) (2012). UK Post-2010 Biodiversity Framework;
- Scottish Executive (2004). Scottish Biodiversity Strategy: It's in Your Hands;
- Scottish Government (2000). Planning Advice Note (PAN) 60: Planning for Natural Heritage;Scottish Government (2022). Onshore Wind Policy Statement 2022;
- Scottish Biodiversity Strategy to 2045. Tackling the Nature Emergency in Scotland;
- Scottish Government (2023). National Planning Framework (NPF) 4; and
- Proposed West Dunbartonshire Local Development Plan (LDP2) (as modified 2020).

Guidance

6.4.3 The following guidance have been considered in carrying out this assessment:

- Chartered Institute for Ecology and Environmental Management (CIEEM) (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine;
- Collins, J. (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition);
- Dunbartonshire Local Biodiversity Action Plan;
- European Commission, Directorate-General for Environment (2010). Wind Energy Developments and Natura 2000;
- NatureScot (2020). General Pre-application and Scoping Advice for Onshore Wind Farms;
- Joint Nature Conservation Committee (JNCC) (2019). Guidelines for selection of biological Sites of Special Scientific Interest (SSSI);
- Scottish Badgers (2018). Surveying for Badgers: Good Practice Guidelines;
- Scottish Environment Protection Agency (SEPA) (2017). Land Use Planning System Guidance Note 4 – Planning guidance on on-shore windfarm developments;
- SEPA (2017). Land Use Planning System Guidance Note 31 – Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystem;
- Scottish Executive (2000). Nature conservation: implementation in Scotland of EC Directives on the conservation of natural habitats and of wild flora and fauna and the conservation of wild birds ('The Habitats and Birds Directives'). Revised guidance updating Scottish Office Circular No. 6/1995;
- SERAD (Scottish Executive Rural Affairs Department) (2001). European Protected Species, Development Sites and the Planning Systems: Interim guidance for local authorities on licensing arrangements;
- Scottish Government (2016). Draft Peatland and Energy Policy Statement;
- Scottish Government (2017). Planning Advice Note 1/2013 – Environmental Impact Assessment, Revision 1.0;
- Scottish Government (2017). Planning Circular 1/2017: Guidance on The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017;
- Scottish Government, Scottish Natural Heritage (SNH) and SEPA (2017). Peatland Survey – Guidance on Developments on Peatland;
- Scottish Government (2019). The Scottish Forestry Strategy (SFS);
- Scottish Government (2020). EU Exit: The Habitat Regulations in Scotland;

- Scottish Government (2020). Securing a green recovery on a path to net zero: climate change plan 2018–2032 – update;
- Scottish Government (2020). Update to the Climate Change Plan 2018-2032;
- Scottish Government (2021). Freshwater and diadromous fish and fisheries associated with onshore wind farm and transmission line developments: generic scoping guidelines.
- SNH (2015). Scotland's National Peatland Plan;
- SNH (2016). Decommissioning and Restoration Plans for wind farms;
- SNH (2016). Planning for Development: What to consider and include in deer assessments and management at development sites (Version 2);
- SNH (2016). Planning for Development: What to consider and include in Habitat Management Plans. Version 2;
- SNH (2018). Advising on carbon-rich soils, deep peat and priority peatland habitat in development management;
- SNH (2018). Environmental Impact Assessment Handbook – Version 5: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland;
- Scottish Renewables, SNH, SEPA, Forestry Commission (Scotland), Historic Environment Scotland & AEECoW (2019). Good Practice During Windfarm Construction (4th Edition);
- NatureScot (2021). Assessing the cumulative landscape and visual impact of onshore wind energy developments; and
- NatureScot, Natural England, Natural Resources Wales, RenewableUK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter & Bat Conservation Trust (BCT) (2019, with minor updates 2021). Bats and Onshore Wind Turbines – Survey, Assessment and Mitigation.

6.5 Existing Environment

6.5.1 This Section details the results of the desk study and field surveys, providing the ecological baseline for the Application Boundary (i.e., collectively the Site and Site Access), and study area, and includes:

- statutory nature conservation designated sites (excluding those designated solely for ornithological or geological features);
- desk study results;
- habitats and vegetation; and
- protected or notable species.

Desk Study

Designated Sites

6.5.2 There are no statutory designated sites within the Application Boundary. There are two designated sites within 100 m of the Application Boundary that contain ecological qualifying interests; these are Dumbarton Muir SSSI and Auchenreoch Glen SSSI. There are a further five designated sites within 5 km of the Application Boundary. Details of these sites are listed in **Table 6.6**, and shown in **Figure 6.1**.

Table 6.6: Ecological designated sites within 5 km of the Application Boundary

Site Name	Distance to Application Boundary	Qualifying Ecological Features	Last Assessed Condition & Date
Auchenreoch Glen SSSI	0.068 km	Lowland calcareous grassland	Favourable Maintained (19 August 2010)
		Springs (including flushes)	Favourable Maintained (10 August 2013)
Dumbarton Muir SSSI	0.075 km	Lowland calcareous grassland	Favourable Maintained (19 August 2010)
		Springs (including flushes)	Favourable Maintained (10 August 2013)
Lang Craigs SSSI	1.352 km	Tall herb ledge	Favourable Recovered (2 August 2016)
Blairbeich Bog SSSI	2.425 km	Raised bog	Unfavourable No change (17 July 2019)
Inner Clyde SSSI	2.523 km	Saltmarsh	Favourable Maintained (16 June 2011)
Caldarvan Loch SSSI	2.652 km	Eutrophic loch	Favourable Maintained (14 July 2009)
Haw Craig – Glenarbuck SSSI	3.997 km	Rocky slopes (includes inland cliff, rocky outcrops, chasmophytic vegetation)	Favourable Declining (22 August 2017)
		Upland mixed ash woodland	Unfavourable Declining (17 November 2000)

6.5.3 Designated sites situated downstream of watercourses associated with the Proposed Development but outwith 5 km were also considered from a fisheries perspective. The Endrick Water SAC, which has Atlantic salmon (*Salmo salar*), brook lamprey (*Lampetra planeri*) and river lamprey (*Lampetra fluviatilis*) as qualifying features, lies 6.81 km downstream of watercourses associated with the north-east of the Site (i.e., the headwaters of Finland Burn and Gallangad Burn, and minor unnamed first order tributaries of these same watercourses).

Ancient Woodland

6.5.4 567.3 ha of ancient woodland (as listed in the AWI) can be found within 5 km of the Application Boundary, with many of these situated to the south-west and north of the Application Boundary, for example around Murroch Glen, Hazel Glen and along Gallangad Burn (see **Figure 6.1**).

6.5.5 The proposed access route will pass through Barr Wood (**Figure 6.1**) which is listed as 15.12 ha in size, is part of the Vale of Leven (East) Tree Preservation Order (TPO No DCC 2) and recorded on the AWI as Long-Established Woodland of Plantation Origin 2b (LEPO 2b); 0.66 ha of Barr Wood is within the Application Boundary.

6.5.6 The access track for the Proposed Development will impact upon a small area (approximately 0.06 ha) of Barr Wood ancient woodland resulting in the felling of a maximum number of 28 mature/semi-mature beech (*Fagus sylvatica*) hedgerow trees and three mature downy birch (*Betula pubescens*) to facilitate construction of the track,

some of which are already partially windblown and/or suffering from extensive decay (**Appendix 15.1**).

6.5.7 The existing character and condition of the woodland here was recorded during the NVC surveys, see **Appendix 6.1** and in forestry surveys, see **Appendix 15.1**. These survey found that where the proposed Site Access passes through Barr Wood the woodland is generally in poor condition and primarily comprised of two rows of large beech trees (non-native to Scotland and likely historically planted hedgerows) with some other tree species sparsely infilling the ground between the two rows of beech, including Scots pine (outwith it native range at this location). The trees are generally mature, with some of the beech likely to be considered veteran trees (**Appendix 15.1**). The woodland is ageing and declining due to a lack of regeneration, with few younger or immature trees present locally, and no seedling or saplings present due to the heavily grazed field layer; there is also no understorey/scrub layer present. There is unlikely to be natural regeneration here considering current conditions and ongoing grazing.

Habitats

Terrestrial Habitats

6.5.8 The Site falls within a grazed upland area and contains habitats consistent with this. The Site Access falls partially within an upland area, and partially within more intensively managed farmland with improved fields.

6.5.9 The Carbon and Peatland Map 2016 was consulted to determine likely peatland classes present. The map is a predictive tool that provides an indication of the likely presence of peat at a high level. The map has been developed as "*a high-level planning tool to promote consistency and clarity in the preparation of spatial frameworks by planning authorities*"[2]. It identifies areas of "*nationally important carbon-rich soils, deep peat and priority peatland habitat*"[3] as Class 1 and Class 2 peatlands. Class 1 peatlands are also "*likely to be of high conservation value*" and Class 2 "*of potentially high conservation value and restoration potential*".

6.5.10 **Figure 6.2** indicates that, according to this predictive tool and map, there is an area of Class 1 peatland in the north-east of the Site around Lang Dyke (mostly mapped outwith the Application Boundary) and a larger area of Class 2 peatland north and west of Lang Dyke around Blairquhomrie Muir, Merkins Muir and Red Brae. Class 1 and Class 2 peatland areas, according to this map, are largely avoided by the Proposed Development, although there is some overlap with Class 1 peatland at T4 and Class 2 peatland at T2 (**Figure 6.2**). Much of the Site and the majority of the proposed infrastructure locations are on areas categorised as Class 3[4] soils, with large areas of Class 0[5] (mineral) soils in the west on steeply sloping ground.

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[2] https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/soils/carbon-and-peatland-2016-map [Accessed July 2023].

[3] Priority peatland habitat is land covered by peat-forming vegetation or vegetation associated with peat formation.

[4] Class 3 - Dominant vegetation cover is not priority peatland habitat but is associated with wet and acidic type. Occasional peatland habitats can be found. Most soils are carbon-rich soils, with some areas of deep peat. Indicative soil = Predominantly peaty soil with some peat soil. Indicative vegetation = Peatland with some heath.

[5] Class 0 - Mineral soil - Peatland habitats are not typically found on such soils. No peatland vegetation.

6.5.11 As the Carbon and Peatland Map is a high-level tool, detailed habitat and peat depth surveys have been carried out across the Site to inform siting, design and mitigation and the detailed assessment on peatland and associated habitats. The results of the habitat surveys are discussed in **Appendix 6.1**, and the results of the peat depth surveys are presented and discussed in **Chapter 8: Geology, Hydrogeology, Hydrology and Peat** and associated Appendices.

6.5.12 It was noted a large section of the east of the Site is mapped as Class 5[6] soils; however, this would seem to be a misclassification or error in the Carbon and Peatland Map data. The majority of this particular area is categorised as Class 5 soil (i.e., no peatland vegetation) but is also concurrently a large part of the Dumbarton Muir SSSI, which is designated for blanket bog (**Table 6.6**). The results of the NVC survey undertaken for the Proposed Development (**Appendix 6.1**) have also confirmed that this area is generally intact and active blanket bog vegetation on deep peat, and therefore should be considered Class 1 peatland rather than Class 5 as currently indicated. This area has largely been avoided by the Proposed Development with the exception of approximately 300 m of new access track between T7 and T10 (**Figure 6.2**).

Aquatic Habitats

6.5.13 Watercourses within the Application Boundary form tributaries to Murroch Burn to the south, which feeds into the River Leven and the Clyde estuary, and Gallangad Burn to the north, eventually feeding into the Endrick Water. The River Leven was classified by SEPA as part of their Water Framework Directive (WFD) classification, and was assessed in 2014 as having Moderate overall condition and water quality, with Good freedom from invasive species and High access for fish migration. Gallangad Burn and Catter Burn were assessed by SEPA in 2014 as having Poor overall condition and access for fish migration, High freedom from invasive species, and Good water quality. Barriers to fish migration are noted as a pressure on the condition of the Gallangad/Catter Burns.

Protected Species (non-avian)

6.5.14 The NBN Atlas Scotland returned records of the following protected species within 5 km of the Application Boundary in the last 15 years (i.e., since 2008):

- adder (*Vipera berus*);
- common lizard (*Zootoca vivipara*);
- palmate newt (*Lissotriton helveticus*);
- beaver (*Castor fiber*);
- brown hare (*Lepus europaeus*);
- pine marten (*Martes martes*); and
- red squirrel (*Sciurus vulgaris*).
- common pipistrelle (*Pipistrellus pipistrellus*);
- soprano pipistrelle (*Pipistrellus pygmaeus*); and
- Daubenton's bat (*Myotis daubentonii*).

[6] Class 5 - Soil information takes precedence over vegetation data. No peatland habitat recorded. May also include areas of bare soil. Soils are carbon-rich and deep peat. Indicative soil = Peat soil. Indicative vegetation = No peatland vegetation.

6.5.15 An NBN Atlas Scotland extended search out to 10 km for bat species included additional records for:

- brown long-eared bat (*Plecotus auritus*); and
- Natterer's bat (*Myotis nattereri*).

6.5.16 Sightings of red squirrels have been recorded on Saving Scotland's Red Squirrels within 5 km of the Application Boundary in the past 13 years, particularly in Nobleston Wood and in woodland around Balloch.

Fish

6.5.17 The Proposed Development falls within the Loch Lomond catchment, which is in the jurisdictional area of the LLFT. The application documents for the Merkins Wind Farm Environmental Statement (Lomond Energy Ltd., 2011) detail consultation with LLFT which confirmed the presence of brown trout (*Salmo trutta*) and Atlantic salmon in both the Catter and Gallangad Burns, but that migratory salmonids were restricted to the lower reaches of the burns and were not able to access the site due to impassable waterfalls in the Finland Burn and the upper reaches of the Catter Burn. LLFT suggested that only resident brown trout populations are likely to be present above these barriers.

Other Species

Deer

6.5.18 The NBN Atlas Scotland search returned records of roe deer (*Capreolus capreolus*) within 5 km of the Application Boundary in the last 15 years (i.e., since 2008).

6.5.19 The results of the Deer Distribution Survey (British Deer Society, 2016) suggest the presence of roe, red (*Cervus elaphus*) and fallow (*Dama dama*) deer within the general area of the Site and Site Access. These were all recorded in 2007 and/or 2011, and then reconfirmed in 2016.

6.5.20 The Kilpatrick Hills Forest Design Plan 2014-2024 refers to deer within the wider area as comprising resident populations of roe deer across the hills with a smaller red deer population more restricted to the north towards Merkins Muir.

Invasive Non-Native Species (INNS)

6.5.21 The NBN Atlas Scotland search returned records of the following INNS within 5 km of the Application Boundary in the last 15 years (i.e., since 2008):

- American skunk cabbage (*Lysichiton americanus*);
- grey squirrel (*Sciurus carolinensis*);
- Himalayan balsam (*Impatiens glandulifera*); and
- Japanese knotweed (*Fallopia japonica*).

6.5.22 Sightings of grey squirrels have been recorded on Saving Scotland's Red Squirrels within 5 km of the Application Boundary in the past 13 years.

6.5.23 LLFT list Japanese knotweed, giant hogweed (*Heracleum mantegazzianum*), Himalayan balsam, American skunk cabbage and American mink as prominent INNS in the area (LLFT, 2023).

Field Surveys

Habitats

National Vegetation Classification (NVC) and Phase 1

6.5.24 **Appendix 6.1** presents information on the habitat surveys and the detailed descriptions of all habitat types and vegetation recorded in the surveys.

6.5.25 The habitats survey results are shown on **Figure 6.3** which display all data collected during surveys[7]. The survey area for habitats covered an area greatly exceeding the Application Boundary as it was based on a previous design iteration, and also in some areas to provide sufficient survey buffers to account for the possible presence of potential GWDTE[8].

6.5.26 The habitat extents provided and discussed below relate only to those within the Application Boundary as these habitats form the baseline conditions and the basis for the assessment of potential effects and habitat loss, discussed further below.

6.5.27 The NVC data collected across the survey and study area were also cross-referenced to the Phase 1 Habitat Survey Classification (JNCC, 2010) to allow a broader characterisation of habitats. The extent of Phase 1 habitat types within the study area was calculated using the Site-specific correlation of NVC communities to their respective Phase 1 types (see **Appendix 6.1** for full details), and their extents mapped within ArcGIS software, including within mosaic areas.

6.5.28 The NVC communities and non-NVC types recorded within the study area are provided in **Annex A**, **Table 6.12** (located at the end of this Chapter) and include proportions of particular habitat types that are found within the Application Boundary, including those within mosaic habitats. Full descriptions of the habitats, NVC communities and associated flora of the Application Boundary and wider survey area are provided in **Appendix 6.1**.

6.5.29 **Chart 6.1** summarises the Phase 1 habitats which contribute over 1% of the study area and shows that over half of the study area, 53.0%, is comprised of blanket bog (see also **Figure 6.3**). The other more extensive habitat types are marshy grassland (20.4%) and wet heath (8.8%). Wet modified bog, acid/neutral flushes, unimproved acid grassland, improved grassland, and bracken are present at coverage levels of between 1% and 5% of the study area. Details of the NVC communities, and their respective extents, underpinning these Phase 1 habitat types, along with all other communities and habitat types covering less than 1% of the study area is detailed in **Annex A**, **Table 6.12**.

6.5.30 As detailed in **Annex A**, **Table 6.12**, the study area contains a variety of habitat types, and whilst some relatively homogenous stands of vegetation occur, many of the identified

[7] The Phase 1 symbology shading in **Figure 6.3** has been used to broadly characterise stands of vegetation based on the dominant NVC community within a particular area. The Phase 1 characterisation has been utilised to allow a broader visual representation of the habitats within the survey and study area. Polygons or areas where there are mosaic NVC communities have generally been assigned a single Phase 1 classification based on the dominant NVC type (despite some polygons containing multiple Phase 1 types, often in low percentages). Therefore, the Phase 1 characterisation is generally a broader overview, and the NVC data should be referred to for further detail in any specific area.

[8] The habitats survey area covered 1450.4 ha as per **Figure 6.3**, whereas the Site and Site Access encompassed by the Application Boundary covers 330.2 ha; the 330.2 ha within the Application Boundary constitutes the 'study area' within this assessment.

communities form complex mosaics and transitional areas across the study area. The only habitat types that have subsequently been scoped-in to the assessment of effects due to their extent and nature conservation value are blanket bog and wet modified bog. Detailed descriptions of these habitat types are included in **Appendix 6.1**.

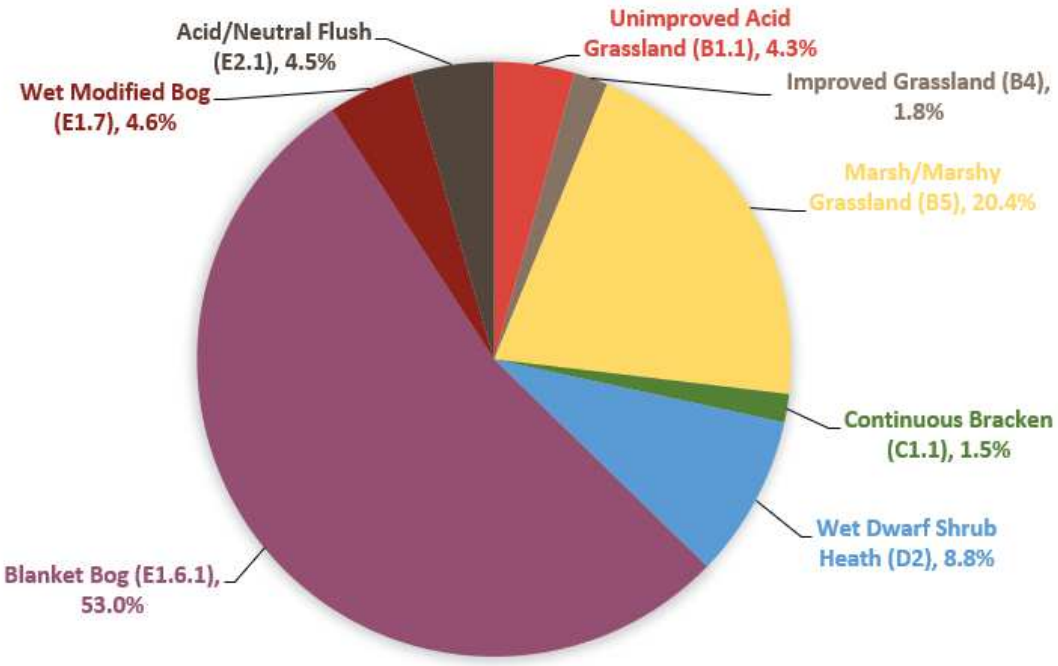

Chart 6.1 Predominant Phase 1 Habitat Types Recorded within the study area (habitat types making up <1% of the study area are not included)

Groundwater Dependent Terrestrial Ecosystems (GWDTE)

6.5.31 The NVC results were referenced against SEPA guidance (SEPA, 2017a and 2017b) to identify those habitats which may be classified, depending on the hydrogeological setting, as being potentially groundwater dependent. Potential GWDTE NVC communities recorded within the survey area are detailed in **Appendix 6.1** and shown on **Figure 6.4**.

6.5.32 Within **Figure 6.4**, the potential GWDTE of each polygon containing a potential GWDTE community was classified on a four-tier approach as follows:

- 'Highly – dominant' where potential high GWDTE(s) dominate the polygon;
- 'Highly – sub-dominant' where potential high GWDTE(s) make up a sub-dominant percentage cover of the polygon;
- 'Moderately – dominant' where potential moderate GWDTE(s) dominate the polygon and no potential high GWDTEs are present; and
- 'Moderately – sub-dominant' where potential moderate GWDTE(s) make up a sub-dominant percentage cover of the polygon and no high GWDTEs are present.

6.5.33 Where a potential high GWDTE exists in a polygon, it outranks any potential moderate GWDTE communities within that same polygon.

6.5.34 GWDTE sensitivity has been assigned solely on the SEPA listings. However, many of the NVC communities on the list are common habitat types across Scotland and generally of

low nature conservation value. Furthermore, depending on several factors such as geology, superficial geology, presence of peat and topography, many of the potential GWDTE communities recorded may in fact be only partially groundwater fed or not dependant on groundwater. Because designation as a potential GWDTE is related to groundwater dependency and not nature conservation value, GWDTE status has not been used as criteria to determine a habitat's nature conservation value and similarly does not factor in the identification of IEFs within ecological impact assessments. There is however a requirement to consider GWDTEs and the data gathered during the NVC surveys has been used to inform this assessment in **Chapter 8: Geology, Hydrogeology, Hydrology and Peat**.

Annex I Habitats

6.5.35 Many NVC communities can also correlate with various Annex I habitat types listed under the Habitats Directive. The fact that an NVC community can be attributed to an Annex I type however does not necessarily mean all instances of that NVC community constitute Annex I habitat. Its status can depend on various factors such as quality, extent, species assemblages, geographical setting, and substrates.

6.5.36 NVC survey data and field observations have been compared to JNCC Annex I habitat listings and descriptions[9]. Those habitats within the Application Boundary which could be considered Annex I habitats are discussed within **Appendix 6.1**.

Scottish Biodiversity List Habitats

6.5.37 The SBL (NatureScot, 2022) is a list of animals, plants and habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland. The SBL identifies habitats which are the highest priority for biodiversity conservation in Scotland; these are termed 'priority habitats'. Some of the priority habitats are quite broad and can be correlated to many NVC types. Relevant SBL priority habitat types and corresponding associated NVC types recorded within the study area are summarised within **Appendix 6.1**.

6.5.38 These SBL priority habitats correspond with UK Biodiversity Action Plan (BAP) Priority Habitats (JNCC 2019b).

Protected Species (non-avian)

6.5.39 This section outlines the results from the protected species surveys. Detailed methodologies, survey timings, and results, including the legal status of each species, are included within **Appendices 6.2 - 6.4** and their associated annexes. Results are presented in **Figures 6.5 - 6.10**, with confidential information presented on **Figure 6.5C**.

Badger

6.5.40 No field signs indicative of badger were recorded within the Application Boundary. However, four setts were identified within the wider survey area to the north-east of the Site, the closest being 359 m from the Application Boundary (see **Figure 6.5C**). Field signs of badger in the wider survey area also included potential feeding signs and paths.

Bats

[9] https://sac.jncc.gov.uk/habitat/

6.5.41 This section provides a summary of the field surveys and associated results for bats. Full details are contained within **Appendix 6.3**.

Automated Activity Surveys

6.5.42 Static bat activity surveys involved the deployment of 13 detectors onsite between May and September 2020 over a total period of 42 days, covering spring, summer and autumn and up to a maximum of 14 consecutive nights per season. This resulted in 496 associated data recording nights (more than the 390 as required by NatureScot *et al*. (2021) guidance for a development of this size; see **Appendix 6.3**). Anabat locations are detailed on **Figure 6.6**.

6.5.43 Bats were detected on all of 42 survey nights, with 3,248 bat registrations in total. A total of four bat species and two genera were recorded during surveys. The total number of passes recorded for each species across all detectors is shown below in **Table 6.7**.

6.5.44 Soprano and common pipistrelles combined accounted for 99.2% (n = 3,222) of registrations across all surveyed locations (**Table 6.7).**

Table 6.7: Total Number of Bat Passes for Each Species Across all Locations 2020

Species/Species Group	No. of Registrations	Percentage of Total (%)[10]
Common pipistrelle	1501	46.2
Soprano pipistrelle	1721	53.0
Nyctalus spp.	10	0.3
Brown long-eared bat	1	0.0
Myotis spp.	8	0.2
Daubenton's	7	0.2
Total	**3248**	**99.9**

Quantifying Activity

6.5.45 The data from the 2020 static bat activity surveys was analysed using the Ecobat tool (Mammal Society, 2017) to gain a measure of relative bat activity at and around the Site. The data was then evaluated in accordance with NatureScot *et al*. (2021) guidance tables to determine overall Site risk level for each species. The guidance explains that: "*The tool compares data entered by the user with bat survey information collected from similar areas at the same time of year […] Ecobat generates a percentile rank for each night of activity and provides a numerical way of interpreting the levels of bat activity recorded at a site across regions in Britain*". Data from the Site were compared with data within a range of 100 km of the Site and within 30 days of the survey date from all years. The full Ecobat Report is provided in **Annex F** of **Appendix 6.3**.

6.5.46 The Ecobat analysis provides a measure of average annual Site activity based on the median (most frequent activity category and representative of the 'typical' bat activity levels in the study area) and maximum (unusually high levels or important peaks of bat

[10] The 'Total' percentage may not be exactly 100% due to the rounding of the percentages per species – output taken directly from Ecobat Report – see Annex F of **Appendix 6.3**.

activity) percentiles[11]. A reference range representing the number of nights for each species that the data was compared to was also generated. In general, a reference range of more than 200 nights is recommended for confidence in the activity level stated by the Ecobat output; this reference range was achieved for all species recorded and as such the activity levels detailed in the following paragraphs can be treated with confidence.

6.5.47 Common pipistrelle was attributed Moderate (median) to High (maximum) activity levels. Soprano pipistrelle was attributed Moderate-High (median) to High (maximum) activity levels.

6.5.48 *Nyctalus* spp. were attributed Moderate activity levels for both the median and maximum percentiles.

6.5.49 Brown long-eared bat, Daubenton's bat and *Myotis* spp. were all attributed Low activity levels for both the median and maximum percentiles.

Assessing Potential Risk

6.5.50 As detailed in **Appendix 6.3**, the Site risk level was determined to be Low/Lowest, based on having a Medium project size and a Low habitat risk.

6.5.51 As per NatureScot *et al*. (2021) guidance, common pipistrelle, soprano pipistrelle and *Nyctalus* spp. were the only bat species recorded which are deemed to have a high collision risk. All other bat species recorded are categorised as low collision risk and of low population vulnerability in line with the same guidance.

6.5.52 The Ecobat activity levels calculated for the high collision risk species and the Site risk level were used to calculate an overall risk assessment score, which is summarised in **Table 6.8**. All high collision risk bat species were calculated to have an overall risk assessment score of Medium (median) to Medium (maximum).

Table 6.8: Risk Assessment Scores Based on Median and Maximum Percentiles for High Collision Risk Species

Species	Risk Assessment Score based on Median Percentile	Risk Assessment Score based on Maximum Percentile
Common pipistrelle	Medium (6)	Medium (10)
Soprano pipistrelle	Medium (8)	Medium (10)
Nyctalus spp.	Medium (6)	Medium (6)

6.5.53 **Figures 6.7** – **6.9** illustrate further the results of the median monthly risk assessment scores for high collision risk bat species recorded at the Site at each survey location, and per month[12], to provide an overview of how bat activity and risk levels vary across the Site through the year and by species. As seen in these figures many locations in many of the survey months recorded no activity by high collision risk bat species (in particular

[11] The percentile rank is attributed to one of the following five bat activity categories as defined within relevant guidance: Low (0-20%), Low-Moderate (20-40%), Moderate (40-60%), Moderate-High (60-80%) and High (80-100%).

[12] Risk assessment scores are displayed per month rather than per season due to the format and nature of the Ecobat outputs. It should be noted that in July, only one night of data was recorded as part of the summer deployment, as this surveyed spanned 18/06/2020 – 01/07/2020.

Nyctalus spp.). However, in locations and months where bat activity was recorded, the Site risk level for common pipistrelle, soprano pipistrelle and *Nyctalus* spp. per month at each location was either 'Low' or 'Medium', with no 'High' risk assessment scores recorded.

6.5.54 As shown in **Figure 6.7**, analysis of the medium risk assessment scores for common pipistrelle, when considering the median percentiles, indicate quite consistent levels of activity across the majority of survey locations throughout the year, with peaks in May and August, and June showing relatively lesser levels of activity compared to the rest of the year.

6.5.55 As shown in **Figure 6.8**, analysis of the medium risk assessment scores for soprano pipistrelle, when considering the median percentiles, indicate an activity pattern very similar to that of common pipistrelle with quite consistent levels of activity across the majority of survey locations throughout the year. Again, there are peaks in May and August for this species, and June appeared to show relatively lesser levels of activity, and in September the south-eastern section of the Site exhibited a much reduced soprano pipistrelle activity.

6.5.56 As shown in **Figure 6.9**, the majority of survey locations recorded no *Nyctalus* spp. activity throughout the year, and there were no *Nyctalus* spp. recorded at all from July to September. Medium risk assessment scores were only recorded twice, these were at Anabat location 1 in May (which is 1,129 m from the Application Boundary) and Anabat location 10 in June. Low risk assessment scores for *Nyctalus* spp. were only recorded at Anabat location 2 in May (403 m from the Application Boundary) and Anabat locations 6 and 7 in June.

6.5.57 A comparison between bat registrations and the known roost emergence times returned a number of instances where the timing of the registration indicated the potential proximity of a bat roost. These registrations were recorded at all surveyed locations, with all registrations attributed to common and soprano pipistrelle, with the exception of two dates at anabat location 1 where a maximum of two *Nyctalus* spp. registrations were recorded and one date at anabat location 10 where two *Nyctalus* spp. registrations within the relevant emergence time ranges were recorded. Registrations indicative of a potential nearby roost were recorded within the maternity season (15 June to 30 July) for common and soprano pipistrelle at all surveyed locations. The *Nyctalus* spp. registrations at anabat location 10 were also within the maternity season.

6.5.58 The highest number of registrations recorded falling within the time period indicative of a potential nearby roost was 54 (soprano pipistrelle, anabat location 4, May 2020). Only four other instances of more than 20 registrations were recorded: a maximum of 28 registrations for soprano pipistrelle in May 2020 at Location 2, 36 registrations of soprano pipistrelle in May 2020 at anabat location 5, 26 registrations for soprano pipistrelle in May 2020 at anabat location 6 and 44 registrations for common pipistrelle in August 2020 at anabat location 7. All these instances fall outwith the maternity season for bat species.

Preliminary Bat Roost Assessment

6.5.59 Forty-three features (all trees) offering potential suitability for roosting bats were recorded in the course of preliminary roost assessment surveys, of which four fall within the Application Boundary (**Figure 6.6**). All potential roost features (PRF) within the

Application Boundary were associated with the Site Access, with two categorised as Moderate suitability and two categorised as Low suitability.

6.5.60 As the Site Access goes through a strip of trees at Barr Wood within which features attributed a classification of Moderate suitability for roosting bats were recorded during preliminary bat roost assessment surveys, further tree inspections were conducted in November 2022. No bats or field signs were found on the four trees climbed by licensed bat surveyors, with the features reclassified after closer inspection to one of negligible and three of low suitability.

Otter

6.5.61 No field signs indicative of otter presence were recorded within the Site or within 200 m of the Site Access. In the wider survey area, features with the potential for use by otter as holts were identified, but no field signs confirming otter presence were found at these features. None of the potential holt features are within 250 m of the Application Boundary (**Figure 6.5C**).

6.5.62 Several of the burns within the wider survey area (outwith the Application Boundary) were found to have good suitability for otter, with trees and gullies providing potential shelter. The flow conditions of Murroch Burn, Gallangad Burn, Catter Burn and tributaries were noted as having good suitability for otter foraging and shelter, with Finland Burn also noted as having good potential shelter and foraging opportunities. As these burns are connected to those watercourses within the Site, there is a possibility that otter could range into the Site, using the watercourses for foraging and commuting purposes. However, even in the areas with good suitability for otter, it should be noted that no definitive field signs were identified.

Pine Marten

6.5.63 No field signs indicative of pine marten were recorded within the survey area. Areas of forestry within the wider survey area were deemed to potentially offer some suitable habitats for pine marten, with the adjacent habitats likely to offer hunting and foraging habitat.

Red Squirrel

6.5.64 No field signs indicative of red squirrel were recorded within the survey area. The wooded riparian zones in Murroch Glen and Gallangad Glen may offer suitable habitat for red squirrel, with forestry at Nobleston Wood and Tombocle Hill in the wider local area also likely to offer some suitability.

Reptiles

6.5.65 Two common lizard sightings were recorded within the survey area; these were both recorded over 1 km north-east of the Application Boundary. Twelve features offering potential for use as hibernacula by reptile species were identified, which were mostly attributed to dry stone wall features and rock piles. Several of the potential hibernacula features fell within the Application Boundary. The Site has habitat offering suitability for reptiles, with heath and tussocky grassland features in addition to the scattered potential hibernacula.

Water Vole

6.5.66 No field signs attributable to water vole were recorded within the survey area. Within the wider survey area most of the smaller watercourses were of low-moderate suitability for this species.

Fish

6.5.67 Electrofishing surveys were undertaken by LLFT in October 2022, with full results detailed in **Appendix 6.4**.

6.5.68 The Murroch Burn was electrofished at seven locations (**Figure 6.10**). Trout were present at all seven sampling locations, with Atlantic salmon also present at the three sampling locations furthest downstream.

6.5.69 Within some surveyed sections of Murroch Burn, the age classes present suggested that spawning has taken place for trout and Atlantic salmon over at least the last two years, with potentially three juvenile year classes present, suggesting the Murroch Burn is an important spawning burn for salmonid fish.

6.5.70 European eel (*Anguilla anguilla*) was a notable bycatch species in five of the seven sampling sites. Brook lamprey, flounder (*Platichthys flesus*) and stickleback (*Gasterosteus acueatus*) were noted in the electrofished site closest to the confluence with the River Leven.

6.5.71 Watercourses with hydrological connectivity to the Site to the north-east were considered as part of the previous Merkins Wind Farm application, with findings included within the Desk Study section of this chapter (see **Paragraph 6.5.17**).

Other Species & INNS

6.5.72 Two mammal holes were recorded across the survey area (**Figure 6.5**), which were of a size that would be suitable for use by protected species, although no field signs of any protected species were recorded. Such features may be used by other mammal species such as red fox (*Vulpes vulpes*) which are likely to be present in the area. One of these records was within the Application Boundary, but 356 m from the nearest proposed infrastructure for the Proposed Development, while the second record was over 1.6 km from the Application Boundary.

6.5.73 Himalayan balsam, an INNS, was recorded once during NVC surveys. This was located on a shaded track edge just off the A813 but outwith the Application Boundary and 90 m from the Site Access (see **Appendix 6.1**). No other instances or signs of INNS were noted in the course of any ecology field surveys.

The Do-Nothing Scenario

6.5.74 In the absence of the Proposed Development, it is likely that the IEFs would generally remain as they are at present, although numbers and distribution of species may fluctuate naturally. Vegetation and habitat composition, structure and extents within the Site may fluctuate marginally in the long-term in line with increasing or decreasing grazing.

6.6 Predicted Impacts

6.6.1 This section provides an assessment of the likely effects of the Proposed Development on the IEFs identified through the baseline studies. The assessment of effects is based

on the project description outlined in **Chapter 2: Proposed Development**, and is structured as follows:

- construction effects;
- operational effects; and
- decommissioning effects.

Ecological Features and Effects on Ecological Features Scoped-out of the Assessment

6.6.2 In addition to those ecological features and effects already scoped-out as detailed within **paragraph 6.2.2**, with consideration of the additional desk study and baseline data collected, and following the iterative design and embedded mitigation measures described above (**paragraphs 6.2.32** to **6.2.38**) and project assumptions below (**paragraph 6.6.21**), several potential effects on IEFs can be scoped-out of further assessment based on the professional judgement of the EIA team and experience from other relevant projects and policy guidance or standards. This includes effects from the construction and operational phases of the Proposed Development, as well as cumulative effects. The following paragraphs detail the ecological features and effects that have been scoped-out following further desk studies and field surveys.

Designated Sites

6.6.3 Auchenreoch Glen SSSI is located 68 m from the Application Boundary, and 98 m from the route of the proposed access track (**Figure 6.1**). Given the distance to the SSSI, the nature of construction works on the Site Access, and with good practice embedded mitigation (as descried above) it is not expected there would be any adverse effects on the qualifying features of this SSSI, i.e., lowland calcareous grassland, and springs (including flushes) and it is scoped out of the assessment. Any potential hydrological effects on the springs (including flushes) qualifying feature are also discussed in **Chapter 8: Geology, Hydrogeology, Hydrology and Peat**. In addition, measures are proposed as part of the Proposed Developments OBEMP to enhance the habitats within Auchenreoch Glen SSSI (see **Appendix 6.6**).

6.6.4 Dumbarton Muir SSSI is designated for its blanket bog and raised bog habitats. The Application Boundary maintains a 75 m buffer from the SSSI, and the closest proposed infrastructure to the SSSI is 94 m away (i.e., the turning head for T4). There will be no direct loss of habitat as a result of the Proposed Development. There are also no predicted indirect ecological effects on the SSSI due to the Proposed Development as it is considered unlikely that there would be any discernible or significant indirect drainage effects from infrastructure on the composition, structure and function of the qualifying bog habitats. In wind farm ecological impact assessments, it is generally assumed that indirect habitat modification or losses to wetland habitats (such as bog) due to drainage effects from new infrastructure may precautionarily extend out to 10 m from infrastructure (maximum 50 m), i.e., in keeping with standard indirect drainage assumptions within carbon calculator guidance (SEPA, 2018). Consequently, given the distance between the Proposed Development infrastructure and the SSSI it is not expected that any indirect drainage effects would materialise. Considering this discussion, and taking in to account good practice embedded mitigation, such as a CEMP and pollution prevention measures, it is not expected there would be any adverse effects on the qualifying features of this

SSSI and it is scoped-out of the assessment. Potential hydrological effects on the SSSI are also discussed in **Chapter 8: Geology, Hydrogeology, Hydrology and Peat**.

6.6.5 With respect to Lang Craigs SSSI, Blairbeich Bog SSSI, Caldarvan Loch SSSI and Haw Craig – Glenarbuck SSSI, given the locations of, and the distances between the Application Boundary and the SSSIs, and the respective qualifying features for these SSSIs (**Table 6.6**) it is considered that there is no connectivity between the Proposed Development and these designated sites and as such they are scoped-out of the assessment.

6.6.6 The Inner Clyde SSSI and Endrick Water SAC are 2.5 km and 6.8 km downstream of the Proposed Development with partial hydrological connectivity. Given the distances from the Site, the respective qualifying features, and with embedded mitigation in place (including a robust CEMP with pollution prevention measures) it is not anticipated that any potential effects would materialise on these designated sites, and as such they are scoped-out of the assessment.

Terrestrial Habitats

6.6.7 As per **paragraph 6.2.2**, habitats that are considered to be of lower conservation value and are very common habitat types locally and regionally are scoped out of the assessment. Within the study area these include:

- dense/continuous scrub;
- unimproved acid grassland;
- unimproved neutral grassland;
- improved grassland;
- continuous bracken;
- tall ruderal vegetation; and
- bare ground.

6.6.8 Marshy grassland is scoped out of the assessment. As per **Annex A**, **Table 6.12**, marshy grassland covers 67.45 ha (20.4% of the study area) and is characterised by several common and widespread communities, overwhelmingly dominated by either rushes (*Juncus* spp., i.e., M23, MG10, Je and Ja) or purple moor-grass (*Molinia caerulea*, i.e., M25 and M25b); with the bulk of the marshy grassland vegetation made up of NVC type M25b and a non-NVC sharp-flowered rush (*Juncus acutiflorus*) acid grassland community (i.e., Ja). These marshy grassland communities recorded in the study area are species-poor and grazed, often consisting of little more than a dense sward of rushes or purple moor-grass with some grasses and common herbs; full descriptions of these communities are provided in **Appendix 6.1**. The range of marshy grassland communities present in the study area are common habitat types locally, regionally and nationally and the small direct and indirect losses predicted as a result of the Proposed Development, as per **Annex A**, **Table 6.12**, are of minor significance. These marshy grassland communities are considered potential GWDTE's in line with guidance (SEPA, 2017a; 2017b). However, designation as a GWDTE does not infer an intrinsic biodiversity value, and GWDTE status has not been used as criteria to determine conservation value in the ecology assessment. There is however a statutory requirement to consider GWDTEs and the data gathered during the NVC surveys has been used to inform this assessment (see **Chapter 8: Geology, Hydrogeology, Hydrology and Peat**).

6.6.9 A number of other habitats recorded within the study area are of local importance, some due to their listing as Annex I habitats or SBL Priority Habitats. However, as they occupy such small areas within the study area, they are species-poor examples, and/or any direct or indirect effects on the habitat will not occur or will be negligible in magnitude (particularly due to embedded mitigation assumptions described above) all effects on them are scoped out of the assessment. These habitats are broadleaved semi-natural woodland, scattered broadleaved tree, wet dwarf shrub heath, dry dwarf shrub heath, acid/neutral flush, swamp and standing water (see also **Annex A**, **Table 6.12**).

Aquatic Habitats and Species

6.6.10 Effects on aquatic habitats including standing water, running water and fisheries interests are scoped-out of the assessment. Migratory salmonids are able to access watercourses with connectivity to the Proposed Development, including Murroch Burn which is adjacent to the Application Boundary; European eel and brook lamprey were also recorded in the course of fisheries surveys along the Murroch Burn (**Appendix 6.4**). The Proposed Development has the potential to impact negatively on water quality and hydrogeomorphology in the absence of mitigation. However, to avoid direct or indirect impacts on these features a minimum 50 m buffer distance between infrastructure and watercourses has been maintained where possible (see **Chapter 2: Proposed Development**), except where a watercourse crossing cannot be avoided (see **Chapter 8: Geology, Hydrogeology, Hydrology and Peat**). The design of permanent and temporary access track watercourse crossings would comply with SEPA good practice guidance to minimise impacts on fish and their habitat. As detailed in **paragraphs 6.2.32** to **6.2.38**, the embedded mitigation includes that construction work would comply with a CEMP developed by the Principal Contractor, which would be monitored by a suitably experienced EcoW. The CEMP would include good practice mitigation for effective silt and pollution prevention and undertaking works in accordance with SEPA best practice guidelines. With this embedded mitigation in place, water pollution impacts and associated likely significant effects associated with the Proposed Development on watercourses, aquatic ecology and fish are considered unlikely and therefore these pollution impacts are scoped-out of further assessment. Further assessments of watercourses are provided in **Chapter 8: Geology, Hydrogeology, Hydrology and Peat**.

Protected Species

6.6.11 Effects on protected species that have been recorded locally or may be present locally such as badger, otter, brown hare, pine marten, great crested newt, water vole, red squirrel and reptiles are scoped out of the assessment due to the absence of protected features, lack of suitable habitat, limited desk-based or field evidence within the Application Boundary and/or lack of potential effects from the Proposed Development.

6.6.12 Bats (roosting) are scoped out of the assessment. Whilst a small number of low to moderate suitability features with the potential to support roosting bats were identified along the Site Access, none are of a size/character that could support maternity roosts or significant hibernation roosts. Additionally, the land passed through is actively worked farmland, and whilst an increase in traffic would be expected in addition to some temporary construction disturbance, it is expected that any bats potentially using roosts in this area would be somewhat habituated to a certain level of disturbance and as such

no significant effects on these are expected. Within the Site, there were no PRFs within 200 m plus rotor radius of any proposed turbine. Analysis of the bat activity data referenced against known emergence times for high collision risk species was used to determine if a bat roost is likely to be close to the survey locations. It was found that although there were registrations indicative of a potential nearby roost at all survey locations, the numbers of bat passes recorded on any single night were low enough to suggest that the Proposed Development is not in the vicinity of any significant roost (**Appendix 6.3**).

6.6.13 Overall, the SPP as described in **paragraph 6.2.35** (draft in **Appendix 6.5**) will ensure that the provisions of the relevant wildlife legislation are complied with in relation to all protected species, should any evidence of presence be found during pre-construction surveys or during the construction period.

6.6.14 Operational and cumulative effects arising from collision mortality for low collision risk bat species are scoped out of the assessment (as per NatureScot *et al.,* 2021). Brown long-eared bat, Daubenton's bat and the *Myotis* spp. genera were the low collision risk species recorded at the Proposed Development.

6.6.15 Effects on all IEFs during operation of the Proposed Development (with the exception of collision risk to high risk bat species) have been scoped out. Maintenance of the Proposed Development will involve vehicular access along the access tracks only, and any maintenance of turbines will be occasional, typically carried out by a small number of maintenance staff inside the turbines during normal working hours. This is unlikely to result in any operational effects on any species or habitats recorded at and around the Proposed Development.

Other Species

6.6.16 Effects on deer are scoped out of the assessment. Roe, red and fallow deer are likely to be present in the local area. There is no commercial forestry present within the Application Boundary. Operational effects are not anticipated as there is no deer fencing around the Proposed Development and therefore deer may use and pass through uninhibited. Due to the open nature of much of the Site, the loss of shelter habitat is not expected. Grazing habitat loss has been minimised through design, and with the extensive amount of similar suitable grazing habitat in the surrounding land and its availability and accessibility, any loss of this habitat is expected to be negligible to the wide-ranging species. The size of the Proposed Development is not considered to pose a significant barrier to any local movements or migrations of deer. Construction effects, due to disturbance, are expected to be minimal due to the timing of works (primarily during the day when deer are least active) and short-term construction period (approximately 21 months as per **paragraph 6.6.21**). If individuals are displaced during construction, there are suitable routes around the Proposed Development which will not force deer into areas of risk, including public roads or towards built up areas; these are present to the south of the Site but separated from the open hill land by fenced farmland. As a result of the size and location of the Proposed Development, temporary construction period, minimal habitat loss and extensive suitable habitat and commuting corridors locally within the Site and beyond, no negative effects on deer are predicted. Due to minimal displacement outwith the Site during construction and operation, no negative effects, through increased

browsing/trampling on surrounding habitats, including the Dumbarton Muir SSSI, are expected.

Cumulative Effects

6.6.17 The purpose of the assessment of cumulative effects is to identify situations where effects on habitats or species populations that may be non-significant from individual developments, are judged to be significant when combined with nearby existing or proposed projects. In the interests of focusing on the potential for similar significant effects, this assessment considers the potential for cumulative effects with other wind farm developments, including those that are operational, under construction, consented or at application stage. Wind farm projects at scoping stage have been scoped out of the cumulative assessment because they generally do not have sufficient information on potential effects to be included, as the baseline survey period is ongoing, or results have not been published. Projects that have been refused or withdrawn are also scoped out.

6.6.18 Small projects with three or fewer turbines have also been excluded from the cumulative assessment as often these projects are not subject to the same level of detail of assessment, and so there are no directly comparable data. Because of the small scale of such projects, effects are likely to be negligible on the IEFs assessed.

6.6.19 No wind farm developments fulfilling the above criteria fall within 10 km of the Proposed Development, and as such cumulative effects on all IEFs are scoped-out of the assessment and not considered further.

Important Ecological Features

6.6.20 A summary of the Nature Conservation Value of the remaining IEFs identified within the Application Boundary and surrounding area (as confirmed through survey results and consultation outlined above) which have been scoped-in to the assessment is provided in **Table 6.9** below, together with the justification for inclusion. These comprise Ancient Woodland, Blanket Bog and Wet Modified Bog, and Bats (operational, high collision risk species common and soprano pipistrelle, and *Nyctalus* spp. only).

Table 6.9: Nature Conservation Value of scoped-in IEFs

IEF	Nature Conservation Value	Relevant Legislation/Guidance & Justification
Ancient Woodland	Regional	One area of ancient woodland falls within the Application Boundary, where the Site Access is proposed to pass through a narrow strip of woodland known as Barr Wood. Barr Wood is categorised in the AWI as class 2b long-established woodlands of plantation origin. The area of ancient woodland that falls within the Application Boundary is 0.66 ha, and it is also directly connected to a larger expanse of ancient woodland in Murroch Glen (**Figure 6.1**). Ancient woodland is is land that is currently wooded and has been continually wooded at least since 1750 and is an irreplaceable resource[13] due to age and ecological

[13] https://www.nature.scot/doc/guide-understanding-scottish-ancient-woodland-inventory-awi

IEF	Nature Conservation Value	Relevant Legislation/Guidance & Justification
		complexity which is associated with a rich biodiversity that cannot be recreated when lost. Policy 6 of NPF 4 (Scottish Government, 2023) provides that development that results in loss of ancient woodlands, ancient and veteran trees, or adverse impact on their ecological condition will not be supported (see also **Chapter 4: Planning Policy**). Similarly, Forestry and Land Scotland (FLS) Policy on Control of Woodland Removal (Forestry Commission Scotland, 2009) asserts a strong presumption against removing ancient semi-natural woodland, or Plantations on ancient woodland sites, amongst other types of woodland. There is approximately 609,990 ha of ancient woodland UK wide[14] of which approximately 352,766 ha is in Scotland. There is 567.3 ha of ancient woodland within 5 km of the Application Boundary. Considering the above, and the area of ancient woodland within the Application Boundary (c.f. **Table 6.1**) and its connectivity to ancient woodland in the wider area a Nature Conservation Value of Regional is considered appropriate.
Blanket Bog and Wet Modified Bog	Local	The Proposed Development would result in direct and indirect habitat loss for blanket bog and wet modified bog habitats. Blanket bog covers 174.95 ha (53.0%) of the study area, whilst wet modified bog covers a further 15.12 ha (4.6%) (**Annex A, Table 6.12**). Both these habitat types are also extensive locally outwith the Application Boundary (e.g., see **Figure 6.3**). The blanket bog communities present, including M17 and M19 with some infrequent M2 and M3 bog pools, tend to represent areas of relatively undamaged, active and better-quality bog with, in the case of M17, frequent to abundant *Sphagna* in the basal layer. Communities representing wet modified bog habitat within the Application Boundary comprise M25a which has a lower relative quality. These habitats are associated with SBL blanket bog habitat with some areas also corresponding to Annex 1 type 7130 blanket bog habitat, including M17, M19, M2 and M3 communities. M25 mire can also fall within the blanket bog Annex I type, usually M25a and where the underlying peat depth is greater than 0.5 m and the habitat is wet and contains peat forming species; however, the M25a in the study area is not considered to be of Annex I quality (see **Appendix 6.1** for further details). The Site also contain some relatively small areas of Class 1 and Class 2 peatland from the SNH Carbon and Peatland Map (**Figure 6.2**); see also discussion in **paragraphs 6.5.9** to **6.5.12.** It is recognised that this definition is not solely for nature conservation and so not directly applicable to evaluating the value of a peatland.

[14] https://www.woodlandtrust.org.uk/trees-woods-and-wildlife/habitats/ancient-woodland/

IEF	Nature Conservation Value	Relevant Legislation/Guidance & Justification
		Despite some of these communities being associated with Annex I and SBL blanket bog classifications, the habitat within the study area is not considered to be Nationally or Regionally important due to its size and distribution. Therefore, assigning a Nature Conservation Value higher than Local is not deemed appropriate. In addition, mire habitat of this quality (and greater) is relatively widespread across the local area as well as within West Dunbartonshire and beyond, which further reduces the relative value of this habitat within the Application Boundary
Bats (high collision risk species: common pipistrelle, soprano pipistrelle, *Nyctalus* spp.)	Local	All UK bat species are listed on Annex II of the Habitats Directive, and fully protected through the Conservation (Natural Habitats &c.) Regulations 1993 (as amended) ('The Habitats Regulations'). Nine species are listed on the SBL, and several species are also listed within the Dunbartonshire BAP (West Dunbartonshire Council, 2010), including *Pipistrellus* spp. a genus for which two high collision risk species were recorded at the Site. Common and soprano pipistrelle are considered to have a favourable conservation status in the UK and Scotland, under Article 17 of the Habitats Directive and are listed as Least Concern (LC) in Scotland under the IUCN Red List criteria (Matthews *et al.* 2018, JNCC 2019c). *Nyctalus* spp. comprise Leisler's bat (*Nyctalus leisleri*) and noctule bat (*Nyctalus noctule*). *Nyctalus* spp. are considered to have a favourable conservation status in the UK (no Scotland specific categorisation), with noctule also listed as LC, and Leisler's as Near Threatened (NT), on the IUCN Red List (Matthews *et al.* 2018, JNCC 2019c). The Proposed Development is outwith the main areas of predicted occurrence and predicted activity for both *Nyctalus* spp., being located on the northern edge of predicted *Nyctalus* spp. occurrence (see Matthews *et al.* 2018). Reliable population estimates for *Nyctalus* spp. in Scotland are currently not available with some currently used population estimates of only a few hundred bats (e.g., Harris *et al*. 1995) outdated and based on expert opinion. Actual populations in Scotland, and their distribution range, are now thought to be much larger than previously reported with populations suggested to be in the region of many thousands (Newson *et al*. 2017). The majority of bat activity (99.2% of overall bat activity, 99.7% high collision risk bat species activity) was attributed to common or soprano pipistrelle bats, which are considered to have a 'common' population relative abundance and are considered of 'medium' potential vulnerability (NatureScot *et al.* 2021). *Nyctalus* spp. are considered to have 'rarest' population relative abundance and are considered of 'high' potential vulnerability (NatureScot *et al.* 2021); only ten *Nyctalus* spp. registrations were recorded during surveys (**Table 6.7**). Considering the above information, including a lack of potential roost sites within the Site, and the vast majority of

IEF	Nature Conservation Value	Relevant Legislation/Guidance & Justification
		species recorded being common and soprano pipistrelles, a Nature Conservation Value of Local is considered suitable for all bat species.

Assumptions of the Assessment

6.6.21 The following assumptions are included in the assessment of otherwise unmitigated effects on IEFs:

- Work on the Proposed Development, including vegetation clearance and construction of new access tracks, turbine hardstandings and other ancillary infrastructure, erection of the turbines and Site restoration is predicted to last for approximately 21 months (comprising civil works (9 months), wind turbine delivery and erection (5 months) and wind turbine commissioning and site reinstatement (18 months)).
- All electrical cabling between turbines and the associated infrastructure would be underground in shallow trenches which would be reinstated post-construction and, in all cases, follow the access tracks.
- The construction compound and any temporary laydown areas will be temporary infrastructure. Any disturbance or earthworks around permanent infrastructure during construction would be temporary and areas reinstated or restored before the construction phase ends. The only excavation in these areas would be for cabling as noted above and otherwise may only be periodically used for side-casting of spoil until reinstatement.
- The embedded pre-construction and construction phase mitigation described in the Embedded Mitigation section above will be fully applied, e.g., the presence of an ECoW, adherence to the agreed SPP and CEMP post-consent.

Construction Impacts

6.6.22 This section provides an assessment of the likely effects of the construction of the Proposed Development upon the scoped-in IEFs.

Predicted Construction Impacts

6.6.23 The most tangible effect during construction of the Proposed Development would be direct habitat loss due to the construction of infrastructure such as new access tracks, turbines, hardstandings, laydown areas, compounds, borrow pits and substation. Much of this infrastructure would be permanent, however the temporary construction compound, temporary crane pad sections and borrow pits would be restored at the end of construction.

6.6.24 In addition, where the Site Access passes through Barr Wood some additional felling would be required to create a safe access corridor of 20 m in width to accommodate for abnormal load vehicles.

6.6.25 There may also be some indirect habitat losses to wetland habitats due to drainage effects. For the purposes of this assessment, it is assumed that wetland habitat losses to wetland habitats due to indirect drainage effects may extend out to 10 m from infrastructure (i.e., in keeping with precautionary indirect drainage assumptions within the

carbon calculator guidance (SEPA, 2018)). It is expected that any indirect drainage effects would only impact wetland habitat such as blanket bog, wet modified bog, wet heath, flushes etc. No indirect drainage effects are expected to impact or alter the quality or composition of non-wetland habitats, such as dry heath, bracken, acid grassland etc., as such only direct habitat loss applies to these habitats.

6.6.26 Temporary habitat losses due to the creation of a temporary infrastructure and up to two borrow pits have been calculated separately. These have been considered separately to permanent infrastructure as although these areas would be restored at the end of the construction period and therefore would not show a loss in habitat extent, the habitat type resulting after restoration may not be the same as the original due to changes in topographical or hydrological conditions. In particular, areas of land take for this temporary infrastructure may represent permanent losses for habitat types such as blanket bog/wet modified bog due to the effects on the structure and function of the habitat type, and the complexities and long timescales involved in restoring or re-creating these particular habitat types.

6.6.27 **Table 6.10** details the estimated relative losses expected to occur for scoped-in habitats, for all new permanent and temporary infrastructure (with habitat loss estimated for all habitat types presented in **Annex A, Table 6.12**).

Table 6.10: Estimated Loss of IEF Habitats in study area for Permanent and Temporary Infrastructure

Habitat Type	Extent in study area (ha)	NVC Community Code or Habitat Type[15]	Direct Habitat Loss (ha)	Direct Habitat Loss as a % of Habitat Type	Direct & Indirect Habitat Loss (ha) in study area	D & I Habitat Loss as a % of Habitat Type in study area
Permanent						
Ancient Woodland	0.66	W11	0.06	9.09	N/A	N/A
Blanket Bog	174.95	M2, M3, M17, M19	5.00	2.86	13.38	7.65
Wet Modified Bog	15.12	M25a	0.47	3.12	0.94	6.22
Temporary						
Blanket Bog	174.95	M2, M3, M17, M19	3.76	2.15	N/A	N/A
Wet Modified Bog	15.12	M25a	0.34	2.25	N/A	N/A

6.6.28 The following Sections assess the effect of these losses for each IEF scoped-in.

[15] Only specific IEF habitats, communities or features subject to habitat losses are presented within this table. Any IEF communities not listed here are not subject to any predicted direct or indirect habitat losses. Full details of habitat losses for all habitat types are presented in **Annex A, Table 6.12**.

Ancient Woodland

6.6.29 **Impact:** Direct loss, disturbance and fragmentation of ancient woodland for permanent track infrastructure, leading to a reduction in the extent of ancient woodland and associated biodiversity.

6.6.30 **Nature Conservation Value:** Regional (as detailed in **Table 6.9**).

6.6.31 **Conservation Status:** Due to their age and associated complex biodiversity, ancient woodland is considered an irreplaceable habitat. Nationally ancient woodland is generally under threat from development and wider impacts such as overgrazing and air pollution, many stands have also historically been felled and replanted with non-native conifers. Overall, the Conservation Status of ancient woodland is likely to be considered unfavourable.

6.6.32 **Magnitude of Effect:** The UK has approximately 609,990 ha of ancient woodland[14], of which approximately 352,766 ha is in Scotland. There is 567.3 ha of ancient woodland within 5 km of the Application Boundary, of which approximately 0.66 ha is within the Application Boundary, primarily at Barr Wood; however this is directly connected to a much larger expanse of ancient woodland in Murroch Glen (**Figure 6.1**). The area of ancient woodland to be felled within the Application Boundary for the Site Access is 0.06 ha.

6.6.33 The ancient woodland within Barr Wood is classified as a long-established woodland of plantation origin. The habitats surveys (see **Appendix 6.1**) noted that the area of ancient woodland to be directly impacted by the Proposed Development is primarily comprised of beech (not native to Scotland) with some Scots pine (outside native range in Scotland) some immature birch and a single oak. Due to grazing, there is no underscrub vegetation or regenerating trees/saplings present. The field flora comprises a typical grazed acid grassland species assemblage.

6.6.34 The Proposed Development would include the direct loss of approximately 0.06 ha of ancient woodland. The narrow 20 m corridor required through this area of woodland is also considered unlikely to lead to any notable potential fragmentation effects or barriers to species dispersal and movements.

6.6.35 When considering the small scale of the loss of ancient woodland habitat and its character and poor and declining condition as described above and in **paragraph 6.5.6** and **Appendix 15.1**, an impact magnitude of low spatial and permanent temporal is deemed appropriate.

6.6.36 **Significance of Effect:** Given the above consideration of Nature Conservation Value, Conservation Status and Magnitude of Effect, the effect significance is considered to be **Minor adverse** and **Not Significant**.

Blanket Bog & Wet Modified Bog

6.6.37 **Impact:** Impacts upon blanket bog and wet modified habitats will be direct (through permanent and temporary habitat loss) and indirect (through potential drying effects upon neighbouring bog habitats) occurring from the construction period into the operational period. Direct loss would occur in areas where permanent infrastructure such as access tracks, turbine foundations, and hardstandings are sited on these habitat types. The excavation of these habitat types for temporary infrastructure would also lead to the

losses of blanket bog and wet modified bog due to the long-term effect on the ecological and hydrological structure and function of these habitat types. In addition, there may be indirect losses as a result of drainage around infrastructure (precautionarily around 10 m from infrastructure is assumed as per SEPA (2018)) and disruption to hydrological flows.

6.6.38 Fragmentation could involve the creation of smaller areas of habitat which in turn could impair the functioning and reduce the resilience of essential hydrological processes. This could make the impacted habitat more vulnerable to future decline in condition and potentially lead to a transition to a different habitat type such as blanket bog to wet modified bog/wet heath or wet modified bog to dry modified bog/wet heath, or more subtle sub-community shifts.

6.6.39 For blanket bog and wet modified bog, fragmentation effects are a function of the extent of the hydrological unit, location of impact within the unit and magnitude of direct and indirect impact in the context of the hydrological unit. **Figure 6.3** shows that blanket bog and wet modified bog habitats exist together and with other wetland habitats (e.g., mires, flushes and marshy grasslands) in large expansive hydrologically connected mosaics across the study area and in the wider local area. The large scale of these wetland habitat mosaics reduces the likelihood that small, fragmented habitat patches would be created. No small-scale habitat fragments appear to be created by the location of tracks and other infrastructure, and where some wetland habitats are subject to infrastructure there are good practice construction methods that will allow the maintenance of sub-surface hydrological connectivity between areas. It is therefore unlikely that the potential effects of fragmentation would lead to further loss of blanket bog and wet modified bog in addition to that predicted to occur as a result of direct loss and precautionary indirect loss figures detailed above.

6.6.40 **Nature Conservation Value:** Local (as detailed in **Table 6.9**).

6.6.41 **Conservation Status:** Conservation Status of this habitat as assessed in the 2019 JNCC report by the UK on blanket bog is 'Unfavourable Bad' and 'Stable' at the UK level (JNCC, 2019d).

6.6.42 **Magnitude of Effect:** The UK has an estimated 2,182,200 ha of blanket bog (JNCC, 2019d) of which around 1,759,000 to 1,800,000 ha is in Scotland (JNCC, 2019e) (approximately 23% of the land area)[16]. Blanket bog is also relatively extensive in the Kilpatrick Hills of West Dunbartonshire (East and West Dunbartonshire Councils, 2010; WDC 2015).

6.6.43 Blanket bog covers 174.95 ha (53.0%) of the study area, with a relatively even split between the M17 and M19 NVC communities which comprise the bulk of the blanket bog vegetation (see **Annex A, Table 6.12**). As per **Table 6.10**, the direct habitat loss for blanket bog is predicted to be 5.00 ha due to permanent infrastructure with up to an additional 3.76 ha due to temporary works areas and borrow pits. This results in a potential total direct loss of 8.76 ha, equivalent to 5.01 % of the blanket bog within the study area.

6.6.44 Wet modified bog covers 15.12 ha (14.58%) of the study area and is all comprised of lower quality M25a. As per **Table 6.10**, the direct habitat loss for wet modified bog is

[16] https://www.nature.scot/landscapes-habitats-and-ecosystems/habitat-types/mountains-heaths-and-bogs/blanket-bog

predicted to be 0.47 ha due to permanent infrastructure with up to an additional 0.34 ha due to the temporary works areas and borrow pits. This results in a potential total direct loss of 0.81 ha, equivalent to 5.36% of the wet modified bog within the study area.

6.6.45 For this blanket mire resource as a whole, i.e., combining blanket bog and wet modified bog, direct losses amount to 5.47 ha for permanent infrastructure and 4.10 ha for temporary works areas and borrow pits: a total of 9.57 ha, or 5.03%, of the combined resource within the study area.

6.6.46 In addition, there may be some indirect losses because of the zone of drainage around infrastructure. The actual distance of the effects of drainage on a peatland is highly variable and depends on various factors such as the type of peatland and its characteristics and properties of the peat; the type, size distribution and frequency of drainage feature; and whether the drainage affects the acrotelm, penetrates the catotelm, or both. Consequently, drainage effects can be restricted to just a few metres around the feature or extend out to tens of metres, or further (e.g., see review within Landry & Rochefort (2012)). The hydraulic conductivity of the peatland is one of the key variables which affect the extent of drainage. In general, less decomposed more fibric peatlands (which tend to be found commonly in fen type habitats) generally have a higher hydraulic conductivity and drainage effects can extend to around 50 m, whilst in more decomposed (less fibrous) peat drainage effects may only extend to around 2 m. Blanket bog habitats commonly are associated with more highly decomposed peats (Nayak *et al*. 2008). For this assessment, indirect effects are precautionarily assumed to extend out to 10 m from infrastructure (as per SEPA, 2018).

6.6.47 As per **Table 6.10**, if indirect drainage effects are fully realised out to 10 m around permanent infrastructure in all blanket bog and wet modified bog areas, then the total predicted potential habitat modification or losses increase for blanket bog to 13.38 ha and 0.94 ha for wet modified bog. This worst-case scenario of direct and indirect habitat loss for permanent and temporary works areas is an overall total of 17.14 ha or 9.80% of the study areas blanket bog and 1.28 ha or 8.47% of the study areas wet modified bog. For this blanket mire resource as a whole, i.e., combining blanket bog and wet modified bog, direct and indirect losses for permanent and temporary works areas overall amount to 18.42 ha, or 9.69% of the combined resource within the study area.

6.6.48 However, it is considered highly unlikely that indirect drainage effects of this scale (i.e., out to 10 m either side of all permanent infrastructure) would occur or would have such an effect on the habitat as to result in any notable effect on the type of bog present or shifts to a lower conservation value habitat type (such as acid grassland for example). For instance, Stewart & Lance (1991) in their study found that a lowering of the water table next to drains was slight and confined to just a few metres either side of the drain, on sloping ground the uphill zone of drawdown was even narrower. Subtle variations in plant species abundance were noted, with species dependent on high water-tables having a lower cover-abundance near to drains, and species with drier heathland affinities having higher cover than at places farther away. However, there were no wholescale changes in vegetation or the species assemblage; for instance, declines in *Sphagna* cover were highly localised and took nearly 20 years to achieve statistical significance. Anecdotal observations from wind farms around Scotland also suggest that bog habitats readily persist around infrastructure and within this 10 m zone of possible influence.

6.6.49 It should also be noted that the predicted indirect losses due to drainage are calculated in GIS and based on the habitat survey mapping, there may be small-scale local specific factors such as those relating to natural breaks in hydrology, geology or topography, or the presence of non-wetland habitats that act as a barrier or buffer, that would prevent the full predicted indirect drainage effects from materialising.

6.6.50 Overall, evidence suggests that if some drainage effects materialise locally around infrastructure due to the Proposed Development the most likely effect will not be a major change in overall bog habitat type but rather a potential change in vegetation micro-topography, certain species cover, or abundance that may result in a subtle NVC community or sub-community shift, and which may only be apparent in the long term. If severe indirect drying effects are observed long term, then wet modified bog/blanket bog may transition to wet heath (e.g., NVC type M15), dry modified bog, or dry heath. Wet and dry heaths are still habitats of conservation interest, being Annex I, UKBAP and SBL Priority Habitats also.

6.6.51 When considering the scale of the above habitat losses (i.e., direct and precautionary indirect effects on up to 9.69% of the combined blanket bog and wet modified bog within the study area and accounting for the relative abundance, distribution and quality of the blanket bog and wet modified bog within the study area and connected immediately adjacent to the Proposed Development, an effect magnitude of low spatial (c.f. **Table 6.2**) and long-term temporal is appropriate.

6.6.52 **Significance of Effect:** Given the above consideration of Nature Conservation Value, Conservation Status and Magnitude of Effect, the effect significance is considered to be **Minor adverse** and **Not Significant**.

Operational Effects

6.6.53 This section provides an assessment of the likely effects of the operation of the Proposed Development upon the scoped-in IEFs.

Predicted Operational Effects

Habitats

6.6.54 All likely direct and indirect effects on habitats have been considered in the Construction Impacts section above.

6.6.55 Although the majority of habitat loss is associated with infrastructure required for the operation of the Proposed Development (rather than temporary construction infrastructure), the physical loss of habitat would occur during the construction stage and is therefore considered above.

6.6.56 Indirect effects on wetland habitats would largely occur during the operational phase as potential drying effects become established. However, for ease and clarity of assessing effects on habitats these are considered together in Construction Impacts.

Bats

6.6.57 **Effect:** During the operational phase, there is potential collision risk for commuting and foraging bat species in addition to the risk that bats may be affected by barotrauma[17] when flying in close proximity to moving turbine blades. For the purposes of this assessment, the potential effects from barotrauma are assumed to be the same as for collision risk. This is due to the lack of published empirical evidence in causes of bat fatalities around wind farms and the difficulties in determining whether bat fatalities are due to strikes (collisions) with the turbine blades or barotrauma.

6.6.58 Research undertaken by Exeter University on behalf of DEFRA (DEFRA, 2016) found that most bat fatalities at UK wind farms have been common pipistrelle, soprano pipistrelle and noctule bats. Further work (Richardson *et al.* 2021) found that common pipistrelle activity was higher at turbine locations than at control locations in similar habitat, suggesting that this species may be at particular risk. In the same study soprano pipistrelle activity was comparable between sites with no attraction or repulsion by turbines. It is suggested the observed higher levels of activity could be because there are more individual bats around turbines, or because bats spend more time in these locations relative to controls, even if the number of individual bats remains the same; however, it is not possible to distinguish between these possibilities using acoustic bat data (Richardson *et al.* 2021).

6.6.59 Because the proposed turbines would have a blade tip height of 250 m, some or all of them will require red aviation warning lights. A five-year study by Spoelstra *et al.* (2017) concluded that foraging bats are not attracted to red lighting. This is attributable to the fact that white and green spectrum lights attract insects whereas red lights do not. Based on this, Spoelstra *et al.* (2017) advised "*Hence, in order to limit the negative impact of light at night on bats, white and green light should be avoided in or close to natural habitat, but red lights may be used if illumination is needed*". A study by Voight *et al.* (2018) found evidence of attraction of migratory soprano pipistrelle to red lighting. However, soprano pipistrelles do not migrate in the UK as they do in continental Europe, so this finding is not relevant to the Proposed Development. With regard to *Nyctalus* spp., the results were inconclusive due to the difficulty in distinguishing between species, although there was some suggestion of attraction to red light. The explanation for the contrasting findings between these studies is given by Spoelstra *et al.* (2017) as "*migratory bats may be more susceptible to light sources of specific wavelength spectra because vision may play a more dominant role than echolocation during migration. Non-migratory bats might use orientation cues that are more involved during general hunting behaviour, for example, echoes reflected from local landmarks, instead of cues from natural or artificial light sources*".

6.6.60 Bats may also be displaced from their foraging grounds through avoidance of operational wind turbines (Scholz and Voigt, 2022). Barré *et al.* (2018) recorded a marked reduction in bat activity around operational wind turbines.

6.6.61 **Nature Conservation Value:** Local (as detailed in **Table 6.9**).

[17] Barotrauma describes injuries that occur when a bat (or other animal) encounters sudden and extreme changes in atmospheric pressure. The rapid pressure fluctuations can rupture air-containing structures in the bodies of mammals which causes internal bleeding and, potentially, death.

6.6.62 **Conservation Status:** Common pipistrelle are assessed in the 2019 JNCC report as 'Favourable' and 'Improving' at the UK level (JNCC, 2019f); soprano pipistrelle, noctule bat and Leisler's bat are assessed as 'Favourable' and 'Stable' at the UK level (JNCC 2019g, 2019h, 2019i). Mathews *et al.* (2018) also consider all bat species recorded at the Proposed Development to have a 'Favourable' conservation status.

6.6.63 Further details on the Conservation Status of the high collision risk bat species recorded within the Site are provided below. Information on both noctule and Leisler's bats are presented as registrations for both species were present (**Appendix 6.3**), however given the very low total number of registrations recorded for these species (n = 10) these bats are assessed at the genus level (i.e., *Nyctalus* spp.).

6.6.64 Both common and soprano pipistrelle are widespread in central Scotland. The low population estimates for *Nyctalus* spp. in Scotland are outdated and likely underestimated due to under-recording (Mathews *et al.* 2018). The survey data indicates that both noctule and Leisler's bats may be present at the Site; studies by Newson *et al* (2017) have shown a general east-west geographical divide between the species distribution in southern Scotland; however, the Proposed Development is located just north of and outwith their research area. The Proposed Development is also on the northern edge of *Nyctalus* spp. distribution range (Mathews *et al.* 2018).

6.6.65 Population estimates of common pipistrelle in 2013 were 1,390,000 in the UK and 352,000 in Scotland (JNCC 2013). More recently, the 2019 Article 17 of the UK Habitats Directive Reports estimates the population range to be from 1,100,600 to 7,843,000 in the UK (JNCC, 2019f) and from 285,000 to 2,160,000 in Scotland (JNCC, 2019j), although best single value estimates are not provided due to the uncertainty around population estimates. Matthews *et al*. (2018) provided a UK estimate of 3,040,000 for common pipistrelle (with a plausible range of 991,000 – 7,510,000); population estimates for Scotland were not provided in that review.

6.6.66 Population estimates of soprano pipistrelle in 2013 were 774,000 in the UK and 198,000 in Scotland (JNCC, 2013). The 2019 Article 17 of the UK Habitats Directive Reports estimates the population range to be from 2,024,000 to 8,563,000 in the UK (JNCC 2019g) and from 512,000 to 2,180,000 in Scotland (JNCC, 2019k), although best single value estimates are not provided due to the uncertainty around population estimates. Matthews *et al*. (2018) provided a UK estimate of 4,670,000 for soprano pipistrelle (with a plausible range of 970,000 –8,400,000); population estimates for Scotland were not provided in that review.

6.6.67 Population estimates of Leisler's bat in 2013 were 28,000 in the UK and 250[18] in Scotland (JNCC 2013). There is no recent population estimate available for this species across the UK (Mathews *et al.* 2018, JNCC 2019h) or Scotland (JNCC, 2019l) and there is limited accurate data on trends, and population changes, meaning that the detailed population status of this species in the UK and Scotland is currently unknown. However, Newson *et al*. (2017) in their study stated that the previously used population estimates in Scotland of only a few hundred bats are outdated, with their research indicating actual populations

[18] Estimate based on expert opinion with no or minimal sampling, expected to be an underestimate as per Newson, S.E., Evans, H.E., Gillings, S., Jarrett, D. & Wilson, M.W. (2017). A survey of high risk bat species across southern Scotland. Scottish Natural Heritage Commissioned Report No. 1008.

of *Nyctalus* spp. in Scotland, and their distribution range, are much larger than previously reported, with populations suggested to be in the region of many thousands.

6.6.68 Population estimates of noctule bat in 2013 were 50,000 in the UK and 250[18] in Scotland (JNCC 2013). The 2019 Article 17 of the UK Habitats Directive Reports estimates the population range to be from 20,600 to 2,176,000 in the UK (JNCC 2019i) with no population value provided for Scotland (JNCC, 2019m). Matthews *et al*. (2018) did not provide a UK population estimate; countrywide estimates were provided for England (565,000 with a plausible range of 17,700 - 1,872,000) and Wales (91,900 with a plausible range of 2,900 - 304,000); no estimate was provided for Scotland. As for Leisler's above, Newson *et al*. (2017) in their study stated that the previously used population estimates in Scotland of only a few hundred bats are outdated, with their research indicating actual populations of *Nyctalus* spp. in Scotland, and their distribution range, are much larger than previously reported, with populations suggested to be in the region of many thousands.

6.6.69 **Magnitude of Effect:** Evaluating the vulnerability of a bat populations to wind farms is based on three factors; activity level recorded, population vulnerability (determined by collision risk of species and population size) and Site risk level. These factors are multiplied to generate an overall risk assessment scope per species of either Low (0-4), Moderate (5-12) or High (15-25) in line with guidance (NatureScot *et al.* 2021). **Appendix 6.3** presents the results of this risk assessment for each high collision risk species and provides detailed results from the Ecobat analysis. **Figures 6.7 - 6.9** also present the spatial and temporal risk categories for high-risk species, based on the results of the surveys undertaken for the Proposed Development. A summary is provided below to inform the assessment.

6.6.70 Average Site activity levels (median and maximum percentiles) were recorded for the following high collision risk bat species:

- common pipistrelle: moderate (median) to high (maximum);
- soprano pipistrelle: moderate-high (median) to high (maximum); and
- *Nyctalus* spp.: moderate (median) to moderate (maximum).

6.6.71 Due to having a 'high' collision risk and a 'common' population abundance rating, common and soprano pipistrelle bats are classified as having 'medium' population vulnerability. With a 'high' collision risk and a 'rarest' population abundance rating, *Nyctalus* spp. are classified as having 'high' population vulnerability.

6.6.72 The evidence in Britain shows that most bat activity is close to habitat features e.g., woodland or wetlands. Foraging habitat quality and connectivity within the Site is low with a largely treeless environment, small open upland burns and a fairly homogenous area of open grazed moorland habitat present. The Site has thus been categorised as a 'Low/Lowest' (level 2) Site risk to bats due to its 'Medium' project size and 'Low' habitat risk (see **Appendix 6.3** for full details).

6.6.73 The following overall collision risk assessment score for median and maximum percentiles was obtained for the undernoted species:

- common pipistrelle: medium (6) to medium (10);
- soprano pipistrelle: medium (8) to medium (10); and
- *Nyctalus* spp.: medium (6) to medium (6).

6.6.74 **Figures 6.7 - 6.9** display the risk assessment categories per month and per Anabat based on the median percentile for the Site. As can be seen in these figures, the risk level varied temporally and spatially between May and September for each species. The figures also show that there were no 'High' risk locations evident within the Site for any scoped-in bat species (see further discussion on spatial and temporal variability in **paragraphs 6.5.53 - 6.5.56**.

6.6.75 The embedded mitigation described in **paragraph 6.2.38** with respect to bats, namely reduced rotor speed when idling through feathering of the blades, will be implemented throughout operation during the bat active period (April to October), reducing the risk of bat fatalities. The guidance (NatureScot *et al.* 2021) notes that "*The reduction in speed resulting from feathering compared with normal idling may reduce fatality rates by up to 50%"*. The presence of this mitigation measure has been taken into account when assigning the Significance of Effect.

6.6.76 Further context on each high collision risk species is provided in the following paragraphs.

6.6.77 Common pipistrelle: There were no high-risk locations identified for common pipistrelle within the Site or wider survey area in any month during the May to September deployment period. Using the median percentile, all locations within the Site were 'Medium' risk May and August, with locations 9 and 11 being 'Medium' risk in June, location 11 in July, and locations 5, 7, 8, 9, 10 and 11 in September (**Figure 6.7**). All other Anabat locations and survey months either had no bat activity or activity by common pipistrelle had an overall risk assessment of 'Low'. An effect magnitude of low spatial and long-term temporal is considered appropriate for common pipistrelle.

6.6.78 Soprano pipistrelle: There were no high-risk locations identified for soprano pipistrelle within the Site or wider survey area in any month during the May to September deployment period. Using the median percentile, all locations within the Site were 'Medium' risk May and August, with locations 3, 6, and 10 being 'Medium' risk in June, and locations 4, 5, 6, 8, and 11 in September (**Figure 6.8**). All other Anabat locations and survey months either had no bat activity or activity by soprano pipistrelle had an overall risk assessment of 'Low'. An effect magnitude of low spatial and long-term temporal is considered appropriate for soprano pipistrelle.

6.6.79 *Nyctalus* spp.: There were no high-risk locations identified for *Nyctalus* spp. within the Site or wider survey area in any month during the May to September deployment period. Using the median percentile, location 10 was 'Medium' risk in June and location 1 was 'Medium' risk in May, however location 1 is over 1.1 km from the Application Boundary (**Figure 6.9**). All other Anabat locations and months either had no bat activity or activity by *Nyctalus* spp. had an overall risk assessment of 'Low'. An effect magnitude of low spatial and long-term temporal is considered appropriate for *Nyctalus* spp.

6.6.80 All species were calculated to have an overall collision risk assessment score of Medium to Medium (based on median and maximum percentiles respectively; **Table 6.8**). While there may be an effect on individuals, the assessment determines that the effect would be unlikely to occur in sufficient numbers to affect the local populations.

6.6.81 **Significance of Effect:** Given the above consideration of Nature Conservation Value, Conservation Status and Magnitude, the effect significance of collision risk on all high collision risk bat species recorded at the Site is considered **Minor adverse** and **Not Significant**.

Decommissioning Effects

6.6.82 Due to the distance time frame until their occurrence (>35 years), decommissioning effects are difficult to predict with confidence. In general, decommissioning effects are usually considered for the purposes of assessment to be similar to (or likely less than) those of construction effects in nature and are likely to be of shorter duration. A method statement would be prepared and agreed with the relevant statutory consultees prior to decommissioning of the Proposed Development, which would include the need for pre-works surveys.

6.6.83 Decommissioning of the Proposed Development would involve removal of all infrastructure and restoration of the associated ground. Restoration would seek to return areas to their pre-construction habitat type, or as similar as feasible depending on local substrates, topography, hydrology etc. As a result, decommissioning will not lead to any further direct or indirect habitat losses, rather, it is predicted that due to restoration of upland habitats in these areas, there would be a net positive effect.

6.7 Mitigation, Compensation and Enhancement

Construction Phase

6.7.1 General and embedded mitigation measures for habitats and species, such as complying with best practice, micrositing provisions, presence of an ECoW and adherence to a detailed CEMP and SPP are included in **paragraphs 6.2.32 - 6.2.38**.

6.7.2 No significant construction effects were identified on IEFs, however a number of additional mitigation, compensation and significant enhancement measures are proposed as part of the Proposed Developments OBEMP, as detlaied in **Appendix 6.6** and outlined below.

6.7.3 Enhancement, restoration and creation of habitats through the delivery of a BEMP would reduce effects on ancient woodland and other habitats further. Overall, the BEMP would aim to achieve significant biodiversity enhancement at the Proposed Development, in line with objectives outlined in NPF4 Policy 3 (Scottish Government, 2023). The BEMP would include provisions for the protection, maintenance, restoration and/or enhancement of bog habitats locally, and also for the respective qualifying habitats within Auchenreoch Glen SSSI. Furthermore, the BEMP would deliver native broadleaved and mixed scrub enhancement, creation and expansion to enhance the existing broadleaved woodland and the assisted regeneration of ancient woodland areas at Barr Wood, with the aim also to increase woodland connectivity and join up fragmented stands locally. The BEMP also aims to deliver native hedgerow creation.

6.7.4 The OBEMP is provided in **Appendix 6.6**, also see **Figure 6.11**. The OBEMP is based on a number of identified ‘Search Areas’ for each respective habitat management and biodiversity enhancement proposal. These Search Areas will likely be refined following further specialist surveys and feedback from relevant consultees, and all search areas may not be taken forward for the final BEMP, and other search areas and/or proposals may also be considered; however, the Applicant remains committed to delivering significant biodiversity enhancement at the Proposed Development.

6.7.5 In summary the OBEMP includes the following proposals:

- 89.94 ha of peatland restoration/enhancement in Search Area A, likely primarily delivered through drain blocking and removal of self-seeding conifer trees;
- 15.05 ha of woodland enhancement (including enhancement of ancient woodland) and 96.36 ha of native broadleaved woodland creation (via planting) in Search Area B. The ancient woodland at Barr Wood will primarily be enhanced through enrichment planting, soil translocation, and deadwood creation from trees requiring felling for Site Access construction;
- Restoration of qualifying grassland habitats within the Auchenreoch Glen SSSI (Search Area C, 12.19 ha) through the removal and management of encroaching bracken;
- 7.25 ha of native mixed scrub creation/enhancement in Search Area D, via planting; and
- Creation of approximately 2000 m of new native species-rich hedgerows in Search Area E.

6.7.6 Full details of the proposals and associated monitoring and reporting schedules are provided in **Appendix 6.6**.

6.7.7 As part of the OBEMP a Biodiversity Net Gain (BNG) assessment was undertaken using a BNG metric. This demonstrates the measures proposed for the creation and enhancement of habitats would result in an increase in the biodiversity value of the Site post construction. The BNG metric was applied to the Proposed Developments baseline habitats, considered predicted habitat losses, and the habitat creation and enhancement measures as proposed in the OBEMP. The BNG metric indicates that following construction, Site restoration, BEMP implementation and subsequent habitat management, the Proposed Development would compensate for predicted habitat and biodiversity losses and provide further enhancement that would result in an increase and net gain for biodiversity of 13.3% over and above the baseline and pre-development value (see **Appendix 6.6**).

6.7.8 The detailed and final BEMP would be agreed with the WDC and NatureScot in advance of construction and would ensure the Proposed Development secures significant biodiversity enhancements through restoring degraded habitats and strengthening nature networks.

Operational Phase

6.7.9 Bats are the only IEF scoped-in to the assessment of potential operational effects, and mitigation during operation is detailed in **paragraph 6.2.38** – this embedded mitigation has been considered as part of the assessment. No significant operational effects were identified, and no non-standard mitigation is proposed.

6.7.10 Creation of woodland and riparian habitat through the delivery of the BEMP, as detailed in **Appendix 6.6**, would create and enhance bat foraging and commuting habitat within the Site and locally.

Decommissioning Phase

6.7.11 None proposed.

Cumulative

6.7.12 None proposed.

6.8 Summary of Residual Effects

6.8.1 No significant effects are identified. All scoped-in IEFs have been assessed as having Minor adverse effects, or less, and which are Not Significant (as per the assessment sections above).

6.8.2 **Table 6.11** provides a summary of the effects detailed within this chapter.

Table 6.11: Summary of Effects

IEF	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Construction Phase				
Ancient Woodland	Direct habitat loss	Minor adverse – Not significant	In addition to embedded mitigation, the implementation of a BEMP which includes woodland creation and enhancement, deadwood creation, and ancient woodland soil translocation in and around the area of ancient woodland at Barr Wood to be affected by the Proposed Development.	Minor adverse and Not significant in the short-term. Likely Minor-Moderate beneficial in the long-term when implementation of the BEMP is taken into account
Blanket Bog and Wet Modified Bog	Direct and indirect habitat loss	Minor adverse – Not significant	In addition to embedded mitigation, the implementation of a BEMP which includes bog restoration/enhancement.	Minor adverse and Not significant in the short-term. Likely Minor beneficial in the long-term when implementation of the BEMP is taken into account
Operational Phase				
High collision risk bat species (Common pipistrelle, soprano pipistrelle and *Nyctalus* spp.)	Fatality through barotrauma or collision	Minor adverse – Not significant	In addition to embedded mitigation (i.e., feathering whilst idling), proposals for woodland enhancement and new woodland planting included as part of biodiversity enhancements detailed in the BEMP would create and improve bat foraging habitat and corridors away from the turbine area.	Minor adverse and Not significant
Decommissioning Phase				
None identified. Generally, as for Construction (or less). No further direct or indirect habitat losses; potential net positive effect on habitats after Site restoration.				
Cumulative				
None identified				

6.9 References

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6.10 Annex A

Table 6.12: Habitat Baseline Composition and Habitat Loss Calculations for Study Area

		Study Area (Baseline)				Permanent Direct Loss		Permanent Indirect Loss (only applies to Wetland Habitats)[19]		Permanent Direct + Indirect Loss		Temporary Direct Loss	
Phase 1 Description (Code)	**NVC**	**Phase 1 Area (ha)**	**Phase 1 % of Study Area**	**NVC Area (ha)**	**% of NVC Type within Study Area**	**NVC Area (ha)**	**% Loss of Phase 1 Type within Study area**	**NVC Area (ha)**	**% Loss of Phase 1 Type within Study area**	**NVC Area (ha)**	**% Loss of Phase 1 Type within Study Area**	**NVC Area (ha)**	**% Loss of Phase 1 Type within Study Area**
Totals		**330.25**	**100**	**330.25**	**100**	**10.33**	**3.13**	**16.54**	**5.01**	**26.87**	**8.14**	**7.79**	**2.36**
Broadleaved Semi-Natural Woodland (A1.1.1)	W11	0.51	0.15	0.406	0.12%	0.060	11.76	0.000	0.000	0.060	11.76	0.000	0.000
	W10			0.001	0.00%	0.000		0.000		0.000		0.000	
	W10e			0.030	0.01%	0.000		0.000		0.000		0.000	
	W9a			0.021	0.01%	0.000		0.000		0.000		0.000	
	W4			0.007	<0.01%	<0.001		0.000		<0.001		0.000	
	W7c			0.041	0.01%	0.000		0.000		0.000		0.000	
Dense/Continuous Scrub (A2.1)	W23	0.29	0.09	0.212	0.06%	0.032	18.05	0.000	0.000	0.032	18.05	0.005	1.74
	W21			0.074	0.02%	0.020		0.000		0.020		0.000	
Scattered Broadleaved Tree (A3.1)	SBT	0.01	<0.01%	0.008	<0.01%	<0.001	1.29	0.000	0.000	<0.001	1.29	0.000	0.000
Unimproved Acid Grassland (B1.1)	U4	14.33	4.34	11.452	3.47%	0.131	1.22	0.000	0.06	0.131	1.28	0.452	3.38
	U5			2.368	0.72%	0.041		0.000		0.041		0.032	
	U4a			0.012	<0.01%	0.000		0.000		0.000		0.000	
	U6			0.496	0.15%	0.003		0.009		0.011		0.000	
Unimproved Neutral Grassland (B2.1)	MG1	<0.01	<0.01%	<0.01	<0.01%	<0.001	1.85	0.000	0.000	<0.001	1.85	0.000	0.000
Improved Grassland (B4)	MG7	5.98	1.81	5.690	1.72%	0.689	11.53	0.000	0.000	0.689	11.53	0.030	0.50
	MG6			0.285	0.09%	<0.001		0.000		<0.001		0.000	
Marsh/Marshy Grassland (B5)	M25b	67.45	20.43	34.747	10.52%	2.325	4.95	4.389	9.31	6.714	14.26	1.711	3.93
	Ja			23.304	7.06%	0.711		1.569		2.281		0.604	
	M25			1.212	0.37%	0.010		0.033		0.042		0.026	
	M23a			6.404	1.94%	0.204		0.125		0.329		0.129	
	Je			1.659	0.50%	0.087		0.118		0.205		0.181	
	MG10a			0.070	0.02%	0.005		0.044		0.049		0.000	
	M23b			0.057	0.02%	0.000		0.000		0.000		0.000	
Continuous Bracken (C1.1)	U20	5.04	1.53	4.937	1.49%	0.001	0.02	0.000	0.000	0.001	0.02	<0.001	0.01
	U20a			0.104	0.03%	0.000		0.000		0.000		0.000	
Tall Ruderal (C3.1)	OV25	0.02	0.01	0.003	<0.01%	0.000	0.53	0.000	0.000	0.000	0.53	0.000	0.000
	W24			0.020	0.01%	<0.001		0.000		<0.001		0.000	
	OV24			0.001	<0.01%	<0.001		0.000		<0.001		0.000	
	OV26			<0.001	<0.01%	<0.001		0.000		<0.001		0.000	

[19] Based upon the precautionary 10 m indirect drainage assumption (SEPA, 2018).

		Study Area (Baseline)				Permanent Direct Loss		Permanent Indirect Loss (only applies to Wetland Habitats)[19]		Permanent Direct + Indirect Loss		Temporary Direct Loss	
Phase 1 Description (Code)	**NVC**	**Phase 1 Area (ha)**	**Phase 1 % of Study Area**	**NVC Area (ha)**	**% of NVC Type within Study Area**	**NVC Area (ha)**	**% Loss of Phase 1 Type within Study area**	**NVC Area (ha)**	**% Loss of Phase 1 Type within Study area**	**NVC Area (ha)**	**% Loss of Phase 1 Type within Study Area**	**NVC Area (ha)**	**% Loss of Phase 1 Type within Study Area**
Totals		**330.25**	**100**	**330.25**	**100**	**10.33**	**3.13**	**16.54**	**5.01**	**26.87**	**8.14**	**7.79**	**2.36**
	OV27			<0.001	<0.01%	0.000		0.000		0.000		0.000	
Acid Dry Dwarf Shrub Heath (D1.1)	H12a	2.60	0.79	1.620	0.49%	<0.001	0.12	0.000	0.000	<0.001	0.12	<0.001	0.99
	H12c			0.968	0.29%	0.003		0.000		0.003		0.026	
	H9			0.013	<0.01%	0.000		0.000		0.000		0.000	
Wet Dwarf Shrub Heath (D2)	M15b	28.92	8.76	16.099	4.87%	0.309	1.11	0.956	3.34	1.265	4.45	0.440	1.57
	M15			12.820	3.88%	0.011		0.011		0.022		0.014	
Blanket Bog (E1.6.1)	M19a	174.95	52.98	90.140	27.29%	2.323	2.86	0.000	4.79	6.216	7.64	1.847	2.15
	M17a			79.549	24.09%	2.662		3.893		7.091		1.908	
	M17			5.169	1.57%	0.014		4.429		0.058		0.001	
	M2			0.048	0.01%	0.001		0.044		0.005		0.001	
	M3			0.048	0.01%	0.001		0.003		0.005		0.001	
Wet Modified Bog (E1.7)	M25a	15.12	4.58	15.117	4.58%	0.468	3.09	0.475	3.14	0.943	6.24	0.344	2.28
Acid/Neutral Flush (E2.1)	M6d	14.84	4.49	13.642	4.13%	0.166	1.14	0.419	2.98	0.585	4.12	0.041	0.28
	M6c			0.830	0.25%	0.003		0.023		0.026		0.000	
	M4			0.372	0.11%	<0.001		<0.001		<0.001		0.000	
Swamp (F1)	S9	0.01	<0.01%	0.010	<0.01%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Standing Water (G1)	SW	<0.01	<0.01%	0.005	<0.01%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bare Ground (J4)	BG	0.18	0.05%	0.179	0.05%	0.048	26.90	0.000	0.000	0.048	26.90	0.000	0.000