9. ECOLOGY

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9. Ecology

9.1. Introduction

9.1.1. This Chapter of the EIA Report identifies and assesses the potential effects that the proposed Shepherds' Rig Wind Farm (the Proposed Development) may have on the ecological resources of the local environment. Analysis and assessment of baseline ecological data has enabled identification of appropriate mitigation and compensation measures to prevent, reduce, or offset potential adverse ecological effects as well as enhancement measures to provide beneficial effects, where possible. This assessment was undertaken by Arcus Consultancy Services Limited (Arcus).

9.1.2. This chapter is broadly structured as follows:

- Legislation, policy and guidance;
- Assessment methodology and significance criteria;
- Baseline methodology;
- Scoping Responses and Consultation;
- Baseline conditions;
- Assessment of ecological importance;
- Embedded mitigation;
- Ecological impact assessment;
- Assessment of cumulative effects;
- Mitigation measures;
- Residual effects and
- Summary.

9.1.3. Potential effects on ecology and designated sites for nature conservation are often interrelated with effects on ornithology, hydrology, geology, cultural heritage, and forestry. This Chapter should be read in conjunction with Chapter 7: Forestry, Chapter 10: Ornithology, Chapter 11: Cultural Heritage, Chapter 12: Geology and Peat, and Chapter 13: Hydrology and Hydrogeology.

9.1.4. Supporting ecological information pertinent to the Ecological Impact Assessment (EcIA) includes the following Appendices:

- **Appendix 9.1**: Habitats & Botany;
- **Appendix 9.2:** Protected Species;
- **Appendix 9.3**: Bats; and
- **Appendix 9.4:** Fisheries.

9.1.5. The following figures support this chapter:

- **Figure 9.1** Designated Sites;
- **Figure 9.2** Extended Phase 1 Habitat Survey Results;
- **Figure 9.3** Protected Species Survey Results; and
- **Figure 9.4** Bat Activity Surveys.

9.1.6. Common, vernacular species names are presented in this chapter (except with reference to species without such) followed by the scientific name (upon first use of the common name only). Full scientific names and comprehensive species lists are provided in the Appendices.

9.1.7. The following terms are used within this chapter to describe the Proposed Development and various associated study areas:

- The Proposed Development: the whole physical process involved in the development of Shepherds' Rig Wind Farm, including wind farm construction, operation and decommissioning (i.e. not a piece of land or an area);
- The Site Boundary: the red line or application boundary as shown in Figure 2.2;
- The Site: the land within the Site Boundary available for turbine development and associated wind farm infrastructure;
- Desk Study Area: a variable radius around the Site in which existing information and data have been considered. This comprises 5 km but is extended to 10 km for bats;
- Survey Area: the area in which any given ecology survey has been undertaken. The area varies among surveys and is defined accordingly in the Appendices and associated Figures; and
- Zone of Influence: this area includes all areas within the potential zone of influence of the Proposed Development. This is the area over which ecological features may be subject to significant effects as a result of the Proposed Development. The zone of influence varies for different ecological features depending on their sensitivity to environmental change

9.2. Legislation, Policy and Guidance

Legislation

9.2.1. The following is a summary of legislation of relevance to this chapter:

- Council Directive 92/43/EEC (the 'Habitats Directive')[1];
- Council Directive 2000/60/EC ('Water Framework Directive')[2] ;
- Wildlife and Countryside Act 1981 (as amended)[3];
- Conservation (Natural Habitats, & c) Regulations 1994 (the 'Habitat Regulations')[4];
- Conservation of Habitats and Species Regulations 2017[5];
- Wildlife and Natural Environment (Scotland) Act 2011[6] ;
- Protection of Badgers Act 1992[7] ;
- Nature Conservation (Scotland) Act 2004[8] ; and
- Salmon and Freshwater Fisheries Act 2003[9].

[1] European Commission (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
[2] European Commission (2000) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy
[3] UK Government (1981) Wildlife and Countryside Act 1981, Chapter 69. Part 1
[4] Scottish Government (1994) The Conservation (Natural Habitats, &c.) Regulations 1994
[5] UK Government (2017) The Conservation of Habitats and Species Regulations 2017
[6] Scottish Government (2011) Wildlife and Natural Environment (Scotland) Act 2011
[7] UK Government (1992) Protection Of Badger Act 1992
[8] Scottish Government (2014) Nature Conservation (Scotland) Act 2004
[9] Scottish Government (2003) Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003

Policy and Guidance

9.2.2. In addition to the above legislation and the detailed survey guidance detailed below (see Section 9.6), the following is a summary of the key policy and guidance of relevance to this chapter;

- EU Biodiversity Strategy[10];
- The Scottish Government, 2020 Challenge for Scotland's Biodiversity[11];
- Scottish Biodiversity List (SBL)[12];
- SEPA Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems[13,14] ;
- Good Practice During Wind Farm Construction[15];
- SNH General pre-application/ scoping advice to developers of onshore wind farms[16];
- SNH Decommissioning and Restoration Plans for wind farms ; and
- Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment (EcIA)[17].

9.2.3. In addition to the above, published guidance regarding the specific ecology aspects (such as survey methodology) are considered within this chapter and associated Appendices, with full citation where relevant presented in Section 9.6 (Baseline Methodology). Work has been carried out in accordance with BS:42020 Biodiversity: Code of Practice For Planning and Development[18], by ecologists working to the CIEEM Code of Professional Conduct[19].

[10] European Commission, (2011). EU Biodiversity Strategy. Available at: http://ec.europa.eu/environment/nature/biodiversity/strategy/index_en.htm Accessed July 2018.
[11] Scottish Government (2015). Scotland's Biodiversity, a Route Map to 2020. Available online at: http://www.gov.scot/Resource/0048/00480289.pdf Accessed July 2018.
[12] Scottish Government (2013) Scottish Biodiversity List. Available online at: https://www.gov.scot/Topics/Environment/Wildlife-Habitats/16118/Biodiversitylist/SBL
[13] SEPA (2017). Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Land Use Planning System SEPA Guidance Note 31. Version 2, 27th October 2014. Accessed July 2018
[14] SEPA (2014). Planning guidance on on-shore windfarm developments. Land Use Planning System SEPA Guidance Note 4. Version 7, 14th May 2014 Accessed July 2018
[15] Scottish Renewables, SNH, SEPA, Forestry Commission Scotland, Historic Environment Scotland (2015). Good Practice During Wind Farm Construction. Version 3, September 2015.
[16] SNH (2018). General pre-application/ scoping advice to developers of onshore wind farms. Available at: https://www.nature.scot/sites/default/files/2018-02/SNH%20General%20pre-application%20and%20scoping%20advice%20%20to%20developers%20of%20onshore%20wind%20farms.pdf . Accessed August 2018
[17] CIEEM, 2018. Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.
[18] BSI Group (2013) BS 42020 – a code of practice for biodiversity in planning and development - Smart guide to biodiversity in
planning and development . Available online at: https://www.bsigroup.com/LocalFiles/en-GB/biodiversity/BS-42020-Smart-Guide.pdf. Access August 2018
[19] CIEEM (2017) Code of Professional Conduct. Available online at: https://www.cieem.net/data/files/Website_Downloads/Code_of_Professional_Conduct.pdf. Accessed August 2018

9.3. Assessment Methodology and Significance Criteria

Scope of Assessment

9.3.1. In summary, the scope of ecological assessment includes the following elements:

- Identification of statutory and non-statutory designated sites of nature conservation interest located up to 10 kilometres (km) from the Site;
- Identification of historical records of rare, notable or protected species or habitat located up to 5 km from the Site (up to 10 km for bat and bat roost records);
- Consideration of the likely significant effects on ecological features arising from the Proposed Development;
- Description of measures required to mitigate adverse effects on ecological features within or adjacent to the Site, with the aim to avoid, reduce or compensate for the effect, or offer an opportunity for enhancement; and
- Identification of residual effects on ecological features, including those considered to be significant, taking into account the above mitigation.

9.3.2. The principal ecological issues considered within this EcIA include:

- Potential effects on statutory and non-statutory sites designated for nature conservation, located within 10 km of the Site;
- Long-term or short-term direct habitat loss or damage due to land take during construction, operation and decommissioning of the Proposed Development;
- Indirect disturbance effects, i.e. the displacement of species as a consequence of construction or decommissioning activities, or due to the operational phase of the Development; and
- The potential mortality of ecological features considered vulnerable during construction, operation and decommissioning of the Proposed Development.

Assessment Methodology

9.3.3. The approach taken to impact assessment follows CIEEM guidance for EcIA[17] which sets out the process for assessment through the following stages:

- Identification and characterisation of ecological effects;
- Determining importance of ecological features;
- Incorporation of measures to mitigate identified effects;
- Assessment of significance of residual effects following mitigation;
- Identification of appropriate compensation to offset significant residual effects; and
- Identification of opportunities for ecological enhancement.

9.3.4. Upon identification of the likely direct and indirect effects from the Proposed Development, it is necessary to undertake a systematic assessment of 'important' ecological features (IEFs) that could be significantly affected, including negative and positive effects. Where ecological features are not considered important enough to warrant further consideration or where they will not be significantly affected, these are scoped out of the assessment with justification for exclusion provided.

9.3.5. Mitigation to reduce potential for ecological effects has been incorporated into the design of the Proposed Development (embedded mitigation). This will

include elements which have been re-designed to avoid or reduce ecological effects (known as 'mitigation by design'). This type of mitigation is particularly beneficial for ecological resources as there is greater certainty that it will be delivered. Embedded mitigation includes both mitigation by design and mitigation by practice; this will be taken into consideration when undertaking the EcIA.

9.3.6. The assessment includes consideration of potential impacts on each IEF from all phases of the Proposed Development, including direct, indirect, secondary and cumulative impacts. Impacts and their effects on IEFs will be fully considered taking the following into account: effect duration, reversibility, permanency and whether the effect is positive or negative. Baseline conditions are examined, taking embedded mitigation into account, to accurately describe how these will change as a result of the Proposed Development and to assess the cumulative impacts of the Proposed Development in combination with other developments. Where identified, significant effects will be assessed in the context of predicted baseline conditions within the zone of influence, throughout the lifetime of the Proposed Development.

Determining Importance

9.3.7. Habitats and species of nature conservation importance at regional, national and international level are identified through policy and legislation, providing a focus for biodiversity conservation in the UK. These elements provide a starting point for the identification of IEFs requiring consideration in EcIA, enabling demonstration of compliance with policy objectives and statutory requirements for biodiversity. Expert judgment is also required for the identification of IEFs, particularly where these may not be included in lists, designated sites or features, or highlighted in nature conservation policy.

9.3.8. In accordance with CIEEM guidance[17], the importance of an ecological feature is considered within a defined geographical context, as outlined below in Table 9.1. Only ecological features with at least regional importance are considered as IEFs requiring assessment for potential significant effects.

Table 9.1: Geographic Context of Important Ecological Features

Level of Importance/ Sensitivity	Examples of Definitions
International	An internationally designated site (e.g. a Special Area of Conservation (SAC)) or a site meeting criteria for international designations. Species in internationally important numbers (> 1 % of biogeographic populations).
National (i.e. UK)	A nationally designated site (e.g. a Site of Special Scientific Interest (SSSI)) or a site meeting criteria for national designations. Species present in nationally important numbers (> 1 % UK population). Large areas of priority habitats listed on Annex I of the Habitats Directive and smaller areas of such habitats that are essential to maintain the viability of that ecological resource.

Level of Importance/ Sensitivity	Examples of Definitions
Regional (i.e. Scotland)	Species present in regionally important numbers (> 1 % Scottish population). Sites not meeting criteria for SSSI selection but of greater than the regional criteria below.
Local (i.e. Dumfries & Galloway)	Scottish Wildlife Trust (SWT) Reserves and Local Nature Reserves (LNRs). Local Biodiversity Action Plan (LBAP) priorities, where they occur in sufficient abundance to maintain the local resource. Areas of habitat or species considered to appreciably enrich the ecological resource within the local context.
Less than Local (within 10 km of the Site)	Usually widespread and common habitats and species. Features falling below regional importance will not be considered in detail within the assessment process.

9.3.9. Habitats of international importance are listed on Annex I of the Habitats Directive. Where these are considered of principal importance for biodiversity in Scotland, habitats are listed under Part 1, section 2(4) of the Nature Conservation (Scotland) Act and included on the Scottish Biodiversity List. Habitats of local importance may be listed in the LBAP. Where important habitat types may be in sub-optimal baseline condition, the potential habitat value is considered, including the possibility for contribution to conservation objectives.

9.3.10. Species listed on Annexes II, IV and V of the Habitats Directive[1] are considered of principal importance within the context of EcIA, due to the international level of protection afforded to them. Other species of notable importance are those afforded national protection under Part 1, section 2(4) of the Nature Conservation (Scotland) Act[8]. However when determining the importance in the context of EcIA, contextual information regarding distribution and abundance of a given species is essential, including population trends based on historical records. The scale within which importance is determined may also relate to a particular population and should also be considered when determining importance.

9.3.11. In accordance with CIEEM guidance, where a legally protected species is present within the zone of influence and there is potential for a breach of legislation, such species should be considered as IEFs. If deemed appropriate, legally protected species may be considered in the context of legal and policy implications (where they are of less than regional importance) instead of, or in addition to, potential ecological impacts. The EcIA will determine whether a breach of legislation will result from the Proposed Development, to inform design and implementation of mitigation, thereby ensuring the law is not contravened.

9.3.12. Part of the process of attributing importance to a species involves defining the relevant population and requires professional judgement to identify an

ecologically coherent population, against which effects on conservation status can be assessed. For example, for wide-ranging species such as otter (*Lutra lutra*) it may be more appropriate to assess the importance of the otter population in a whole catchment, whereas for more localised species, such as water vole, importance may be attributed to groups of related colonies which function as a meta-population.

9.3.13. In this assessment, sensitivity is synonymous with importance and is therefore defined according to the geographical scale in Table 9.1 (above).

Characterising Ecological Impacts

9.3.14. The prediction of ecological impacts will take into account relevant aspects of ecosystem structure and function, including available resources, environmental and ecological processes, anthropogenic influences, historical context, ecological relationships, ecological role or function, ecosystem properties and other environmental influences. The assessment will describe the relevant characteristics required to understand the ecological impact and to determine significance. This may include the following:

- Beneficial or adverse impact: these will be determined according to whether the change is in accordance with nature conservation objectives and policy. A beneficial impact is a change that improves the quality of the environment and may include halting or slowing an existing decline in the quality of the environment. An adverse impact is a change that reduces the quality of the environment;
- Extent: the spatial or geographical area over which the impact may occur;
- Duration: this is defined in relation to ecological characteristics in addition to human timeframes. Impacts may be described as short, medium, long-term, permanent or temporary;
- Frequency and timing: this will take into account the number of times an activity will occur in a defined time period that may influence the resulting impact. The timing and frequency of an activity or change may result in an impact if it coincides with seasonal ecological elements (such as a protected species' breeding season); and
- Reversibility: in line with the CIEEM guidelines[17], an irreversible impact is one from which recovery is not possible within a reasonable timescale, or there is no reasonable chance of action being taken to reverse it. A reversible impact is one from which spontaneous recovery is possible or which may be counteracted by mitigation.

9.3.15. The above-listed impact characteristics combine to form a qualitative description of impact magnitude, referring to impact size, amount, intensity and volume, as summarised in Table 9.2.

Table 9.2 Impact Magnitude Criteria

Effect Magnitude	Description
High	These are changes that will almost always have an adverse effect on the integrity or conservation status of an ecological

Effect Magnitude	Description
	feature. They are usually long-term and often permanent/irreversible.
Medium	These are adverse changes that may in some circumstances be considered to impact the integrity or conservation status of an ecological feature. They may be long-term but are potentially reversible.
Low	These are adverse changes that do not usually change the integrity or conservation status of an ecological feature. They are often short-term and/or reversible.
Negligible	There is no perceptible change in the ecological feature. As a guide, less than 1 % of the population or area will be predicted to be affected.

Determining Significance

9.3.16. For the purposes of EcIA, a 'significant effect' is defined as an effect that either supports or undermines biodiversity conservation objectives for IEFs or for biodiversity in general. Conservation objectives may be specific, broad or wide-ranging; therefore, effects can be considered as significant at a wide range of scales from international (major) to local (negligible). Significant effects encompass impacts on structure and function of defined sites, habitats or ecosystems, and the conservation status of habitats and species, including their distribution and abundance.

9.3.17. Where identified, significant effects will be qualified with reference to an appropriate geographic scale. It is important to note that the scale of the significance of an effect may not be the same as the geographic context in which the feature is considered important. This will enable consistency in scale when determining appropriate mitigation or compensation solutions.

9.3.18. For defined sites or ecosystems, significant effects encompass impacts on the structure and function of such systems. For designated sites, it is necessary to assess whether or not an impact will affect the integrity of a site or ecosystem (and is therefore significant). This is achieved through understanding whether the changes arising from the Proposed Development are likely to move the baseline conditions closer to, or further from, the condition which constitutes integrity for that specific system.

9.3.19. For habitats and species, consideration of conservation status is required to determine whether or not an effect on a habitat or species is likely to be significant. For habitats, conservation status is determined by the sum of influences acting on the habitat that may affect its extent, structure and functions, in addition to its distribution and typical species composition within a given geographical area. For species, conservation status is determined by the sum of influences acting on the species concerned, which may affect its abundance and distribution within a given geographical area. When assessing potential effects on conservation status, the known or likely background trends and variations in status are taken into account. Estimation is also given to the level of ecological resilience or conditions that would allow the population of a

species or area of habitat to continue to exist at a given level, such as to increase along an existing trend or to reduce a decreasing trend.

9.3.20. Within this assessment, the significance of the potential effects on each identified IEF is determined by considering both the nature conservation importance of each feature and the degree to which it may be affected (the effect magnitude) by the Proposed Development.

9.3.21. An effect determined to be significant at international (major), national (high moderate) or regional (moderate) level, is considered to be 'significant effect'. An effect determined to be significant at a local (low) or less that local (negligible) level will be considered to be 'non-significant effect.

Cumulative Effects

9.3.22. Cumulative effects can result from individually insignificant but collectively significant effects or actions taking place over a period of time or concentrated in a location. Within EcIA, cumulative effects are particularly important as many ecological features are exposed to background levels of threat or pressure and may be close to reaching critical thresholds where further impact could cause irreversible decline. It is recognised that different actions can cause cumulative effects as follows:

- Additive/incremental effects: multiple activities/projects may give rise to a significant effect due to their proximity in time and space. These may be additive or synergistic effects; and
- Ancillary: ancillary developments may include different aspects of the project which may be authorised under different consent processes, these will be included as part of the cumulative assessment.

Residual Impacts

9.3.23. Following assessment of effects, including incorporation of embedded mitigation, all attempts will be made to avoid and mitigate any significant effects, through specific ecological mitigation. Upon finalisation of mitigation specific to any significant effects, assessment of the residual effects will be undertaken to determine the significance of effects on ecological features. Where residual effects still result in a significant effect, or require application of compensatory measures, these will be considered against the relevant ecological policy and legal objectives to determine the outcome of the application.

9.4. Baseline Methodology

Desk Study Methodology

9.4.1. A desk study was conducted in 2018 with the aim of identifying nature conservation sites in both the local and wider environment and to obtain historical records of ecological features. The desk study searched for records of statutory and non-statutory sites of nature conservation, protected species,

and priority habitats and species for nature conservation listed in LBAPs[20] and the SBL[12].

9.4.2. A radius of 10 km from the Site was used to search for internationally designated statutory sites for nature conservation (such as Special Areas of Conservation (SAC) or Ramsar sites), with a radius of 5 km applied for nationally designated statutory sites (such as Sites of Special Scientific Interest (SSSI)), and 2 km for non-statutory sites. A search radius of 5 km was applied to records of notable or protected flora and faunal species (extended to 10km for bats); with a search radius of 2 km of the Site applied to records of invasive, non-native species.

9.4.3. As part of the desk study records from the following organisations were requested:

- South West Scotland Environmental Information Centre (SWSEIC) (formally DGERC);
- Dumfries and Galloway Bat Group (DGBG);
- Scottish Wildlife Trust (SWT);
- Galloway Fisheries Trust; and,
- Nith District Salmon Fisheries Board.

9.4.4. Additional information was obtained from publically available sources.

Baseline Survey Methodology

9.4.5. Baseline ecology surveys were undertaken by (or on behalf of) Arcus in 2018. An overview of the ecology survey methods undertaken to provide baseline data is summarised below; however, full details are presented in **Appendices 9.1 to 9.4**.

Extended Phase 1 Habitat Survey

9.4.6. An Extended Phase 1 Habitat survey (hereby referred to as the Phase 1 Survey) of the Site was undertaken by Michael Stopa, CEcol, CEnv, MCIEEM of Bear Environmental on behalf of Arcus, between the 13th – 15th April 2018 following standard Joint Nature Conservation Committee (JNCC) survey methodology[21] (**Appendix 9.1**). Phase 1 habitat survey is a standard technique for classifying and mapping British habitats. The survey was extended to include consideration of the likely presence of protected or otherwise notable species.

9.4.7. Due to the lack of sensitive habitats and botanical species recorded during the Phase 1 Survey, there was no requirement for a National Vegetation Classification (NVC) Survey to be carried out.

Protected Species Survey (excluding bats)

9.4.8. Protected species surveys were carried out by suitably experienced Arcus ecologists between 26th and 28th June 2018 as detailed in **Appendix 9.2**. The

[20] Dumfries & Galloway Biodiversity Partnership (2009) Dumfries & Galloway Local Biodiversity Action Plan. Available at: https://www.dumgal.gov.uk/media/19945/Local-Biodiversity-Action-Plan/pdf/Local_Biodiversity_Action_Plan.pdf. Accessed September 2018

[21] JNCC (2010) Handbook for Phase 1 Habitat Survey: A technique for environmental audit. 5th Edition

Protected Species Survey Area encompassed all land within the Site, plus an additional buffer of up to 250 metres (m) informed by a review of Scottish Natural Heritage (SNH) guidance[22]. Although the Survey Area includes all species assessed likely to be present, the area surveyed for each species varied depending on species specific survey guidelines and best practise[22], as outlined below:

- Badger (*Meles meles*): Suitable habitats within the Site and up to 100 m buffer outwith[23].
- Otter: Suitable riparian habitats within the Site and up to 200 m up and downstream of watercourses potentially impacted by the Development.
- Pine marten (*Martes martes*): Suitable habitats within the Site and up to 250 m buffer outwith.
- Red squirrel (*Sciurus vulgaris*): Suitable habitats within the Site and up to 50 m buffer outwith.
- Water vole (*Arvicola amphibius*): Suitable riparian habitats within the Site and up to 50 m up and downstream of watercourses potentially impacted by the Development.

Bat Surveys

9.4.9. Bat surveys were carried out in accordance to Bat Conservation Trust (BCT) survey guidelines[24,25] between May and September 2018 (the bat survey season), with all survey work undertaken by Arcus as detailed in **Appendix 9.3**. Bat Surveys included both Transect Activity Surveys and Remote Static Activity Surveys and were carried out within the Bat Survey Area. As the layout was not defined at the time of survey this represents a 200 m buffer of the Site.

Transect Activity Surveys

9.4.10. Transect Activity Surveys were carried out via driven transect across three seasonal survey sessions during the bat survey season (May to September)[24] on 15th May 2018 (Session A: Spring), 12th July 2018 (Session B: Summer) and September (Session C: Autumn) by suitably experienced Arcus ecologists in accordance with BCT survey guidance[24] as detailed in **Appendix 9.3**.

9.4.11. The transect route included a series of 5-minute spot counts and was designed with reference to accessibility, habitat features, and an indicative Site Boundary. Surveyors recorded bat activity with an Echo Meter Touch Pro 2 ultrasonic bats detector connected to iPhones, which recorded and mapped all bat calls. Ultrasonic recordings captured during transect surveys were analysed using audio software such as Bat Sound and Wave Surfer, with reference to Russ[26], to enable identification of bat species.

[22] SNH, (2016) Protected Species Advice for Developers (Guidance notes on otter, water vole, red, squirrel, pine marten and Scottish wildcat). Guidance on planning and protected animals. Available at: https://www.nature.scot/professional-advice/planning-and-development/natural-heritage-advice-planners-and-developers/planning-and-development-protected-animals. Accessed: September 2017

[23] SNH (2001) Scotland's Wildlife: Badgers and Development

[24] Hundt, L.(2012) Bat Surveys: Good Practice Guidelines, 2nd edition. Bat Conservation Trust. London

[25] Collin,J. (ed) (2016) Bat Surveys for Professional Ecologists: Good Practise Guidelines (3rd Edition) The Bat Conservation Trust. London

[26] Russ, J (2012) British Bat Calls: A Guide to Species Identification. Pelagic Publishing

Remote Static Activity Surveys

9.4.12. Remote Static Activity Surveys at (ground level) were undertaken using AnaBat SD2 bat detectors across three seasonal survey sessions (A - C) during the 2018 bat survey season as detailed in **Appendix 9.3**. Nine AnaBats were deployed during each survey session for a minimum of five consecutive nights across a range of habitat, within two broad habitat classifications, defined as either edge or open. Edge habitats were defined as those of higher value to commuting or foraging bats and included habitats within 50 m of woodland edge, riparian features or linear features such as a hedgerow. Open habitats were defined as more exposed areas, that were outwith 50 m of Edge habitat, such as felled woodland or grassland habitats.

9.4.13. The AnaBats recorded from approximately half an hour before sunset until approximately half an hour after sunrise. Ultrasonic recordings were analysed with AnalookW Software with reference to Russ[26], to enable identification of bat species.

Preliminary Roost Assessment Surveys

9.4.14. Surveys to identify potential bat roosting habitats within trees and structures were carried out during the Extended Phase 1 Habitat Survey in April 2018 (**Appendix 9.1**) and during Protected Species Surveys in June 2018 (**Appendix 9.2**). The aim of this survey was to identify actual or potential roost sites and to assess if further surveys, such as emergence/re-entry surveys were required to inform the assessment of bat habitat use across the Bat Survey Area.

Fisheries Surveys

9.4.15. Fisheries Surveys were carried by Galloway Fisheries Trust (GFT) by Scottish Fisheries Co-ordination Centre (SFCC) qualified surveyors between the 22nd and 30th of August 2018. Surveys were carried out across nine Fisheries Survey Sites (FSS) on the Water of Ken, its associated tributaries, including one small tributary of the Water of Deugh. A summary of each FSS is presented in Table 9.3 below, with further information, as well as detailed survey methods, presented in **Appendix 9.4**.

Table 9.3: Fisheries Survey Sites

Fisheries Survey Site	Primary Watercourses	Grid Ref	
		X	Y
1	Poldores Burn	263244	596208
2	Drumpail Burn	263553	595151
3	Craigengillan Burn	262530	594270
4	Black Burn	263256	593715
5	Water of Ken/Black Burn	263448	593168
6	Dry Burn	262884	591670
7	Water of Ken/Kirkcudbright Dee	262566	590956
8	Marbrack Burn	261375	595062

9 (Control)	Water of Ken	264836	596140

Fisheries Habitat Survey

9.4.16. At each site an assessment was made of the instream habitat available for older (parr aged) fish, by grading instream cover present as none, poor, moderate, good or excellent. In accordance with SFCC protocols[28], percentage estimates of depths, substrate type and flow type at each site were also recorded. Additionally, percentage estimates of the quantity of the bankside features undercut banks, draped vegetation, bare banks and marginal vegetation were made.

Fish Fauna Survey

9.4.17. Fish faunal surveys were carried out via electro-fishing methods to record Atlantic salmon (*Salmo salar*) and brown trout (*Salmon trutta*) fry and parr (juvenile salmonid age classifications) populations present in watercourses with the potential to be impacted by the Proposed Development. In order to obtain fully quantitative information on the fish populations, each survey site was fished through up to four times consecutively to allow a more accurate calculation of Zippin estimate[27] to be carried out. This is an estimate of the fish population density per 100 m2 of water, including the 95% confidence limits. When the calculation of a Zippin estimate of the population is not possible, a minimum estimate of the fish population is given for that section of river.

9.5. Scoping Responses and Consultation

9.5.1. Throughout the scoping exercises, and subsequently during the ongoing EIA process, relevant organisations were contacted with regards to the Proposed Development. Table 9.4 outlines the consultation responses received in relation to Ecology.

Table 9.4: Summary of Consultation Responses

Consultee	Details	Where Addressed in EIA Report
Dee District Salmon Fisheries Board (Kirkcudbrightshire) via Galloway Fisheries Trust (GFT).	Consider biosecurity especially in regards to invasive crayfish species.	Section 9.9
	EIA report should contain details regarding fish monitoring to be conducted pre-construction, during construction and post-construction surveys.	Section 9.4, 9.6, 9.9 and Appendix 9.4
	Suitable update baseline fisheries surveys are required and must occur between July and September and must adhere to	Section 9.4, 9.6 and Appendix 9.4

Consultee	Details	Where Addressed in EIA Report
	Scottish Fisheries Co-ordination Centre (SFCC) standards[27][28].	
	GFT may hold fisheries data that is available to augment updated baseline survey information, and a license is to be obtained from the GFT.	Section 9.6 and Appendix 9.4
Fisheries Management Scotland	It is important that the proposals are conducted in full consultation with KDSBB and GFT these organisations. Advise following Marine Scotland Science (MSS) advice on engaging with planning process for terrestrial wind farms.	See Section 9.5and Appendix 9.4
Marine Scotland Science (MSS)	Cumulative impacts of present and proposed windfarms in the area on fisheries and hydrology should be assessed.	Section 9.10 and Chapter 13: Hydrology
	Potential impact of felling on water quality and aquatic biota should be discussed in the EIA Report as well as a list of nitrates and phosphates included.	Chapter 13: Hydrology
	Potential impacts upon Groundwater Dependent Terrestrial Ecosystems (GWDTE), abstractions and Buffers must be assessed and mapped.	Sections 9.6, 9.8 and Chapter 13: Hydrology and Appendix 9.3
	Surveys should be carried out to determine populations of macroinvertebrates and fish.	Section 9.4 and Appendix 9.4
RSPB	Support SNH advice that NVC habitat survey should be undertaken for any Annex 1 or UKBAP Priority Habitats and design should minimise impacts to these habitats.	Section 9.7 and Appendix 9.1
SEPA	Design and development must avoid impacts to GWDTE. Map showing locations of GWDTE and buffers.	Sections 9.4, 9.7 and 9.8

[27] SFCC (2007) Electrofishing Team Leader Training Manual - Fisheries Management SVQ Level 3: Manage Electrofishing Operations.
[28] SFCC (2007) Habitat Surveys Training Course Manual

9.6. Baseline Conditions

Desk Study Results

Designated Sites

9.6.1. A review of the SNH Information service (SNHi[29]) identified only one site of (non-avian) nature conservation value within the Desk Study Area (see Table 9.5 and **Figure 9.1**). No SACs were recorded within the Desk Study Area.

Table 9.5: Statutory Designated Sites within Desk Study Area

Site Name	Designation	Distance and Direction	Description/Principal Interest
Cleugh	SSSI	3.5 km S	Best example of unimproved lowland neutral grassland in the region.

9.6.2. No Local Nature Reserves (LNRs) or Local Wildlife Sites lie within the Desk Study Area. The only non-statutory designated site found within the Desk Study Area was Dundeugh Wood, which is listed in the Ancient Woodland Inventory (AWI) and lies to the south of the Proposed Development.

Protected and Notable Species Records

9.6.3. Biological records were returned by SWSEIC; however, no data was returned by Dumfries and Galloway Bat Group, Red Squirrels in South Scotland, Scottish Wildlife Trust Galloway Fisheries Trust, or Nith District Salmon Fisheries Board. This was primarily because all biological records held by these organisations are handled by SWSEIC or are available via publically available resources. Table 9.6 provides a summary of protected or notable species recorded within the Desk Study Area, as returned by the SWSEIC and a search of publically available records.

Table 9.6: Protected and Notable Species Records within Desk Study Area

Species	Latin name	Date of Record	No of Record	Conservation Status	Closest Proximity to Site
Daubenton's bat	*Myotis daubentonii*	2016	5	EU, SBL, LBAP	6.9 km
Natterer's bat	*Myotis nattereri*	2016	4		0.7 km
Noctule bat	*Nyctalus noctula*	2016	17		3.6 km
Common Pipistrelle	*Pipistrellus pipistrellus*	2008-2016	11		0.7 km
Soprano Pipistrelle	*Pipistrellus pygmaeus*	2016	13		0.7 km
Brown Long-eared bat	*Plecotus auritus*	2003-2016	4		9.5 km

[29] SNHi Site Link. Available at: https://gateway.snh.gov.uk/sitelink/. Access September 2018

Species	Latin name	Date of Record	No of Record	Conservation Status	Closest Proximity to Site
Unidentified Myotis bat	*Myotis sp.*	2006	6		3.0 km
Whiskered/ Brandt's Bat	*Myotis mystacinus/ brandtii*	2016	2		2.9 km
Badger	*Meles meles*	2006	1	UK, SBL	5 km
Red squirrel	*Sciurus vulgaris*	2001-2017	17	UK, LBAP, SBL	2.0 km
Adder	*Vipera berus*	2003-2016	6	SBL, LBAP	3.0 km
Common frog	*Rana temporaria*	1998-2008	2	SBL	3.4 km
Common Toad	*Bufo bufo*	1999-2008	2	SBL	3.4 km

9.6.4. The following invasive species were also recorded within the Desk Study Area:

- North American signal crayfish (*Pacifastacus leniusculus*); 1 record (2016) immediately outwith the Site (south east); and,
- American mink (*Neovison vison*); 2 records (2015 & 2017), the closest within 1.3 km of the Site.

Baseline Survey Results

Extended Phase 1 Habitat Survey

9.6.5. A summary of the Phase 1 habitats recorded within the Survey Area is provided in Table 9.6 below, with mapped habitats presented in **Figure 9.2**. Information regarding the survey results is presented in **Appendix 9.2**. Habitat calculations are based on the total estimated area of the Site of 751.6 ha, with area numbers rounded up to the one decimal point. Estimates of area are based on visual observation by the surveyor, which were then digitised with GIS.

9.6.6. Within the Site habitats are overwhelmingly dominated by coniferous plantation of various ages, which comprise approximately 77.7% of the habitat recorded. In accordance with the Wetland Typology of Scotland[30] wetland habitats recorded within the Site were limited to marshy grassland.

9.6.7. Vegetative communities within the above wetland habitat may have potential for moderate groundwater dependency, depending on the underlying hydrogeological setting in accordance with SEPA guidance[13].

[30] SNIFFER (2009) A Functional Wetland Typology for Scotland. Available at: http://www.fwr.org/environw/wfd95.htm. Access September 2018

Table 9.7: Summary of the Phase 1 Habitats recorded in Survey Area

Habitat (JNCC Code)	**Description**	**Area* (ha)**	**Area as a % of Survey Area**
Coniferous woodland – plantation (A1.2.2)	Coniferous woodland is the most dominant habitat recorded in the Survey Area. This habitat was dominated by Sitka spruce (*Picea sitchensis)* and European larch *(Larix decidua)*. Extensive felling and re-planting has been undertaken throughout Survey Area; therefore, the age and understorey flora varied significantly. Mature plantation woodland (361.20 ha) generally contained no ground flora or was dominated by mosses (*Bryophyta spp).* In juvenile to semi mature woodland (241.90 ha), ground flora varied depending on age, but the dominant habitat was marshy grassland with species poor ground flora, as well as moss and blanket mire also recorded. The ground flora within younger plantation woodland was primarily tufted hair-grass (*Deschampsia cespitosa)* and soft rush (*Juncus effuses) dominated* neutral grassland. Woodland rides throughout the Site were dominated by purple moor-grass (*Molinia caerulea*) marshy grassland and blanket mire habitat was present as a coniferous plantation understory habitat in the south-western corner of the northern section of the Survey Area where the water table was high. Coniferous plantation was historically planted on previous bog habitat, which has since been degraded; however, due to poor forestry drainage within this area, some bog species, such as red bog moss (*Sphagnum capillifolium*), papillose bog-moss (*Sphagnum papillosum*), red-stemmed feathermoss (*Pleurozium schreberi*), bog haircap moss (*Polytrichum strictum*) and magellanic bogmoss (*Sphagnum magellanicum*), have been able to become more established than in other areas of coniferous plantation within the Site. Mire habitat, in addition to lying underneath coniferous plantation, was largely intersected with areas of grassland including Hare's-tail cotton-grass (*Eriophorum vaginatum*) and deer-grass (*Trichophorum germanicum*), and bog species were not considered dominant. As a result, this habitat is considered to fall within the classification of modified bog.	603.1	80.2 %
Felled plantation woodland (J5)	Felled woodland was extensive throughout Survey Area and most prevalent in the northern section of the Survey Area. Vegetation was limited in these areas and was dominated by wood brash; other areas of no ground flora, species poor ground flora, or those dominated by species of marshy grassland habitats with soft rush, tufted hair-grass and bent grasses *Agrostis spp.* recorded.	118.3	15.8%

Habitat (JNCC Code)	Description	Area* (ha)	Area as a % of Survey Area
Marsh/marshy grassland (B5)	Marshy grassland habitat recorded was species poor and dominated by purple moor-grass and soft rush. Other flora recorded included bracken (*Pteridium aquilinum)*, dock (*Rumex sp*) and marsh thistle (*Cirsium palustre*). Within the wetter areas, such as in woodland rides and edges, this habitats formed a mosaic of blanket mire with moss species (see above). This habitat was recorded throughout the Survey Area, and particularly in areas of felled plantation, where soft rush dominated.	14.8	2.0%
Bare ground (J5)	Forestry roads were present throughout the Site; sporadic species on either side of the tracks included dock, marsh thistle, spear thistle (*Cirsium vulgare*), bracken, broad-leaved plantain (*Plantago major*), selfheal (*Prunella vulgaris*) and heather (see 'Dry heath/acid grassland' above).	7.1	0.9%
Dry heath/acid grassland-dry heath mosaic (D5)	Dry heath/acid grassland - dry heath mosaic was primarily recorded in small areas along access track verges. This habitat has been heavily affected by felling activities and did not display a continuous habitat swathe. Heather (*Calluna vulgaris*) was the dominant species, with blaeberry (*Vaccinium myrtillus*), pleurocarpous mosses (Hypnum jutlandicum) , rush species (*Juncaceae spp*), bog haircap moss, *Racomitrium lanuginosum*, red-stemmed feathermoss ,*Sphagnum magellanicum* and scattered coniferous trees (predominantly semi mature sitka spruce) also recorded. This habitat was assessed to best correspond to the H12 *Calluna vulgaris–Vaccinium myrtillus* heath vegetative community, and is both a UK Biodiversity Action Plan priority habitat and an Annex 1 habitat.	3.6	0.5%
Broadleaved woodland - plantation (A1.1.2)	Recently planted broadleaf plantation was recorded in the northern section of the Survey Area. This habitat consisted of oak (*Quercus sp*), common alder (*Alnus glutinosa*), rowan (*Sorbus aucuparia*) and silver birch (*Betula pendula*).	3.1	0.4%
Quarry (I2.1)	Two quarries were recorded within the Survey Area with negligible floral diversity and consisting entirely of bare rock.	1.3	0.2%
Running water (G2)	Black Burn, Goat Burn and Craigengillan Burns were the primary watercourses recorded in the Survey Area. All three were connected to the Water of Ken in the East, located outwith the Survey Area. Multiple small burns and ditches were also recorded across the Site, most notably in plantation woodland under dense canopy cover.	N/A	
Wall (J2.5)	Multiple dry-stone walls and sheep folds are situated throughout the Survey Area, bryophytes recorded included rough-stalked feather-moss *Brachythecium rutabulum*.	N/A	
**Estimates of area are based on visual observation by surveyor digitised with GIS*			

Table 9.8: Summary of Fisheries Survey Results

Fisheries Survey Site	Instream Habitat Grading	Salmonids recorded	
		Atlantic salmon	Brown trout
1	Good	No fry or parr recorded	fry & parr in low density
2	Excellent		fry & parr in low density
3	Moderate		parr in low density
4	Moderate		parr in moderate density
5	Good		fry & parr in low density
6	Moderate		fry & parr in low density
7	Good		fry & parr in very low density
8	Moderate		fry in high density & parr in low density
9 (Control)	Moderate		fry in low density

9.6.8. In addition to brown trout, European eel (*Anguilla anguilla*), stoneloach (*Barbatula barbatula*) common minnow (*Phoxinus phoxinus*), northern pike (*Esox lucius*), European perch (*Perca fluviatilis*) were also recorded. Furthermore, the non-native invasive species North American signal crayfish was recorded at three FSS locations (2, 5 and 9, see Table 9.8, above) during the surveys.

9.7. Assessment of Ecological Importance

9.7.1. The following Section evaluates the nature conservation value of the habitats and species present within or in the immediate vicinity of the Site. Each ecological feature has been assigned a level of importance in accordance with the geographical scale outlined in Table 9.1. Where nature conservation sites have designations at different levels (international, national and regional/county/local), the highest level of importance is assigned. Table 9.9 below summarises the importance of ecological features identified with potential for impact from the Development.

Table 9.9: Assessment of Importance of Ecological Features

Ecological Feature	Evaluation Rationale	Reason	Importance
Nationally and Internationally Designated Statutory Sites			
Cleugh SSSI	Best example of unimproved lowland neutral grassland in the region. As this is a nationally designated site, it is considered of national importance, and therefore is **scoped in** for further assessment.	Nationally designated	**National**
Phase 1 Habitats within the Site			
Coniferous woodland – plantation (A1.2.2)	Coniferous woodland was the most abundant habitat recorded during baseline surveys, and accounted for 77.73% of the total land area of the Site, which was actively being felled at the time of survey. The majority of coniferous plantation was mature (thicket stage), and where this has not yet been felled, this is dominated by Sitka spruce with limited ground flora. In areas of juvenile to semi mature (pre-thicket) woodland ground flora was more varied, however generally poor in species diversity. Coniferous plantation habitat is of low conservation value, however it is included as priority habitat within the DGLBAP, where priority actions involve the targeted conversion of coniferous plantation to broadleaf woodland, as well as high forest stage plantation retention. As presented in Table 9.7, an area of modified bog habitat was recorded as a secondary understory habitat within an area of coniferous plantation habitat. As the dominant habitat in this area is coniferous plantation, the area is classified in the context of this assessment as coniferous plantation. Although modified bog exists within this area it only occurred in one localised and isolated area within the Site, and constituted only 2.5% of the total area of the Site. As a result there is little benefit in restoring this habitat to bog. A total of 19.04 ha of this habitat will be lost as a result of the development (turbines layout and related infrastructure), which represents 72.45% of the total area of habitat loss, and 2.5% of the total area of the Site. Coniferous plantation woodland is a common and widespread habitat throughout Scotland and Dumfries & Galloway, and within the Site this habitat is dominated by non-native commercial tree species of low ecological value and generally low biodiversity, therefore is considered of less than local importance and is **scoped out** of further assessment**.**	Although the dominant habitat type within the Development Site, the coniferous plantation is at various stages of harvesting and is of low ecological value.	Less Than Local

Ecological Feature	Evaluation Rationale	Reason	Importance
Felled plantation woodland (J5)	Felled coniferous plantation accounted for 15.74% of the total land area of the Site. Although of negligible conservation value, woodland edge habitats created by felled plantation may provide localised value to commuting bats. Furthermore brash and tree stumps may provide suitable foraging and basking habitat for reptiles, as well as rodent prey species to support local predators population. These potential benefits are considered to be both temporary and localised, and are therefore considered of limited value to ecology and biodiversity. A total of 3.45 ha of this habitat will be lost as a result of the development (turbines layout and related infrastructure), which represents 13.13% of the total area of habitat loss, and 0.45% of the total area of the Site. In light of the above, this habitat is considered of less than local value, and therefore is **scoped out** of further assessment	Habitat is of negligible conservation value, as well as limited value to ecology and biodiversity.	Less than Local
Marsh/marshy grassland (B5)	Marshy grassland is very limited within the Site, and constituted only 2% of the total area of the Site. The habitats is was species poor and dominated by purple moor-grass and soft rush, and is considered of low biodiversity value and of low ecological potential. Marshy grassland habitats can be considered a potential GWDTE of moderate dependency, however due to the habitat's presence in close proximity to watercourse and forest rides, as well its relationship with the topography and the underlying geology of the Site (see Chapter 12 & 13), this habitat is assessed to be surface water fed, and therefore not a GWDTE. A total of 1.14 ha of this habitat will be lost as a result of the development (turbines layout and related infrastructure), which represents 4.34% of the total area of habitat loss, and 0.15% of the total area of the Site. Marshy grassland is a common and widespread habitat throughout Scotland and Dumfries & Galloway, and is both very limited and localised within the Site, and is therefore considered of less than local importance and is **scoped out** of further assessment.	Marshy grassland is a common and widespread habitat, very limited within the Site, and of low ecological value.	Less than Local
Bare ground (J5)	This habitat is comprised primarily of forestry tracks, and is considered of very low biodiversity potential and ecological value. A total of 1.30 ha of this habitat will be lost as a result of the development (turbines layout and related infrastructure), which represents 4.95% of the total area of habitat loss, and 0.62% of the total area of the Site. In light of the above, this habitat is considered of less than local value, and therefore is **scoped out** of further assessment	This habitat is of very low ecological value.	Less than Local

Ecological Feature	Evaluation Rationale	Reason	Importance
Dry heath/acid grassland-dry heath mosaic (D5)	Although dry heath mosaic has the potential to support fauna such as invertebrate and reptile populations, due to its very localised and fragmented occurrence within the Site, it is considered to have relatively low biodiversity potential and low ecological value. A total of 0.65 ha of this habitat will be lost as a result of the development (turbines layout and related infrastructure), which represents 2.47% of the total area of habitat loss, and 0.09% of the total area of the Site. This habitat is a common and widespread habitat throughout Scotland and Dumfries & Galloway, and is both very limited and localised within the Site, and is therefore considered of less than local importance and therefore is **scoped out** of further assessment.	This habitat is of low biodiversity value and very localised within the Development Site, therefore is considered of low ecological value.	Less than Local
Quarry (I2.1)	Quarry habitat supports typical pioneer plant species and has the potential to support sheltering and basking common and widespread reptile species. However this habitat is very localised within the Site is generally of low biodiversity potential and limited ecological value. A total of 0.70 ha of this habitat will be lost as a result of the development (turbines layout and related infrastructure), which represents 2.66% of the total area of habitat loss, and 0.15% of the total area of the Site. In light of the above, this habitat is considered of less than local value, and therefore is **scoped out** of further assessment	This habitat is very localised and of limited ecological value.	Less than Local
Running water (G2)	Watercourses within the Site compromised of tributaries of Water of Ken and the Water of Deugh, and also included a number drainage ditches, likely associated with plantation forestry. This habitat has localised potential to support otter as well as brown trout, and American crayfish, however the assigned importance, as well as any further assessment, has been carried out in the context of the species, rather than the habitat. Further assessment of the potential impacts on running water is included within Chapter 13: Hydrology. None of this habitat will be lost to Development related works. In light of the above, running water habitats are considered of local value, and therefore is **scoped out** of further assessment.	This habitat is localised and of moderate ecological value.	Local

Ecological Feature	Evaluation Rationale	Reason	Importance
Wall (J2.5)	Dry stone wall habitat is very localised within the Site, and generally considered of low biodiversity potential and limited ecological value, however it may offer localised suitable sheltering and basking habitat for common and widespread reptile species. None of this habitat will be lost to development related works. In light of the above, this habitat is considered of less than local value, and therefore is **scoped out** of further assessment.	This habitat is very localised and of limited ecological value.	Less than local
Protected and Notable Species within the Site			
Bats	All Bats in Scotland are European Protected Species and therefore afforded international protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Bats species are also listed as priority species in the LBAP and the SBL. Due to this high level of protection, and the potential for bats to be affected by operational wind farms [31] bats are considered an IEF. As the Site is dominated by conifer plantation, the value of habitats present are considered to be generally of low value. However localised areas of higher value, are present, and connectivity to comparatively high quality foraging habitats, such as the water of Ken, in the wider area does exist. This region of Scotland is known to support populations of *Nyctalus* bat species, considered at high risk from wind farm development, and these species were recorded to use the Site, albeit very occasionally in very low numbers. It is considered that due to the lack of suitable habitats for the species, which are known to primarily utilise broadleaved woodland for foraging and roosting, the Site is of low value to *Nyctalus* species. In light of the above, bat species are considered an IEF of regional value, and therefore **scoped in** for further assessment within this Chapter (see Section 9.10).	Bat species utilise habitats within the Site and surrounding environment, with the local populations containing low numbers of regionally import species.	**Regional**

[31] Mitchell-Jones, T & Carlin, (2014) Natural England Technical Information Note TIN051. Bats and onshore wind turbines, Interim guidance. Third edition, 11 March 2014

Ecological Feature	Evaluation Rationale	Reason	Importance
Otter	The otter population at the Site is deemed of regional importance in the context of this ECiA. Otter is 'European Protected Species' (EPS), as well as a priority species in the DGLBAP, categorised as 'Near Threatened' in the International Union of Conservation of Nature (IUCN) Red List (IUCN, 2016), and is listed on the SBL. Otters have been recorded using habitats within the Site and surrounding environment. Although the habitats present on Site are broadly considered to be of lower value to those in the wider area, such as the Water of Ken, some habitats within the Site are considered of moderate value to local otter populations as an occasional or seasonal resource. Furthermore, otters have been recorded to be predating on the non-native invasive species American signal crayfish, so could be considered important in the context of biosecurity. In light of the above, otters are considered an IEF of regional value, and therefore is **scoped in** for further assessment within this Chapter (see Section 9.10).	Otters utilise habitats within the Development Site and surrounding environment.	**Regional**
Pine marten	Pine martens and their dens are protected under the Wildlife and Countryside Act 1981 (as amended) and the Nature Conservation Act 2004 and is listed on the SBL Pine martens are distributed throughout much of mainland Scotland, with continued expansion and population recovery and have an established present southern Dumfries and Galloway[32]. No evidence of pine marten was recorded during baseline surveys or the desk study, however as the Site lies within the regional range of the species, the presence pine marten cannot be ruled out. In light of the above, the species is considered of local value, and therefore is **scoped out** of further assessment.	Pine marten are not present within the Site, however the Site lies within the regional range for the species.	Local
Water vole	Water vole is listed on Schedule 5 of the Wildlife and Countryside Act 1981(as amended), as well as the SBL, and is a Priority Species listed in the SAF for Scotland. No evidence of water vole was recorded during baseline surveys or the desk study, and habitats recorded on Site were largely of low suitability to support the species. Although some limited suitably was recorded, and the Site lies within the regional range of the species, the presence of American mink, known as a primary reason for the decline of the species, the presence of the water vole is considered unlikely. In light of the above, the water vole is considered of local value, and therefore is **scoped out** of further assessment.	Water voles are not present within the Site, and habitats are of limited suitably.	Local

[32] Birks, J (2017) Pine Martens: the British Natural History Collection. Whittet Books

Ecological Feature	Evaluation Rationale	Reason	Importance
Badger	Badgers and their setts are fully protected by the Protection of Badgers Act 1992 (as amended by the Wildlife and Natural Environment (Scotland) Act, 2011). No setts or evidence of badger was identified within the Site or surrounding environment during baseline surveys; however badger was recorded during the desk study confirming the presence in the local area. Although coniferous plantation and clear-fell is considered of limited potential to support setts, habitats may be utilised by foraging badger on an occasional basic, and therefore the presence of the species cannot be ruled out. In light of the above, the badger is considered of local value, and therefore is **scoped out** of further assessment.	Badger are not present within the Site, and habitats are of limited suitably.	Local
Red squirrel	Red squirrel and their dreys are protected under the Wildlife and Countryside Act 1981 (as amended) and are listed as a priority species both on the DGLBAP, and on the SBL. Signs of red squirrels were recorded during baseline surveys and during the desk study, however no dreys were recorded. Although conifer plantations provides suitable habitat for red squirrel, these habitats within the Site were dominated by Sitka spruce, a tree species considered less favourable to the species, compared to other coniferous species, and coniferous woodlands with as greater species diversity**Error! Bookmark not defined.**. urthermore, large areas of the Site were clear felled or recently replanted woodland, and therefore considered unsuitable to support red squirrel foraging and drey construction. In light of the above, red squirrel is considered of local value, and therefore is **scoped out** of further assessment.	Red squirrel are present within the Site, but habitats are of largely of limited suitably.	Local
Fish Species	Although habitats of moderate to high suitability to support juvenile salmonids were identified in the watercourses draining land within the Site, fish populations recorded were dominated by low densities of resident brown trout, with no legally protected fish species, such as Atlantic salmon, or lamprey species recorded. Furthermore, no watercourses draining land within the Site are classified as Marine Scotland; Scottish Salmon Rivers[33], and no connectively to such classified areas (such as the southern aspects of the Water of Ken) are available due to dams on Loch Kendoon, which likely form a barrier to salmon migration. In light of the above, fish species are considered of less than local value, and therefore is **scoped out** of further assessment.	No protected fish species were recorded, with only low densities of common and widespread fish species recorded.	Less than Local

[33] https://marinescotland.atkinsgeospatial.com/nmpi/

Ecological Feature	Evaluation Rationale	Reason	Importance
Reptiles	Viviparous lizard was recorded during baseline surveys with adder recorded during the desk study. Both of these species are protected under the Wildlife and Countryside Act 1981 (as amended) against intentional or reckless killing and injuring. The aforementioned reptiles species are all included on the SBL, and adder is included the DBLBAP. Localised areas within the Site included rough grassland, heathland and felled plantation habitats considered suitable for foraging, sheltering and basking for reptiles, however the majority of the Site was dominated by coniferous plantation, a habitat not consider suitable to support reptiles. In light of the above, reptiles considered of less than local value, and therefore are **scoped out** of further assessment.	Common lizard was recorded, however the majority of habitats on Site were unsuitable to support reptile species.	Less than Local
Amphibians	Although no amphibians were recorded during baseline surveys, both common toad and common frog were recorded during the desk study. Both of these species are protected under the Wildlife and Countryside Act 1981 (as amended) against intentional or reckless killing and injuring. The aforementioned reptiles species are all included on the SBL, and adder is included the DBLBAP. Although the lack of ponds and waterbodies meant the Site was unsuitable for breeding amphibians, localised areas within the Site such as bog, marshy grassland and riparian habitats, were considered suitable for foraging amphibians, however the majority of the Site was dominated by coniferous plantation, a habitat not considered suitable to support amphibians. In light of the above, amphibians are considered of less than local value, and therefore are **scoped out** of further assessment.	No amphibian species were recorded on Site, and majority of habitats on Site were unsuitable to support amphibians.	Less than Local

9.7.2. Although Cleugh SSSI has been assessed to be an IEF of National importance, it has been **scoped out** of further assessment as there is no potential for significant impact from the Proposed Development, due to the absence of unimproved lowland neutral grassland at the Site, and the designation's distance from the Site.

9.7.3. Following the evaluation of the results and importance outlined in Table 9.9, the following IEFs are **scoped out** of the EcIA, on the basis that they are considered of local or less than local importance, or there is no potential for significant impact from the Development:

- Coniferous plantation woodland;
- Marshy grassland;
- Dry heath/acid grassland mosaic;
- Running water;
- Quarry habitat;
- Pine marten;
- Badger;
- Water vole;
- Red squirrel;
- Fish species;
- Reptile species; and
- Amphibian species;

9.7.4. Although the above IEFs have been **scoped out** of further assessment within this Chapter, measures to mitigate potential impacts on these IEFs have been included to ensure legislative compliance of works as well as adherence to accept industry best practise (see Section 9.9).

9.7.5. IEF **scoped into** the assessment are limited to:

- Bats; and
- Otter.

9.8. Embedded Mitigation

9.8.1. Application of the 'mitigation hierarchy' has been achieved throughout the development process, with identification and incorporation of methods for avoidance of impact, application of embedded mitigation, compensation and enhancement within the EcIA.

Mitigation by Design

9.8.2. Throughout the design process, an informed approach has been taken when determining the Proposed Development layout, to mitigate potential for impact to IEFs through design. Where possible, care has been taken to avoid IEFs.

Mitigation by Practice: Construction

9.8.3. In addition to the incorporation of effective mitigation through design, the following sections outline mitigation of Proposed Development impacts through practice, particularly to ensure the safeguarding of protected species during construction and operation. It is anticipated that these elements will be included in construction environmental management plan (outline CEMP in

Appendix 4.1) and protection plans, as part the wider environmental management of construction and operation.

Ecological Clerk of Works (ECoW)

9.8.4. Mitigation by practice includes measures which will be implemented before and during the construction phase. A suitably qualified and experienced Ecological Clerk of Works (ECoW) will be appointed to provide ecological and environmental advice during construction, including the monitoring of compliance with the recommendations of this EIA Report and subsequent planning conditions.

9.8.5. Before construction begins, the ECoW and project hydrologist will undertake a review of design and drainage plans to inform the requirement for micro-siting, to minimise the potential for effects to habitats of conservation concern, and to assist in the identification of appropriate locations for commencement of habitat restoration works. Where possible, the ECoW will advise on the drainage design to minimise hydrological disruption and reduce the risk of scour and erosion. The ECoW will also monitor and advise on the implementation of pollution prevention and good working practices throughout construction, to protect both terrestrial and aquatic ecosystems from accidental pollution.

Construction Phase Mitigation for Protected Species

9.8.6. Pre-construction surveys for protected species will be undertaken within the working areas and appropriate buffers, to identify changes in the distribution and abundance of protected species from baseline conditions. Updated ecological information obtained from the pre-construction protected species surveys will be used to inform and guide the implementation of species protection plans, for the identification of licencing requirements and appropriate mitigation

Construction Phase Mitigation for Invasive Species

9.8.7. Where works are to take place in or in close proximity to watercourses, particularly where proposed access tracks cross watercourses where North American signal crayfish have been recorded, such as the Crainengillan Burn, the potential exists for the invasive species to be accidentally spread or released, which would constitute a legal offence.

9.8.8. Although there is little information concerning interactions between signal crayfish and salmonid fish, preliminary studies by the Fisheries Research Services (FRS) have shown that North American signal crayfish can exclude juvenile salmon from shelters during winter, which would increase the vulnerability of wild salmon to predators. It is therefore feasible that the continued spread of this species could detrimentally impact salmonid fish species utilising the Site and watercourse in the wider area.

9.8.9. In order to mitigate this potential risk and to ensure Development works are legally complaint, a Construction Biosecurity Plan (CBP) will be written and implemented ahead of the commencement of the construction phase. The CBP will be subject to approval by the local planning authority and will aim to ensure

works do not facilitate the spread of signal crayfish. The implementation of the CBP will be monitored by the ECoW.

Construction Phase Mitigation for Habitats

9.8.10. Felling required for the Proposed Development aims to continue the ongoing restructuring of the woodland during the construction phase. Restructuring the age class and species of such forests via felling and restocking has the potential to improve the ecological value of the coniferous woodland (see Chapter 7: Forestry), which includes areas of onsite compensatory planting to offset the loss of woodland area resulting from the Proposed Development. No additional felling for wind resource is planned during the operational period.

9.8.11. Although no sensitive peatland habitats were recorded with the Site, it is acknowledged that coniferous plantation was historically planted on areas of peat, and bog/mire habitats make up some of the understory habitats within areas of the plantation woodland. Therefore embedded mitigation will ensure implementation measures to reduce potential for disturbance effects, such as the installation of cross-drains to maintain hydrological connectivity under access tracks, and good practice for the management and storage of peat (including appropriate use of vegetated turves) to ensure effective re-use as part of reinstatement works.

Mitigation by Practice: Operation

9.8.12. Best practice mitigation measures will be adopted to minimise the risk of bats colliding with operational turbines, in accordance with Natural England published guidance[31], as adopted by SNH. Turbines (specifically the blade tips) will have a 50 m separation distance between high-value bat habitats, such as riparian features and forest edges. Although this offset has been included in the design of the Proposed Development, it must be maintained throughout the operational life of the Proposed Development, such as by ensuring tree regeneration does not take place within this offset buffer. Any proposed restocking will ensure incorporation of a 50 m separation distance (between turbine blade tips and high value bat habitats), through inclusion in the finalised restocking plan design.

9.8.13. The potential for operational effects of accidental collision and barotrauma on bats has been recognised. At the time of writing, guidance for the survey and assessment of bats and wind farms is currently under review, and it is expected that the updated guidance will include provisions for operational monitoring. This should be considered along with further consultation with SNH, to determine the requirement for post-construction monitoring at the Proposed Development. Should the updated guidance confirm a requirement for post-construction monitoring, this should be developed to identify and minimise the risk of collision and barotrauma to bats. The programme of post-construction monitoring should be detailed within a bat monitoring and mitigation plan and treated as a live document throughout the operation of the Proposed Development, to account for any further changes in guidance or baseline conditions.

Mitigation by Practice: Decommissioning

9.8.14. Decommissioning activities are anticipated to be of a similar nature to those of Proposed Development construction; therefore, the embedded mitigation outlined in Sections 9.5.5 to 9.5.15 above is also considered relevant to the decommissioning phase.

9.9. Ecological Impact Assessment

Assessment of Potential Effects

Bats

9.9.1. Bat activity across the Site was generally low, with a mean BAI of 7.61 pph, the equivalent to a single bat pass being recorded every 7.88 minutes. This activity varied considerably across the Site; from no activity at Location B during Session 1, to 62.25 pph recorded at locations E, which represents a single bat pass being recorded approximately every minute. BAI is not a reflection of population size, but an indicator or relative activity levels. Although notably higher in the context of the site, this level of activity is still considered relatively low, and is likely due to the lack of optimal foraging habitats, such as broadleaved woodland.

9.9.2. The lack of broadleaved woodland with the Site is likely the reason for such a limited presence of woodland specialist species, such as the high risk species[34], noctule and Leisler's bats, and accounts for the dominance of soprano and common pipistrelles, common and widespread species, with broad habitats requirements.

9.9.3. As outlined above, low levels of bat foraging and commuting activity of predominately common and widespread bat species were recorded within the Site; furthermore no bat roosts were recorded within the Site or surrounding area. It is however acknowledged that wind farm development may result in direct and indirect effects to bats including displacement caused by loss of foraging and commuting habitats, disturbance and harm through loss of roosts during construction, and direct operational effects such as mortality and harm caused by turbine collisions.

Construction: Habitat Displacement

9.9.4. The long-term clearance and re-stocking of coniferous plantation is certain to represent a change in coniferous plantation habitat from baseline conditions, which may reduce the short-term value of these habitats for bats. A short term reduction in utilisation potential may result in the displacement of a small number of foraging or commuting bats through direct habitat loss. Displacement of bats from previously utilised habitats may result in a minor reduction in fitness to individual bats and an increase in sensitivity of individuals and populations to ecological and environmental pressures; however the extent of effect is considered small in scale and limited to the Site

[34] Mitchell-Jones, T & Carlin, (2014) Natural England Technical Information Note TIN051. Bats and onshore wind turbines, Interim guidance. Third edition, 11 March 2014

population. Although some displacement may occur in the short term, phased felling may create some additional edge habitats suitable to be utilised by foraging bats in the short term, including those displaced. In the longer term, restocking will take place across the Site and will include areas of mixed broadleaved woodland (see Chapter 7: Forestry), improving habitat suitability for bats in the long term.

9.9.5. In light of the above, the impact to bats from displacement is considered to be adverse but of low magnitude, and therefore significant on a less than local scale, and a **non-significant effect** in terms of the EIA Regulations.

9.9.6. and therefore not significant in terms of the EIA Regulations.

Construction: Roost Loss

9.9.7. Bats within the Site may be impacted through the direct loss of bat roosts, and via direct harm or indirect disturbance to roosting bats, as a result of felling activities and the associated noise and vibration. Although no bat roosts were identified within the Site and coniferous plantation woodland generally offers few roosting opportunities for bats, due to the scale of the felling during the construction of the Proposed Development the removal of a very small number of unrecorded, isolated features with bat roost potential, although unlikely, cannot be completely ruled out. However, restocking of broadleaved woodland may improve roosting suitability in the long term. Such unlikely losses of roosting habitat are considered to be adverse effect of negligible magnitude, and therefore significant on a less than local scale, and a **non-significant effect** in terms of the EIA Regulations.

Operation: Turbine Collison

9.9.8. Operational effects of the Proposed Development on bats will likely be restricted to accidental mortality or injury to bats in flight, through direct collision with moving turbine blades. As presented in Section 9.9, mitigation by design will ensure turbines will have a 50 m separation distance between high-value bat habitats, such as riparian features and forest edges[31]. As research has shown that bats typically do not fly outwith suitable commuting and foraging habitat, these measures will likely notably reduce the risk of turbine related mortality (bat casualties). Furthermore, as the typical flight height for common and soprano pipistrelle is 3-10 m, the vast majority of bats are unlikely to fly at rotor height and are not at risk for turbine collision.

9.9.9. Although it acknowledged that Nyctalus bats fly at greater heights and are more likely to utilise open habitats, these species are recorded in very low numbers, predominantly due to the lack of broadleaved habitats. These findings are in line with recent studies carried out by SNH into high risk species in southern Scotland[35], which places the Site in an area of low occurrence of both Leisler's and noctule bats and in an area of lowest "exposure" to windfarms (a prediction based on occurrence, activity levels and maximum known foraging radius).

[35] 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*

9.9.10. In light of the above, although the risk of turbine bat mortality cannot be ruled out entirely, effects are considered very unlikely to occur. If turbine related mortality does occur, the effects will be too minor to adversely affect local bat populations. Therefore the effects of this impact are considered adverse, but of low magnitude. As a result they are considered significant on a less than local scale, and therefore a **non-significant effect** in terms of the EIA Regulations.

Decommissioning

9.9.11. Decommissioning activities are considered to be of a similar nature to those of Proposed Development construction; however, the potential for impact to bats is considered less likely, and on a significantly smaller scale due to the lack of felling required for decommissioning. As a result effects are considered significant on a less than local scale, and therefore a **non-significant effect** in terms of the EIA Regulations.

Otter

Construction: Disturbance

9.9.12. Where proposed access tracks cross watercourses within the Proposed Development, the potential exists for temporary disturbance to otters during construction, particularly on watercourses within the Site where otter were recorded such as Craigengillan and Black Burn. No otter resting places were identified within the Site, though two couches and a holt were recorded on the Water of Ken, immediately adjacent to the east of the Site. Nevertheless, potential exists for otters to establish new resting places in close proximity to the infrastructure of the Proposed Development. In addition, construction will result in a localised increase in noise, vibration, traffic and the presence of people, which has potential to result in the disturbance of commuting and foraging otters. Suitable otter habitat is present adjacent to the Site and is widespread throughout the surrounding environment, therefore the effects of this impact are considered detrimental but of low magnitude. As a result they are considered significant on a less than local scale, and therefore a **non-significant effect** in terms of the EIA Regulations.

Construction: Collision related Mortality & Injury

9.9.13. In addition to construction phase disturbance, the direct increase of traffic and vehicle movements from Proposed Development construction may also result in a temporary increase in the risk of traffic collisions and accidental otter fatality, particularly if construction works are scheduled to take place during low light levels in the winter months. The potential for accidental traffic collisions with otters is considered greatest at proposed watercourse crossings at the Craigengillan and Black Burns where the established otter population utilises riparian habitats for commuting and foraging; however, due to the temporary nature of construction this is considered a potential impact of low risk, unlikely to affect more than a small number of otters (if any). This detrimental impact is considered of low magnitude, and is significant on a less than local scale, and therefore a **non-significant effect** in terms of the EIA Regulations.

9.9.14. Operation: Collision Mortality or Injury

9.9.15. Operational maintenance is likely to result in occasional vehicle movements and personnel presence throughout the operation of the Proposed Development; however, this activity will be limited to the Proposed Development infrastructure and wind turbine generators, with no disturbance of the surrounding environment (including riparian habitats) expected. Due to the infrequency and localised nature of operational activities, effects are considered to be of negligible magnitude, and therefore less the local in scale and **non-significant effect** in terms of the EIA Regulations.

Decommissioning

9.9.16. Decommissioning activities are considered to be of a similar nature to those of Proposed Development construction; therefore, potential exists for disturbance to otters, particularly where decommissioning works may take place in close proximity to riparian habitats. Decommissioning activities may result in a localised increase in noise, vibration, traffic and presence of people, potentially causing disturbance to commuting and foraging otters. This impact is considered low magnitude, significant on a less than local scale, and therefore a **non-significant effect** in terms of the EIA Regulations.

9.10. Assessment of Cumulative Effects

9.10.1. The EIA Regulations require the cumulative effects of the Proposed Development with other relevant projects or plans to be assessed. SNH guidance (SNH, 2012) on assessing cumulative effects has been followed.

9.10.2. This assessment considers that cumulative effects can result from effects that were individually assessed as non-significant, but in combination with effects or actions taking place over time, or across a wider spatial range (such as where the Zone of Influence of other developments or actions may overlap that of the Proposed Development) non-significant effects may cumulatively be considered significant. Ecological features that require to be cumulatively assessed are those for which there was some indication of a potential effect as a result of the Proposed Development, which may be exacerbated cumulatively.

9.10.3. Given the low level of importance assigned to IEFs scoped out of the assessment, with consideration also given to the limited effect magnitude of any perceptible impact on these features and the likely zone of influence, consideration of combined effects in a cumulative context would not sufficiently increase the scale of impacts to allow any potential effect to be considered cumulatively significant.

9.10.4. All identified impacts of the Proposed Development on IEFs were predicted to be of either negligible or low magnitude, and therefore non-significant. Furthermore the nature of these impacts are considered to be spatially or temporally limited. Effects will largely only occur where the Proposed Development works overlap with habitats suitable for these species. For example, for otter the effects are limited to areas in close proximity to suitable watercourses. Of all protected mammal species recorded, bats are most likely to be affected by additional wind farm development because of the distances travelled by some species of bat and the cumulative risks to bat populations that may result from collision with wind turbines during operation. Therefore the cumulative assessment has been limited to effects on bats.

9.10.5. All developments currently operational, under construction or consented, within 10 km of the Site, were considered as part of the assessment of cumulative impacts for bats. Within this search area there are a total of six developments have been included in the cumulative impact assessment (see Table 9.10). It is important to note that cumulative impact assessments may be complicated by availability of EIA Reports and Appraisals for consented sites and, where this information is available, survey periods and methodologies may differ between sites; furthermore, some schemes may have been in existence for many years, and thus contemporary data may not be available.

Table 9.10: Bat Assessments on Wind Farm Developments with 10km of the Site

Site	Status	Bat Activity	Significance of Effects
Afton	Operational	Low. No high risk species.	No assessment required
Benbrock	Consented/ Under construction	Low. No high risk species	No assessment required
Brockloch Rig	Operational	Low. No high risk species	No significant impact predicted
Windy Standard I	Operational	No mention of bats in ES	
Windy Standard II	Operational	No mention of bats in ES	
Windy Rig	Consented	Low. No high risk species	No significant impact predicted

9.10.6. Bat activity across all cumulative sites within the Zone of Influence of the Site was low, with no high risk species recorded, largely as all sites consisted largely of habitats sub-optimal for anything other than occasional foraging and commuting of common and widespread bat species. Furthermore, where assessment was required, no significant impacts were predicted. It is considered unlikely that there will a measurable population level effect on bat species from the cumulative effects of the schemes assessed, and the impacts on the conservation status of bats as a receptor will therefore be **non-significant**.

9.11. Mitigation Measures

9.11.1. As no significant impacts have been predicted, no further mitigation measures, above those detailed within embedded mitigation, are considered necessary.

9.12. Residual Effects

9.12.1. Following implementation of embedded mitigation, no significant residual effects are predicted.

9.13. Summary

9.13.1. An assessment has been made of the potential for significant effects of the Proposed Development on habitats and non-avian species. This assessment did not identify potential significant effects (in terms of the EIA Regulations) on

any receptors, even in the absence of mitigation, during the construction, operation and decommissioning of the Proposed Development

9.13.2. By applying effective embedded mitigation measures, mainly through the design and following best practice guidelines during construction, the magnitude of residual effects of the Proposed Development both alone and in combination with other schemes are assessed as being negligible magnitude, and thus **non-significant** in terms of the EIA Regulations.