Norham Community Renewable Development

Scoping Report

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Report Prepared for:
Norham Development Trust

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1 Introduction

1.1 Overview

This Scoping Request has been prepared by Green Cat Renewables (GCR) on behalf of Norham Development Trust (NDT), hereafter referred to as ('NDT' or 'the Applicant'). For the purposes of this Scoping Report, Norham Renewable Development (the Proposed Development) would consist of a single wind turbine, with a generation capacity of 0.9MW and a solar array, with a generating capacity of 8.9MW, giving the site a total generating capacity of 9.8MW. The Proposed Development would include a number of ancillary elements, such as access tracks, crane hard standings and control building, as well as temporary features, such as a construction compound and laydown areas. Further details will be provided within this report.

With a generating capacity of up to 9.8MW, the Applicant would be seeking permission for the Proposed Development from the Local Planning Authority (LPA) (the Council) under the Town and Country Planning Act of 1990. The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) would, therefore, also apply. Schedule 2 of the EIA Regulations lists developments for which the need for an Environmental Impact Assessment (EIA) is determined on a case-by-case basis (i.e. if significant environmental effects are considered likely) using applicable thresholds and the selection criteria presented in Schedule 3. The Proposed Development falls under Schedule 2, being an installation "for the harnessing of wind power for energy production (wind farms)" that "involves the installation of more than 2 turbines" with a hub-height that exceeds 15m. However, the selection criteria in Schedule 3 are not clearly defined, and therefore each development must be judged on its own merits in terms of whether or not significant environmental effects are in fact, likely. It is expected that the Proposed Development may have some significant effects on the environment by virtue of its nature. Therefore, an EIA is required to be submitted with the planning application.

1.2 The Applicant

Norham Development Trust (NDT) was officially incorporated as a not-for-profit company limited by guarantee in February 2019. Its objectives are 'To promote for the public benefit regeneration in the village of Norham and the surrounding areas, through a range of activity including (though not exclusively) supporting community services and facilities, the preservation of buildings or sites and the provision of recreational facilities'.

NDT is owned by its members and managed by a volunteer Board of Directors. NDT staff work with other organisations and individuals on projects of various kinds to improve the quality of life in the Norham area for now and for future generations. NDT has identified the development of renewable energy-generating assets as the right thing to do, both from an ethical perspective and to help finance the organisation and its projects for community benefit in the years to come.

1.3 The Agent

Green Cat Renewables Ltd (GCR) has been commissioned by the Applicant to prepare this Scoping Report.

GCR is an environmental and engineering consultancy focused on all aspects of development support. With a team of 75 staff spread across three offices, the company's multi-disciplinary resource base spans all stages of project delivery from feasibility and concept development through to planning, engineering, project management and operational asset management. While much of the company's experience is within the renewable sector, GCR's emphasis is on supporting a diverse client base across a range of renewable projects. GCR has also developed expertise in helping a range of businesses find sustainable energy solutions to aid economic viability in a climate where energy costs are forecast to continue to rise.

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The GCR EIA team brings a diverse skill set that includes planning, environmental and technical expertise and is comprised of project managers, planners, consultants, environmentalists, engineers, acousticians, CAD technicians, GIS technicians, hydrologists and resource analysts.

GCR do not have in-house aviation consultants and ecologists. GLM Ecology Ltd has been appointed to undertake the Ecological Impact Assessment while aviation assessment work will be undertaken by Ian Fletcher of Wind Business Support.

1.4 Purpose of the Scoping Report

The purpose of this Scoping Report is to formally request the opinion of the Northumberland County Council as local planning authority (and the bodies they will consult) as to the scope and level of detail of the information to be provided in the Environmental Statement (ES) in accordance with Regulation 15 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations). The assessments undertaken, as outlined within this report, as part of the EIA process will be presented in an ES, which will be submitted to the Council in support of a full planning application.

The Scoping Report has been prepared as the initial stage of the EIA process. As outlined in Regulation 15(2) this report includes:

- A description of the location of the Proposed Development, including a plan sufficient to identify the land;
- A brief description of the nature and purpose of the Proposed Development and an explanation of the likely significant effects of the Proposed Development on the environment; and
- Such other information or representations which the Applicant considers may assist the Council (and the consultation bodies) in providing a scoping opinion.

The EIA process must identify and assess, in an appropriate manner, in light of the particular circumstances of the project, the direct and indirect significant effects of the proposed development on a number of factors, including the interaction between these factors (Regulation 4(2) and (3)). The factors under the EIA Regulations are:

- Population and human health;
- Biodiversity, and in particular species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;
- Land, soil, water, air and climate;
- Material assets, cultural heritage and the landscape.

The purpose of the Scoping Report is to:

- Identify the key areas to be considered as part of the EIA;
- Identify areas which can be scoped out of the EIA or which do not require to be addressed in greater detail; and
- Review activities which may give rise to potentially significant environmental impacts during the lifecycle of the Proposed Development.

This Scoping Report outlines the proposed approach to the assessment of environmental impacts and the proposed ES content for approval with the Council and other statutory consultees.

The Applicant has appointed an EIA project team to provide relevant assessment, advice and reporting to support the delivery of the EIA. The appointed team have the necessary experience and qualifications to carry out the assessments.

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1.5 Consultation

Consultation forms an integral part of the EIA process. All application and pre-application consultation activity will comply with the statutory requirements and have regard to the advice on meaningful community engagement.

The Scoping Report also includes questions to consultees to promote positive, focussed early consultation in the EIA process.

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2 Proposed Development

2.1 Introduction

The applicant is proposing to construct, operate and decommission a single wind turbine and solar array within an area of farmland south of Norham Village. The site location and indicative layout are provided in the following figures that accompany this report:

- Figure 2.1: Site Location
- Figure 2.2a: Site Constraints Plan for Wind
- Figure 2.2b: Site Constraints Plan for Solar
- Figure 2.3: Site Layout

2.2 The Site

The Proposed Development is located on an area of arable farmland on Galagate Farm. The Application Site, hereafter referred to as 'the Site', is located 700m south of Norham Village, 800m east of the River Tweed and the England – Scotland border. The Site is at approximately 45m AOD.

2.3 Proposed Development and Associated Infrastructure

A detailed design process, taking account of key technical, environmental, and economic constraints, has been undertaken and will continue throughout the EIA process as required. The proposed development will generate clean and sustainable electricity in a post-subsidy market. As such, maximising the efficiency and generational capacity of the scheme, in line with technical and environmental considerations, is paramount to the economic viability of the proposed development.

In additional to the wind turbine and solar array, the Proposed Development is anticipated to include the following ancillary components and associated infrastructure:

- One three-bladed horizontal axis wind turbine measuring up to 67m tip height;
- Solar PV arrays and associated works;
- Hardstanding area for cranes at the turbine location;
- Turbine foundations;
- Site access track;
- Drainage works as required;
- An on-site electrical sub-station and control network of buried cables;
- A temporary construction compound, including parking and welfare facilities; and
- Associated ancillary works.

2.4 Construction

The construction period for the Proposed Development is expected to be approximately six months. Construction activities will include:

- Enablement works to facilitate site deliveries;
- Construction of permanent on-site access track and hardstanding areas;

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- Construction of secure temporary site compound including welfare facilities;
- Construction of crane hardstandings;
- Construction of turbine foundations;
- Wind turbine delivery and erection;
- Installation of solar PV arrays;
- Installation of battery storage containers;
- Installation of cabling, communication, and earthing arrays;
- Construction of substation;
- Commissioning of development; and
- Reinstatement and landscaping works, as required.

The construction works would broadly follow the order as outlined above. However, to reduce the construction time, a number of these activities may be carried out concurrently. A full construction plan, including any phasing will be produced post-consent.

2.5 Operation and Maintenance

Following the commissioning of the Proposed Development, the temporary construction elements, such as cranes and other plant equipment, will be removed from the site, and the site will revert to a calmer overall appearance. Reinstatement works will be undertaken where appropriate and in line with planning conditions.

During operation, the Site will be visited at regular intervals by approved technicians to undertake maintenance and to ensure the safe operation throughout the lifetime of the Proposed Development. These visits will be undertaken utilising standard road vehicles. There will be no requirement for the specialist vehicles utilised during the construction phase to visit the site under normal circumstances.

2.6 Decommissioning

Decommissioning effects are not generally considered in detail at this stage. It is proposed that a decommissioning plan will be agreed upon with Northumberland Council and relevant consultees in line with planning conditions. The decommissioning of the Site will broadly involve similar works as the construction phase and include reinstatement of the Site as agreed with the Council.

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3 EIA Methodology

3.1 Introduction

EIA is a statutory process governed by UK and European law. It is a means of drawing together in a systematic way, an assessment of the likely significant environmental effects arising from a proposed development. In England, the relevant regulations are provided in the *Town and Country Planning (Environmental Impact Assessment) Regulations 2017.*

This section presents an overview of the methodology to be utilised for the production of the Environmental Statement (ES). It outlines the methodology for the identification and evaluation of potential likely significant environmental effects and also presents the methodology for the identification and evaluation of potential cumulative and any inter-related impacts.

To ensure that the information is presented in a structured and consistent way in each topic, the assessments will be presented broadly as outlined below;

- Introduction: Identifies key objectives and issues;
- Guidance: summarises the relevant policy and guidance documents used to inform the assessment;
- Methodology: summarises the methods used in undertaking the assessment work;
- Baseline: summarises the existing situation;
- Assessment of Predicted Impacts and Effects: identification and assessment of the predicted effects (both positive and negative) associated with the construction, operation and decommissioning of the Proposed Development;
- Mitigation: a summary of measures envisaged to avoid, reduce or remedy predicted negative effects of the Proposed Development;
- Summary of Predicted Impacts and Effects: summary of the impacts and effects predicted and proposed mitigation measures; and
- Conclusions: summary of the conclusions of the assessment.

3.2 Assessment Methodology

The individual methodologies for assessing each EIA topic area will be described in more detail in each of the individual chapters of the ES. The following sections briefly outline the overarching assessment methodology to be undertaken.

3.2.1 Identification of Environmental Baseline

A review of the current environmental conditions will be undertaken to determine the appropriate baseline for assessment. In the majority of assessments, this will involve the following:

- Definition of an appropriate study area, based on guidance and best practice;
- A review of currently available information relating to the development study area;
- Identification of likely or potential impacts;
- Outline further data/survey/monitoring required to obtain relevant information if required to support assessment; and
- Review information to ensure sufficient data is available to provide a robust assessment.

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3.3 Assessment of Impacts

The Applicant has appointed a competent team of EIA specialists who will undertake the required assessments using available data, new data (if required), professional and expert judgement.

The methods for predicting the nature and magnitude of any potential impacts vary dependent on the subject area. Quantitative methods of assessment can predict values that can be compared against published thresholds and indicative criteria in Government guidance and standards. Where it is not possible to use a quantitative method, a qualitative assessment method will be utilised, these assessments rely on the experience and professional judgement of the technical specialist.

The potential significant effects of development must be considered in relation to the characteristics of development and the location of the development, with regard to the impact of the development on the factors specified in Regulation 3A(3), taking into account:

- The magnitude and special extent of the impact (for example, geographical area and size of the population likely to be affected);
- The nature of the impact;
- The intensity and complexity of the impact;
- The probability of the impact;
- The expected onset, duration, frequency and reversibility of the impact;
- Cumulative impacts with the impact of other existing and/or approved development; and
- The possibility of effectively reducing the impact.

Table 3.1 illustrates how the criteria will be applied to ascertain the level of significance of a potential impact.

Table 3.1 – Significance of effect matrix

Sensitivity	Magnitude of Change			
	High	Medium	Low	Negligible
High	Major	Major/Moderate	Moderate	Moderate/Minor
Medium	Major/Moderate	Moderate	Moderate/Minor	Minor
Low	Moderate	Moderate/Minor	Minor	Minor
Key:		Significant in terms of the EIA Regulations		
		Not Significant		

3.4 Mitigation

The aim of the EIA is to avoid, reduce and offset any significant adverse environmental effects arising from the Proposed Development.

Where possible, reasonable steps will be taken during the design process to avoid the creation of significant or adverse impacts. Where these cannot be avoided completely, appropriate mitigation will be proposed to avoid or reduce the impacts to acceptable levels.

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3.5 Conclusion and Residual Effects

The conclusion will summarise the key findings of the assessment and outline any residual effects which remain following the assessment and appropriate mitigation process and whether these are acceptable in EIA terms.

3.6 Assumptions and Limitations

The EIA process is designed to enable informed decision making based on the best available information about the environmental implications of the Proposed Development. However, there will always be some uncertainty in the scale and nature of the predicted environmental effects due to the level of detailed information available at the time of the assessment.

Each technical chapter will make clear any assumptions made as part of the assessment process while setting out the limitation encountered whilst undertaking the assessment and subsequent reporting.

3.7 Structure and Content of the Environmental Statement

It is expected that the ES will be structured as below:

1. Landscape and Visual Impact Assessment (LVIA)
2. Cultural Heritage
3. Noise
4. Hydrology and Hydrogeology
5. Ecology
6. Ornithology
7. Traffic and Transport
8. Shadow Flicker
9. Aviation and Radar
10. Telecommunications
11. Carbon Balance
12. Other Issues

- Landscape and Visual Impact Assessment Figures
- Planning Drawings and Technical Figures
- Non-Technical Summary

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4 Planning and Legislative Context

4.1 Introduction

This chapter summarises the key legislation, policy and guidance that the Proposed Development would be assessed against by the Planning Authority. These documents have been taken into account when proposing the scope of the forthcoming Environmental Statement as part of the planning application submission. The documents mentioned do not form an exhaustive list and will be expanded to suit.

4.2 Legislative Context

4.2.1 Planning and Compulsory Purchase Act 2004

The Planning and Compulsory Purchase Act 2004 includes provisions for Regional Spatial Strategies and the formation of Regional Planning Bodies, the replacement of Local Plans and Structure Plans with Local Development Documents. It refines the plan making process including a duty to exercise Planning Authorities functions with the objective of contributing to the achievement of sustainable development.

With regards to development control the Act provides for local permitted development rights by way of local development orders, provides that the Secretary of State can make development orders and regulations for the procedure for making planning applications, new enforcement powers to serve temporary stop notices, requires consultation responses to be provided within specified times and other various amendments, such as removing Crown immunity to the planning system.

4.2.2 The Planning Act 2008

The Planning Act 2008 is the primary legislation that sets out the legal framework for planning decisions in England for Nationally Significant Infrastructure Projects (NSIP) and the setting up of the now superseded Infrastructure Planning Commission. The Planning Act 2008 is supported by a range of regulations.

The Proposed Development is not considered an NSIP, so the pertinent parts of the Act appear to be in Part 9 which includes for changes to the development plan, powers for local planning authorities to decline to determine subsequent planning applications, removal of the right to compensation in some circumstances, express powers for local planning authorities to make non-material changes to planning permissions. It includes provisions for the Secretary of State to make provisions on certain procedures. The Act includes changes to fees and a power to create fees for planning appeals.

4.2.3 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017

These regulations apply the amended EU directive Environmental Impact Assessment Directive to the planning system in England. The Act provides the procedures relating to the application planning permission, the screening process, preparation of environmental statements, publicity and procedures for decision making.

4.2.4 Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, transpose the Water Framework Directive 2000/60/EC with the goal of consolidating the previous regulations and providing detail and transparency. The WFD introduced a comprehensive river basin management planning system to protect and improve the ecological and chemical health of our rivers, lakes, estuaries, coastal waters and groundwater.

4.2.5 Others

Other legislative context is provided by topic specific legislation such as:

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- Ancient Monuments and Archaeological Areas Act 1979
- Planning (Listed Buildings and Conservation Areas) Act 1990
- Environmental Permitting (England and Wales) Regulations 2016
- Bathing Water Regulations 2013
- Flood and Water Management Act 2010
- Land Drainage Act 1991
- Conservation of Habitats and Species Regulations 2017
- Convention on the Conservation of European Wildlife and Natural Habitats 1979
- Countryside and Rights of Way Act 2000
- Environmental Protection Act 1990
- Hedgerow Regulations 1997
- Natural Environment and Rural Communities Act 2006
- Salmon and Freshwater Fisheries Act 1975
- The Protection of Badgers Act 1992
- Wildlife and Countryside Act 1981 (as amended)
- The Habitats Regulations 2017
- Climate Change Act 2008

4.3 Policy Context

4.3.1 National Policy Statements

These are produced by the UK Government in relation to energy, transport, water, wastewater, and waste.

4.3.2 National Planning and Policy Framework (NPPF)

The National Planning and Policy Framework (NPPF) was updated in July 2021 and a further update to the documents is under consultation. NPPF sets out the UK Government's planning policies for England and how these should be applied.

4.3.3 The Development Plan

The Development Plan consists of Northumberland Local Plan 2016 – 2036[1] , which was adopted in March 2022. It covers Northumberland with the exception of Northumberland National Park and any Neighbourhood Plans. There do not appear to be any neighbourhood plans for Norham at present. Similarly, the Northumberland National Park is located 14km to the south of the proposed development, and it is considered that consideration against the corresponding policies of the National Park is not required in this location.

All relevant guidance will be taken into account during the design of the proposed development.

[1] Northumberland Local Plan 2016 – 2036 accessed 16/11/2022

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4.3.4 Northumberland Local Plan 2016 – 2036

The proposed development will be appraised against the spatial vision, objectives, outcomes and policies of the Local Plan. The pertinent policies in relation to the proposed development appear to be policies:

- Policy STP 1 Spatial strategy (Strategic Policy)
- Policy STP 2 Presumption in favour of sustainable development (Strategic Policy)
- Policy STP 3 Principles of sustainable development (Strategic Policy)
- Policy STP 4 Climate change mitigation and adaptation (Strategic Policy)
- Policy STP 7 Strategic approach to the Green Belt (Strategic Policy)
- Policy STP 8 Development in the Green Belt (Strategic Policy)
- Policy QOP 1 Design principles (Strategic Policy)
- Policy QOP 2 Good design and amenity
- Policy QOP 4 Landscaping and trees
- Policy QOP 5 Sustainable design and construction
- Policy ENV 1 Approach to assessing the impact of development on the natural, historic and built environment (Strategic Policy)
- Policy ENV 2 Biodiversity and geodiversity
- Policy ENV 3 Landscape
- Policy ENV 4 Tranquillity, dark skies and a sense of rurality
- Policy ENV 7 Historic environment and heritage assets
- Policy ENV 9 Conservation Areas
- Policy WAT 1 Water quality
- Policy WAT 3 Flooding.
- Policy WAT 4 Sustainable Drainage Systems
- Policy POL 2 Pollution and air, soil and water quality
- Policy POL 3 Best and most versatile agricultural land
- Policy MIN 4 Safeguarding mineral resources (Strategic Policy)
- Policy REN 1 Renewable and low carbon energy and associated energy storage
- Policy REN 2 Onshore wind energy development
- Policy INF 2 Community services and facilities

The policies selected for assessment will be updated as the design of the development progresses – when other potential impacts or constraints are identified.

4.3.5 Others

Other policy context is provided by topic specific policy documents as noted in each of the chapters in this Scoping Opinion Request.

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4.3.6 Guidance

Guidance and policy that the Planning Authority may consider as part of the determination of a forthcoming planning application, includes:

- The Glasgow Climate Pact – COP26
- UK Government supplementary guidance for Renewable and Low Carbon Energy

4.4 Key Questions for the Council and Consultees

- Q4/1: Can the Council and Consultees identify any key material policy or guidance documents that have not been mentioned above?
- Q4/2: Do the Council agree that the above list of legislation, policies and guidance are applicable in this case?

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5 Landscape and Visual Impact Assessment

5.1 Introduction

The Proposed Development will consist of a single 67m to tip wind turbine, ancillary infrastructure and up to 8.9MW of solar illustrated in Figure 2.3. The Proposed Development has the potential to have a direct impact on the physical characteristics of the landscape as well as indirect impacts through its strong visual presence, on the character of the landscape and other visual receptors in the area. The Proposed Development also has the potential to have a cumulative impact over the landscape and visual resource when seen in conjunction with other similar developments. The development site location is illustrated in Figure 5.1.

5.2 Guidance

The methodology for the Landscape and Visual Impact Assessment (LVIA) and the Cumulative Landscape and Visual Impact Assessment (CLVIA) has been undertaken in accordance with the methodology set out below and conforms to, *The Guidelines for Landscape and Visual Impact Assessment*, Third Edition (Landscape Institute and IEMA, 2013). Additional guidance has been taken from the following publications:

- National Character Area Profiles, Natural England, September 2014;
- Assessment of the Sensitivity of the Landscape of Northumberland to Wind Energy Development, Northumberland County Council, January 2018;
- The Borders Landscape Assessment, ASH Consulting Group, 1998;
- Siting and Designing Wind farms in the Landscape, NatureScot, Version 3a, August 2017;
- Visual Representation of Wind Farms, NatureScot, Version 2.2, February 2017;
- Spatial Planning for Onshore Wind Turbines –Natural Heritage Considerations; NatureScot, June 2015;
- Landscape Character Assessment: Guidance for England and Scotland (Countryside Agency and NatureScot publication, produced by the University of Sheffield and Landuse Consultants), 2002;
- Residential Visual Amenity Assessment, Technical Guidance Note 2/19, Landscape Institute, March 2019; and
- Assessing the Cumulative Impacts of Onshore Wind Energy Developments, NatureScot Version 3, March 2012.

5.3 Consultation

Natural England and NatureScot will be consulted with regards to the scope of the LVIA, including, but not limited to, the selection of viewpoints to be included in visualisations (such as photomontages).

5.4 Landscape Capacity

The Proposed Development is situated within the Open Rolling Farmland LCT, within the sub-unit of Duddo and Lowick. The *Assessment of the Sensitivity of the Landscape of Northumberland to Wind Energy Development*, Northumberland County Council, January 2018 offers specific guidance on turbine development within the Duddo and Lowick section of the landscape.

> *This large area rises steadily from the Tweed towards the sandstone hills. The topography is relatively varied. Around Duddo a more undulating landform predominates, with occasional rock outcrops. To*

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the south, the land drops down to Ford, where the influence of the Ford Estate is clear. Ford Castle and the surrounding village are key historic attractions in the area. Other significant features include the stone circle at Duddo, and Barmoor Castle with its associated caravan park. An extension of the area forms the fringe of the Till valley. Around Lowick, the landform is flatter, with large, arable fields.

In general the LCT is not suitable for wind energy development. The only exceptions to this higher sensitivity are Duddo and East Learnmouth which will be generally suitable for small scale wind energy development up to 25 blade tip height where these are well related to other human scale development such as farmsteads and settlement.

The Duddo East Learnmouth units may be suitable for carefully sited small scale wind energy development up to 65m to blade tip height where it can be shown that effects on the most sensitive characteristics and cumulative effects would not be significant. In these circumstances turbines should be no more than 'apparent' in the landscape – they should not be prominent or dominant and should not out-compete important foci in the landscape.

In general, wind turbines above small-medium scale (>25m height to blade tip) in Halidon, and above medium-large (>65m to blade tip height) in Duddo East Learnmouth would in principle be unsuitable as they would significantly affect key characteristics and qualities of the landscape that are highly sensitive to this type and scale of development. This is particularly due to the high inter-visibility with adjacent sensitive LCTs, heritage components in the landscape and sensitive receptors.

The development is not located within any nationally or locally designated landscape which are illustrated on Figure 5.2.

5.5 Methodology

5.5.1 Defining the Study Area

An overall study area of 20km radius from the site centre is proposed based on professional judgement and experience. The study area was further defined for each part of the assessment process as follows:

Landscape and Visual Impact Assessment (LVIA) – the study area will be restricted to the application site, access routes, and the potential Zone of Theoretical Visibility (ZTV) from where there may be a view of the Proposed Development at up to 20km distance from the outer most parts of the development. The main focus of the assessment with respect of landscape and visual receptors will be 10km which would be the distance most likely to experience significant effects as a result of the Proposed Development and is informed with reference to the findings of field survey and viewpoint analysis, as well as professional experience from previous assessments.

Cumulative Landscape and Visual Impact Assessment (CLVIA) – will consider existing wind energy development proposals that have permissions, and those that are currently the subject of undetermined applications within a Search Area of 20km radius of the site centre. It is likely that only some of these will have the potential to contribute to a significant cumulative effect following addition of the Proposed Development turbines. Many of these developments can be scoped out of the assessment at this stage due to the lack of combined visibility or over 20km distance from the proposed site such that they would not contribute to significant cumulative effects. This will assure that the cumulative assessment remains focussed on the schemes that have the greatest potential to give rise to significant cumulative, as to consider all schemes within 20km of the Proposed Development would detract from the key issues relating to the application.

Wind farms over 20 km away are highly unlikely to give rise to significant cumulative effects. It is also considered proportionate to scope out all turbines under 50m, and turbines under 80m beyond 10 km distance from the site. The cumulative impact assessment will therefore focus primarily on those schemes within approximately 20km of

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the Proposed Development. Table 5.1 below lists those developments to be included within the scope of the cumulative assessment, while Figure 5.3 illustrates all wind developments known within 45km.

Table 5.1 - Summary of wind energy projects within the Cumulative Study Area

Development Name	Scale of Project (Single turbine, Cluster or Wind farm)	Distance to Project (approx. in km)	No. on Figure 5.4
Operational Projects			
Barmoor Wind Farm	Wind Farm	10.5km	1
Berwick Community Turbine	Single Turbine	12.0km	2
Blackhouse Cottage	Single Turbine	16.5km	3
Brockholes Wind Farm	Wind Cluster	18.0km	4
Black Hill Wind Farm	Wind Farm	18.5km	5
Consented Projects			
-			
Projects in Planning			
-			

All of the above developments listed in Table 5.1 will be included on any wirelines and CZTVs will be run for the most appropriate of these in conjunction with the Proposed Development.

5.5.2 Zone of Theoretical Visibility

A Zone of Theoretical Visibility (ZTV) was calculated using the ReSoft© WindFarm computer software to produce areas of potential visibility of any part of the proposed wind turbines calculated to blade tip and hub height. The ZTV however, does not take account of built development and vegetation, which can significantly reduce the area and extent of actual visibility in the field and as such provides the limits of the visual assessment study area.

Figure 5.4 illustrates the ZTV for tip height tip height of 67m at a scale of 1:150,000 at A3, Figure 5.5 illustrates the ZTV to a hub height of 40m at this scale. In addition to this, Figure 5.6 illustrates the combined visual impact of the turbine and the solar development.

5.5.3 Baseline Landscape and Visual Resource

This part of the LVIA will refer to the existing landscape character, quality or condition and value of the landscape and landscape elements on the site and within the surrounding area, as well as general trends in landscape change across the study area. A brief description of the existing landscape character and land use of the area which includes reference to settlements, transport routes, vegetation cover, as well as landscape planning designations, local landmarks, and tourist destinations.

5.5.4 Assessing Landscape Effects

Landscape Effects are defined by the Landscape Institute as "*changes to landscape elements, characteristics, character, and qualities of the landscape as a result of development*". The potential landscape effects, occurring during the construction and operation period, may therefore include, but are not restricted to, the following:

- Changes to landscape elements: the addition of new elements or the removal of trees, vegetation, and buildings and other characteristic elements of the landscape character type;
- Changes to landscape quality: degradation or erosion of landscape elements and patterns, particularly those that form characteristic elements of landscape character types;

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- Changes to landscape character: landscape character may be affected through the incremental effect on characteristic elements, landscape patterns and qualities and the cumulative addition of new features, the magnitude of which is sufficient to alter the overall landscape character type of a particular area; and
- Cumulative landscape effects: where more than one wind farm may lead to a potential landscape effect.

The Proposed Development may have a direct (physical) effect on the landscape as well as an indirect effect or effect perceived from outwith the landscape character area. Landscape effects will be assessed by considering the sensitivity of the landscape against the degree of change posed by the development. The sensitivity of the landscape to the Proposed Development is based on factors such as its quality and value and is defined as high, medium or low. Examples of landscape sensitivity and criteria are described below:

High Sensitivity – This would primarily be rare landscapes, or landscapes which have been afforded either a national or local designation such as National Parks, National Scenic Areas or Areas of Landscape Significance. These landscapes can be fairly dramatic in terms of scale and may feature a number of attractive landscape features, including mature woodland, intricate gorges and river valleys, prominent summits or features of cultural heritage. Man-made features or modifications to the landscape will be minimal and the landscape may have a wild or remote feeling to it;

Medium Sensitivity – This would include landscapes which are still relatively attractive and generally rural but do contain some manmade elements. It may be landscapes which have been modified to accommodate farming practices and landscapes which include more prominent settlement pattern and road networks. These landscapes may also contain woodland including plantation forestry and shelterbelts; and

Low Sensitivity – This would only be reserved for landscapes which may be deemed unattractive due to heavy modification and prominent man-made features, such as industrial units.

The magnitude or degree of change considers the scale and extent of the proposed development, which may include the loss or addition of particular features, and changes to landscape quality, and character. Magnitude can be defined as high, medium, low or negligible, examples of magnitude are shown below:

High Magnitude – This would be a major change to baseline conditions, where the character of the landscape may be altered from its existing state into a landscape with wind farms;

Medium Magnitude – This would be a noticeable change in the baseline condition but not necessarily one which would be enough to alter the character of the landscape and will generally diminish with distance;

Low Magnitude – This would be a minor change to the baseline conditions where the development would be readily missed by a casual viewer and any character of the landscape would remain intact; and

Negligible Magnitude – This would be a change which would be difficult to notice and the baseline conditions are likely to remain almost as they were.

The level of effect is determined by the combination of sensitivity and magnitude of change as shown in

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Table 5.2.

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Table 5.2 - Magnitude and Sensitivity Matrix for assessing Overall Level of Effect

Sensitivity	Magnitude of Change			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major/Moderate	Moderate	Moderate/Minor
Medium	Major/Moderate	Moderate	Moderate/Minor	Minor
Low	Moderate	Moderate/Minor	Minor	Minor
Key:		Significant in terms of the EIA Regulations		
		Not Significant		

The significance of any identified landscape or visual effect will be assessed in terms of Major, Major/Moderate, Moderate, Moderate/Minor or Minor. These categories have been based on combining viewer or landscape sensitivity and predicted magnitude of change. The matrices should not be used as a prescriptive tool but will allow for the exercise of professional judgement.

Any effects that are classified as Major or Major/Moderate, will be considered to be equivalent to likely significant effects referred to in the EIA Regulations. Careful consideration will also be given to Moderate effects to test whether (in the professional opinion of the landscape architect) they are significant in EIA terms or not. In all cases, whether an effect is significant or not is confirmed within the assessment.

5.5.5 Assessing Visual Effects

Visual effects are recognised by the Landscape Institute as a subset of landscape effects and are concerned wholly with the effect of the development on views, and the general visual amenity. The visual effects are identified for different receptors (people) who will experience the view at their places of residence, during recreational activities, at work, or when travelling through the area. These may include:

- Visual effect: a change to an existing view, views or wider visual amenity as a result of development or the loss of particular landscape elements or features already present in the view; and
- Cumulative visual effects: the cumulative or incremental visibility of similar types of development may combine to have a cumulative visual effect. Either:
  - Simultaneously - where a number of developments may be viewed from a single fixed viewpoint simultaneously within the viewer's field of view without moving;
  - Successively - where a number of developments may be viewed from a single viewpoint successively by turning around at a viewpoint, to view in other directions; and
  - Sequentially - where a number of developments may be viewed sequentially or repeatedly from a range of locations when travelling along a route.

The general principles adopted for the assessment of visual effects were taken from *The Guidelines for Landscape and Visual Impact Assessment* Third Edition, produced by the Landscape Institute, 2013. This guidance outlines the approach to define the 'sensitivity' for a given view and a 'magnitude of change' that would be caused by the development in question over its lifetime. A matrix in the Guidance is then used to assess the overall 'level of effect'. This matrix is the same format as used to understand landscape effects and can be seen in

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Table 5.2. Examples of visual sensitivity are highlighted below:

> High Sensitivity – These include residential receptors, such as views from individual properties or views from within settlements. Views from both recreational locations, such as hill summits, long distance footpaths, cycle paths and tourist locations such as castles and visitor centres are also considered to be of high sensitivity;
>
> Medium Sensitivity – This would include most other visual receptors such as views from roads, other areas of landscape which would not be classed as recreational areas and views from areas within settlements which would not be considered residential; and
>
> Low Sensitivity – This would cover views experienced by people at work and views where the existing view is already dominated by significant man-made features.

In the context of the Proposed Development, the effects during operation are always direct and long term. Effects may also be non-cumulative or cumulative. None of the visual effects relating to the Proposed Development have been considered positive in order to present a worst-case view of any effects.

5.5.6 Viewpoint Analysis Method

Viewpoint analysis is used to assist the LVIA from selected viewpoints within the study area. The purpose of this is to assess both the level of visual impact for particular receptors and to help guide the assessment of the overall effect on visual amenity and landscape character. The assessment involves visiting the viewpoint location in good weather and viewing wireframes and photomontages prepared for each viewpoint location. Illustrated turbines always face the viewer to give a worst-case impression of the development under consideration. The viewpoints have primarily been selected to meet the following criteria:

- A balance of viewpoints to the north, south, east and west;
- A range of near middle and distance views of the Proposed Development;
- A proportion representing areas known locally where people use the landscape, such as prominent hill tops or footpaths; and
- A proportion representing designated areas.

It is proposed that 14 viewpoints will cover the above criteria as well as representing views from the most relevant visual receptors. Table 5.3 details the proposed viewpoints and they are shown on Figure 5.4 and Figure 5.5.

Table 5.3 - Summary of locations selected for Viewpoint Assessment

Viewpoint	Reason for Inclusion or Exclusion of Location	Distance
VP1 Norham Castle	Representative of views experienced by visitors to the castle as well as illustrating the impact on the setting of the castle.	1.2km
VP2 Norham Cross	Representative of views experienced by residents of Norham.	0.8km
VP3 Ladykirk	Representative of views experienced by residents of Norham.	1.6km
VP4 Ladykirk – Norham Bridge	Representative of views experienced by road users on the B6470, as well as illustrating the impact on the setting of the bridge.	1.3km
VP5 Upsettlington GDL	Representative of views experienced by visitors to the GDL and residents of the area.	1.6km

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Viewpoint	Reason for Inclusion or Exclusion of Location	Distance
VP6 Foulden	Representative of views experienced by residents of Foulden and road users on the A6105.	9.6km
VP7 Halidon Hill	Representative of views experienced by hill walkers and impacts on the scenic viewpoint.	11.4km
VP8 Grindon	Representative of views experienced by residents of Grindon.	2.1km
VP9 A698/B6470 Junction	Representative of views experienced by road users on the A698 and the B6470.	2.3km
VP10 Yeavering Bell	Representative of views experienced by walkers in the area, as well as impacts on the character of the National Park.	17.5km

5.5.7 Methodology for Production of Visualisations

All these locations will be photographed with a full frame digital Single Lens Reflex (SLR) camera set to produce photographs equivalent to that of a manual 35 mm SLR camera with a fixed 50 mm focal length lens. In accordance with *Scottish Natural Heritage, Visual Representation of Wind Farms February 2017,* panoramic images will be produced from these photographs to record a 53.5° panorama which will be extracted from this. In addition to this, a viewpoint pack will also be produced; the single frame images will be for use at the viewpoint location. These images will be prepared from the same baseline photography as the panorama images. The single frame images will be produced at 75mm (extracted from the original 50mm photographs). The wider 360° of each view will also be taken into account, particularly for any hill summit viewpoints.

Each view will be illustrated using a panoramic photograph, a wireline and, in some cases, a photomontage. Wirelines and photomontages will be produced using ReSoft© WindFarm software and utilising 50m² Ordnance Survey Digital Terrain Mapping (DTM) height data covering the study area.

5.5.8 Visual assessment of Settlements and Residential Properties

It is proposed that all settlements within 1km of the Proposed Development will be assessed with regards to the level of visual impact the development will have on them. While the study area is 20km, it is unlikely that there will be any significant visual impact on settlements beyond 10km and as such, it is proposed that all settlements beyond 10km are scoped out of the LVIA. The assessment will include the settlements of Norham, Swinton, Coldstream, Ladykirk and Whitsome, some of which will have photomontages produced to accompany the assessment, where appropriate. The sensitivity for each of the settlements is considered to be high in accordance with Guidelines for Landscape and Visual Impact Assessment, 2013.

A Residential Visual Amenity Assessment (RVAA) for all dwellings inside 2km of the proposed turbine will be carried out. This will include assessing the impact on the dwelling house, the environs including any driveways or access tracks but not include views from upper floor windows. The assessment will be accompanied by wirelines and/or photomontages where appropriate. The *Residential Visual Amenity Assessment*, Landscape Institute, 2019 will be used when conducting this part of the assessment.

5.5.9 Visual Assessment of Main Transport Routes

A route assessment will be undertaken which will explore the visual impact of the Proposed Development on views experienced by road users along major transport routes in the area and assumes that the viewer would be travelling at typical speed for the road conditions. It also includes assessment of any National Cycle Routes, Long Distance Footpaths and locally valued footpaths which fall within the study area. This part of the assessment will

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be considered cumulatively along with all other wind energy development within the study area. It is proposed that significant effects may occur from the following routes:

- A698 between Cornhill on Tweed and Berwick on Tweed; and
- B6470 between Swinton and Salutation.

It is not thought that there will be significant effects from any other routes within the 20km study area and those will be scoped out of the assessment.

- Cumulative Landscape Visual Assessment

In addition to the Landscape Institute methodology for LVIA, the cumulative landscape and visual assessment (CLVIA) has considered the guidance from Scottish Natural Heritage's *Assessing the Cumulative Impact of Onshore Wind Energy Developments,* Scottish Natural Heritage, March 2012. The CLVIA is however, not a substitute for individual wind farm landscape and visual impact assessment.

5.5.10 Predicting Cumulative Landscape Effects

The assessment will consider the extent to which the proposed development, in combination with others, may change landscape character through either incremental effect on characteristic elements, landscape patterns and quality, or by the overall cumulative addition of new features. Identified cumulative landscape effects are described in relation to each individual Landscape Character Area and for any designated landscape areas that exist within the study area.

5.5.11 Predicting Cumulative Visual Effects

The assessment of cumulative visual effects involves reference to the cumulative visibility ZTV maps and the cumulative viewpoint analysis. Cumulative visibility maps are analysed to identify the residential and recreational locations and travel routes where cumulative visual effects on receptors (people) may occur as a result of the proposed development. Table 5.1 lists the projects proposed to be included as part of the cumulative assessment, including Viewpoints and CZTVs.

With potential receptor locations identified, cumulative effects on individual receptor groups are then explored through viewpoint analysis, which involves site visits informed by wireline illustrations that include other wind developments. Travel routes are driven to assess the visibility of different wind developments and inform the assessment of sequential cumulative effects that may occur along a route or journey.

5.5.12 Cumulative Viewpoint Analysis

Each viewpoint will be assessed cumulatively in order to understand whether or not the proposed development introduces a cumulative impact on the view from that location. All visible operational, consented and undetermined planning application wind energy projects are considered along with the Norham development and a level of cumulative magnitude is assigned. The level and significance of cumulative visual effects is determined in the same manner as the main LVIA, using the previous matrix shown in

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Table 5.2.

5.6 Baseline

5.6.1 Landscape Character

The Site is located within the Cheviot LCA, which covers a large section of the southern part of the study area. A detailed assessment of both the direct and indirect impacts on this LCA will be an important part of the LVIA. The 20km study area also contains a number of other LCAs, detailed in the table below.

Table 5.4 - Potential impact on Landscape Character Types

LCTs included in final assessment	LCTs scoped out due to lack of visibility
Northumberland Landscape Character Assessment	
Scoped Into assessment	**Scoped out due to lack of visibility**
Cheviot Fringe	
Cheviots	
Northumberland Sandstone Hills	
Northumberland Coastal Plain	
Scottish Borders Landscape Character Assessment	
Wooded Upland Fringe Valley	
Lowland Margin Platform	
Lowland with Drumlins	
Coastal Pasture	
Lowland Margin with Hills	
Cheviot Uplands	
Pastoral Upland Fringe Valley	
Platform Farmland	
Coastal Valley	
Grassland with Hills	
Moorland	
Coastal Farmland	
Rolling Farmland	
Rolling Lowland Margin	

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LCTs beyond 20km are also proposed to be scoped out, as turbines will typically appear as minor features in distant landscapes from these further away LCTs. An assessment of the indirect effects of the development on the remaining LCTs will be carried out as there is potential for significant indirect effects due to the proposed development.

5.6.2 Landscape Designations

The site is not designated either nationally or locally, and as such it will have no direct impacts on any landscape designations. Due to the visual impact of the development, there may be indirect impacts on the setting and character of any designated landscapes within the 20km study area. Those landscapes are listed in Table 5.6 below and are shown in Figure 5.6.

Table 5.5 - Potential impact on designated landscapes

Designations included in final assessment	Designations scoped out due to lack of visibility
Northumberland Local Development Plan	
Northumberland National Park	
Northumberland Coast AONB	
North Pennines AONB	
Scottish Borders Local Development Plan	
Eyemouth Coast Special Landscape Area	
Registered Parks and Gardens / Gardens and Designed Landscapes	
Tillmouth Park RPG	
Ladykirk GDL	
Paxton House GDL	
Kimmerghame GDL	
The Hirsel GDL	

An assessment of each of these landscapes predicted to have visibility of the turbines will be undertaken as part of the LVIA with photomontages from some of the closer designated landscapes. All GDLs beyond 10km have been scoped out of the LVIA, due to a combination of distance and lack of visibility.

5.7 Summary

The Proposed Development may give rise to some significant effects in terms of both direct and indirect impacts on the landscape character. It may also have significant effects on visual receptors, including residents, road users, walkers and visitors to the area. As such, a detailed assessment will be undertaken through a LVIA, which will include accompanying maps and visualisations.

5.8 Key Questions for the Council and Consultees:

- Q5/1 Do the Council and consultees agree with the proposed methodology?

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- Q5/2 Do the Council and consultees agree with the scope of the viewpoint assessment, identified in Table 5.3.
- Q5/3 Do the Council and consultees agree with the methodology and scope of the cumulative assessment and are the Council aware of any additional projects not listed in Table 5.1.
- Q5/4 Could the Council indicate if any of the projects listed in Table 5.1 are required to have a CZTV produced?
- Q5/5 Are the Council or consultees aware of any further guidance or policy documents not mentioned within the report that are relevant to the assessment?
- Q5/6 Which Core Paths do the Council wish to be considered as part of the assessment?

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6 Cultural Heritage

6.1 Introduction

Cultural heritage is represented by a wide range of features, both above and below ground, which result from past human use of the landscape. These include: standing buildings, many of which are still in use; sub-surface archaeological remains and artefact scatters; industrial remains; earthwork monuments and landscape features such as field boundaries. The aim of this study is to identify elements of archaeological and cultural heritage value that may be directly impacted upon by the Proposed Development, as well as indirectly affecting their setting.

6.2 Legislation, Policy and Guidance

6.2.1 Legislation

National legislation relating to the planning and protection of cultural heritage assets includes:

- *The Town and Country Planning (Environmental Impact Assessment) Regulations*, UK Government, 2017;
- *The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations,* Scottish Government, 2017;
- *Ancient Monuments and Archaeological Areas Act 1979,* UK Government, 1979;
- *Planning (Listed Buildings and Conservation Areas) Act 1990,* UK Government, 1990; and
- *Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997,* UK Government, 1997.

6.2.2 Policy

National and local planning policy relating to the proposed development site includes:

- *UNESCO Convention Concerning the Protection of the World Cultural and National Heritage 1972,* UNESCO World Heritage Convention, 1972;
- *The National Planning Policy Framework,* UK Government, 2012 (Revised 2021);
- *Historic Environment Scotland Act,* Scottish Government, 2014;
- *National Planning Framework for Scotland 3,* Scottish Government, 2014;
- *Scottish Planning Policy, 'Valuing the Historic Environment', (pgs.: 33-35),* Scottish Government, 2014;
- *Historic Environment Policy for Scotland,* Historic Environment Scotland, May 2019;
- *Policy ENV1 – Approaches to Assessing the Impact of Development on the Natural, Historic and Built Environment (Strategic Policy),no Northumberland Local Plan,* Northumberland Council, March 2022;
- *Policy ENV7 – Historic Environment and Heritage Assets, Northumberland Local Plan,* Northumberland Council, March 2022;
- *Policy ENV9 – Conservation Areas, Northumberland Local Plan,* Northumberland Council, March 2022;
- *Policy REN1 – Renewable and Low-Carbon Energy and Associated Energy Storage,* Northumberland Local Plan, Northumberland Council, March 2022;
- *Policy REN2 – Onshore Wind Energy Development, Northumberland Local Plan,* Northumberland Council, March 2022;
- *Policy EP7 – Listed Buildings, Scottish Borders Local Plan,* Scottish Borders Council, May 2016;

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- *Policy EP9 – Conservation Areas, Scottish Borders Local Plan,* Scottish Borders Council, May 2016;
- *Policy EP10 – Gardens and Designed Landscapes, Scottish Borders Local Plan,* Scottish Borders Council, May 2016; and
- *Policy ED9 – Renewable Energy Development, Scottish Borders Local Plan,* Scottish Borders Council, May 2016.

6.2.3 Guidance

In addition to the above legislation and policy, a number of guidance documents have been produced relating to the assessment and protection of cultural heritage assets.

- *The National Planning Policy Framework Guidance – Historic Environment,* UK Government, 2014 (Revised 2019);
- *The Setting of Heritage Assets – Historic Environment Good Practice Advice in Planning 3,* Historic England, 2017;
- *Historic England Advice Note 1 – Conservation Areas,* Historic England, 2019;
- *Historic England Advice Note 10 – Listed Buildings and Curtilage,* Historic England, 2018;
- *Historic England Advice Note 15 – Commercial Renewable Energy Development and the Historic Environment,* Historic England, 2021; and
- *Historic Environment Circular 1*, Historic Environment Scotland, June 2016;
- *Managing Change in the Historic Environment: Setting,* Historic Environment Scotland, June 2016 (updated 2020); and
- *Designation Policy and Selection Guidance,* Historic Environment Scotland, April 2019 (updated 2020).

6.3 Assessment Methodology

In the preparation of this assessment, a range of historical and technical data was collected and analysed. This includes a review of all potential features that fall under the umbrella term of cultural heritage, such as historic buildings and landscapes, in addition to purely archaeological factors. The following sources were consulted:

- Historic Environment Record (HER) via www.heritagegateway.org.uk;
- Northumberland Local HER via www.keystothepast.info;
- LiDAR data via https://environment.data.gov.uk/DefraDataDownload/;
- Historic Environment Local Management (HELM);
- Historic England Heritage at Risk register;
- Natural England Heritage Coasts database;
- Historic England's database of; Listed Buildings (LBs), Scheduled Monuments (SMs), Registered Parks and Gardens, Registered Battlefields, World Heritage Sites and Protected Wreck Sites;
- Scottish National Record of the Historic Environment (NRHE) via www.canmore.org.uk;
- Aerial photograph collection held by Historic Environment Scotland (HES);
- National Library of Scotland (Map Library); and
- HES's database of; Listed Buildings (LBs), Scheduled Monuments (SMs), Gardens and Designed Landscapes (GDLs), Conservation Areas, Inventory Battlefields, World Heritage Sites and monuments proposed for scheduling.

A phased approach to the assessment will be adopted:

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6.3.1 Direct Impact

The area most at risk of direct impact will be land 50m either side of the access track and solar and any areas within 200m of the proposed wind turbine location. See Figure 6.1.

6.3.2 Indirect Impact

The indirect impact on the setting and character of known cultural heritage sites will be considered within this assessment. Nationally significant features such as: Scheduled Monuments, Grade I Listed Buildings (Category A in Scotland), Registered Parks and Gardens (Gardens and Designed Landscapes (GDLs) in Scotland), Registered Battlefields (Inventory Battlefields in Scotland), Heritage Coast and World Heritage Sites will be considered within a 10km radius of the Proposed Development. Any sensitive features beyond this distance may also be considered if there is potential for significant impact. Regionally significant features such as Grade II* Listed Buildings (Category B in Scotland) and Conservation Areas will be considered out to 2km of the proposed development. Locally significant features such as Grade II Listed Buildings are considered out to 1km. See Figure 6.2.

This assessment will include any visual impacts both to and from the monument and any impacts to sense of place, sense of remoteness, cultural identity, evocation of the historical past and associated spiritual responses. Impacts will also be considered cumulatively with other developments in the surrounding area where appropriate.

6.3.3 Cultural Heritage and Archaeology Figures

The assessment will make use of the following visual aids:

- Zone of Theoretical Visibility (ZTV), maps areas where the wind turbines are theoretically visible from. This is a 'bare earth' representation which does not take into account local screening from the natural and built environments; and
- Wirelines and/or photomontages produced using the ReSoft© WindFarm programme where appropriate.

Visual representations will be produced when it is considered to be helpful in visualising the potential indirect visual impact of the development.

6.3.4 Historic Maps

Historic maps held at the National Library of Scotland (Map Library) and aerial photographs will be consulted online as part of the desk-based assessment.

6.3.5 Assessment Criteria

The following general criteria outlined in

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Table 6.1 and Table 6.2 will be used in the assessment of level of effect of any direct or indirect impact on any site of cultural heritage importance.

Table 6.1 – Sensitivity of cultural features

Sensitivity	Definition
High	Grade I Listed Buildings/Category A Listed Buildings Grade II* Listed Buildings/Category B Listed Buildings Scheduled Monuments Registered Parks and Gardens/Gardens and Designed Landscapes World Heritage Sites Registered Battlefields/Inventory Battlefields Protected Wrecks Non-statutory List of sites likely to be of national importance
Medium	Archaeological sites on the Sites and Monuments Record (of regional and local importance) Conservation Areas Heritage Coast Grade II Listed Buildings/Category C Listed Buildings
Low	Archaeological sites of lesser importance Non-Inventory Parks and Gardens

Table 6.2 – Magnitude of cultural effects

Magnitude	Definition
High	Any number of elements that would result in: • a substantial obstruction or addition to the setting where it significantly alters the quality, setting or the visual amenity of the site both to and from the feature; and/or • the removal or partial removal of key features, areas, or evidence important to the historic character and integrity of the site, which could result in the substantial loss of physical integrity.
Medium	Any number of elements that would result in: • a partial obstruction or addition to the setting where it significantly alters the quality, setting or the visual amenity of the site both to and from the feature; and/or • the removal of one or more key features, parts of the designated site, or evidence at the secondary or peripheral level, but are not features fundamental to its historic character and integrity.
Low	Any number of elements that may result in: • an introduction of elements that could alter to a small degree the quality of the setting or visual amenity of the site both to and from the feature; and/or • a partial removal/minor loss, and/or alteration to one or more peripheral and/or secondary elements/features, but not significantly affecting the historic integrity of the site or affect the key features of the site.
Negligible	Any number of elements developments that may result in: • an introduction of elements that could be visible but not intrusive and the overall quality of the setting or visual amenity of the site would not be affected both to and from the feature; and/or • a relatively small removal, and/or alteration to small, peripheral and/or unimportant elements/features, but not affect the historic integrity of the site or the quality of the surviving evidence.

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The level of both direct and indirect effects that the proposed development may have on the surrounding features of historical significance is determined by the combination of the sensitivity and magnitude of change. The following matrix is used to determine the overall significance of effect.

Table 6.3 – Significance of Effect Matrix

Sensitivity	Magnitude of Change			
	High	Medium	Low	Negligible
High	Major	Major/Moderate	Moderate	Moderate/Minor
Medium	Major/Moderate	Moderate	Moderate/Minor	Minor
Low	Moderate	Moderate/Minor	Minor	Minor
Key:		Significant in terms of the EIA Regulations		
		Not Significant		

The significance of any identified effects will be assessed in terms of Major, Major/Moderate, Moderate, Moderate/Minor or Minor. The matrices should not be used as a prescriptive tool but will allow for the exercise of professional judgement.

Any effects that are classified as Major or Major/Moderate, will be considered to be equivalent to likely significant effects referred to in the EIA Regulations. Careful consideration will also be given to Moderate effects to test whether they are significant in EIA terms or not. In all cases, whether an effect is significant or not is confirmed within the assessment.

The following section has considered the current settings of the historic features. It is acknowledged that any woodland and vegetation that currently restricts potential views of the proposed wind turbines from any of the historic features within the study radius is subject to change. External factors such as felling, disease and wind damage are outwith the applicant's control. The assessment has considered the historic features settings at the time of the application submission but recognises that screening provided by vegetation and woodland is potentially subject to change.

6.4 Baseline

6.4.1 Direct Impact

There is potential for features of historical significance within 200m of the proposed wind turbines and 50m from the access tracks and solar to be significantly and directly impacted by the Proposed Development. Table 6.4 indicates that there are two known features of archaeological or cultural heritage significance within these buffers which will be taken forward for assessment.

Table 6.4 - Historic Features within 200m of turbine 50m of all other Proposed Development components

Ref	Type	Monument ID	Name	Feature	Distance
HER01	Local HER	N960	Circular Enclosure (Norham)	Cropmarks of a slight circular enclosure visible on aerial photography.	55m (Turbine)
HER02	Local HER & Scottish NRHE	N934 (Northumberland HER) & 59542 (Scottish NRHE)	Newbiggin Dean Cropmark Enclosure	Cropmarks of a rectangular enclosure visible on aerial photography.	19m (Solar)

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As part of the direct impact baseline, LiDAR data was gathered and reviewed and an extract of this be seen in Figure 6.1b below.

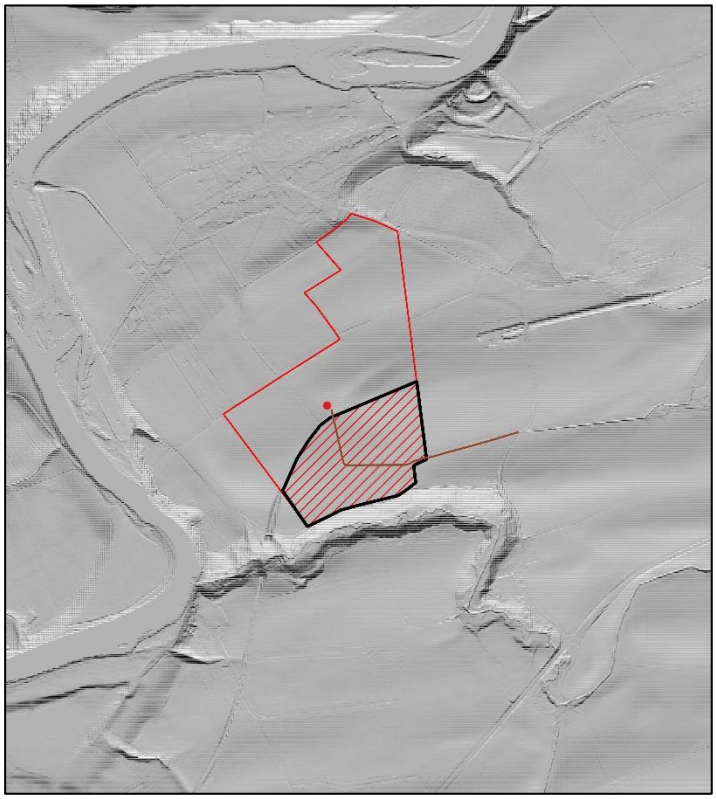

Figure 6.1b - LiDAR Extract of Site

6.4.2 Indirect Impact

Figure 6.2 shows the theoretical visibility of the Proposed Development, the regionally significant historical features out to 2km such as Grade II and II* Listed Buildings (Category B Listed in Scotland) and Conservation Areas; and nationally significant features such as Grade I Listed Buildings (Category A Listed in Scotland), Scheduled Monuments, Registered Parks and Gardens (Gardens and Designed Landscapes in Scotland), Registered Battlefields (Inventory Battlefields in Scotland), Heritage Coast, Protected Wreck Sites and World Heritage Sites.

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Table 6.5 below lists these historical features found within study area.

Within their respective study areas there are 17 Grade I or Category A Listed Buildings, 27 Scheduled Monuments, five Registered Parks and Gardens or Gardens and Designed Landscapes, one Registered Battlefield, three Category B Listed Buildings, 36 Grade II Listed Buildings and one Conservation Area. The assessment will focus on sites within the ZTV and any other the key features which may have the potential to be significantly affected by the turbine development, these sites are highlighted in green in

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Table 6.5 below.

Table 6.5 – Historical features found within 10km

Ref	Distance from Proposed Development	Schedule/LB Ref	Name	Scoped Into or Out of Assessment?
Features within England				
Scheduled Monuments				
SM01	0.8km	1006550	Norham Cross	Scoped In
SM02	0.8km	1009659	Norham Castle, tower keep castle	Scoped In
SM03	2.9km	1018445	Twizel medieval tower house and village, post-medieval folly and garden	Scoped In
SM04	3.2km	1020743	Twizel Bridge	Scoped Out – Outwith ZTV
SM05	3.6km	1006622	Duddo stone circle	Scoped In
SM06	3.8km	1006437	Enclosure on Fadden Hill	Scoped In
SM07	4.4km	1006435	Horncliffe fort	Scoped In
SM08	4.9km	1018443	Duddo Tower	Scoped Out – Outwith ZTV
SM09	6.4km	1006422	Murton High Crags settlements	Scoped In
SM10	7.9km	1006495	Chester Crane camp	Scoped Out - Outwith ZTV
SM11	7.2km	1006508	Cornhill Castle	Scoped Out - Outwith ZTV
SM12	7.1km	1006409	Enclosed settlement	Scoped In
SM13	7.8km	1011644	Etal Castle tower house	Scoped Out - Outwith ZTV
SM14	7.8km	1002906	The King's Stone	Scoped Out - Outwith ZTV
SM15	7.8km	1002948	Hazely Hill round cairn	Scoped In
Listed Buildings				
LB01	0.9km	1303605	Church of St Cuthbert	Scoped In
LB02	1.0km	1154811	Norham Castle	Scoped In
LB03	3.2km	1042199	Twizell Bridge	Scoped Out – Outwith ZTV
LB04	5.3km	1042214	Union Suspension Bridge	Scoped Out – Outwith ZTV
LB05	7.2km	1042183	Etal Castle Great Tower	Scoped Out – Outwith ZTV
LB06	7.2km	1153966	Etal Castle Gate Tower, South Curtain Wall and South West Tower	Scoped Out – Outwith ZTV
LB07	9.6km	1371004	Ford Castle	Scoped Out – Outwith ZTV

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Ref	Distance from Proposed Development	Schedule/LB Ref	Name	Scoped Into or Out of Assessment?
LB08	0.2km	1155065	Railway Viaduct over Newbiggin Dene	Scoped In
LB09	0.3km	1155048	Signal Box and Signal at Norham Station	Scoped In
LB10	0.3km	1303572	Coal Cell and Lime Store at Norham Station	Scoped In
LB11	0.4km	1042226	Goods Warehouse and Oil Land at Norham Station	Scoped In
LB12	0.4km	1042225	Houses, Offices, Waiting Room, Platforms and Lamps and Norham Station	Scoped In
LB13	0.5km	1303583	East Newbiggin Farmhouse	Scoped In
Grade II Listed Buildings within Norham Conservation Area				
LB14	0.8km	1042230	43 West Street	Scoped In
LB15	0.8km	1155084	41 West Street	Scoped In
LB16	0.8km	1042229	The Masons Arms	Scoped In
LB17	0.8km	1154830	Village Cross	Scoped In
LB18	0.8km	1042219	4 Castle Street	Scoped In
LB19	0.8km	1303637	6 Castle Street	Scoped In
LB20	0.8km	1370983	8 Castle Street	Scoped In
LB21	0.8km	1154870	Albion House	Scoped In
LB22	0.8km	1042220	12 Castle Street	Scoped In
LB23	0.9km	1154840	21 Castle Street	Scoped In
LB24	0.9km	1370982	23 Castle Street	Scoped In
LB25	0.9km	1154844	25 Castle Street	Scoped In
LB26	0.9km	1042218	The Victoria Hotel	Scoped In
LB27	0.9km	1370981	1 Castle Street	Scoped In
LB28	0.9km	1042224	10 Cross View	Scoped In
LB29	0.9km	1042223	Alder Side	Scoped In
LB30	0.9km	1303581	4 Cross View	Scoped In
LB31	0.9km	1042222	3 Cross View	Scoped In
LB32	0.9km	1155055	8 and 9 Pedwll Way	Scoped In
LB33	0.9km	1042227	Buchan Lodge	Scoped In
LB34	0.9km	1439671	Norham War Memorial	Scoped In
LB35	0.9km	1155060	Garden Walls Attached to South of Number 12	Scoped In
LB36	0.9km	1042228	Drumore House	Scoped In
LB37	1.0km	1370984	Church Hall Attached to Rear of Number 12	Scoped In
LB38	1.0km	1042221	Gravestone	Scoped In

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Ref	Distance from Proposed Development	Schedule/LB Ref	Name	Scoped Into or Out of Assessment?
LB39	1.0km	1154901	The Old Vicarage	Scoped In
Registered Parks and Gardens				
PG01	3.0km	1001053	Tillmouth Park	Scoped In
Conservation Areas				
CA01	0.6km	CAREA7	Norham	Scoped In
Registered Battlefields				
BF01	7.9km	1000011	Battle of Flodden 1513	Scoped In
Features in Scotland				
Scheduled Monuments				
SM16	1.1km	SM4469	Ladykirk House, barrow	Scoped In
SM17	1.5km	SM4470	Ladykirk House, barrow	Scoped In
SM18	2.4km	SM12362	Hamilton House, fort	Scoped In
SM19	2.9km	SM12932	Horndean Church, church and burial ground	Scoped In
SM20	3.5km	SM12401	Littlehaugh Shiel, fort	Scoped Out – Outwith ZTV
SM21	4.7km	SM12516	Hilton Church, church and burial ground	Scoped In
SM22	8.4km	SM12488	Witches Cleuch, fort	Scoped Out – Outwith ZTV
SM23	8.7km	SM12536	Bellshiel, fort	Scoped Out – Outwith ZTV
SM24	8.6km	SM12349	Hirsel, fort	Scoped In
SM25	8.9km	SM4522	The Hirsel, settlements and ecclesiastical remains	Scoped Out – Outwith ZTV
SM26	9.5km	SM386	The Mount, motte-and-bailey castle	Scoped Out – Outwith ZTV
SM27	9.6km	SM90148	Foulden Old Tithe Barn	Scoped In
SM28	9.7km	SM12356	Cottage Hospital, settlement	Scoped Out – Outwith ZTV
Listed Buildings				
LB40	1.7km	LB8349	St Mary's Church, Ladykirk	Scoped In
LB41	2.6km	LB8351	West Lodge Ladykirk	Scoped In
LB42	5.3km	LB13645	Union Suspension Bridge	Scoped Out – Outwith ZTV
LB43	6.1km	LB10506	Paxton House Estate, Paxton House	Scoped In
LB44	6.2km	LB47697	Paxton House Estate, The Dower House (Former Factor's House)	Scoped In

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Ref	Distance from Proposed Development	Schedule/LB Ref	Name	Scoped Into or Out of Assessment?
LB45	7.3km	LB4068	Lennel House	Scoped Out – Outwith ZTV
LB46	7.9km	LB4075	Coldstream Bridge Over the Tweed	Scoped Out – Outwith ZTV
LB47	8.2km	LB15339	Swinton House	Scoped Out – Outwith ZTV
LB48	8.9km	LB4069	The Hirsel	Scoped Out – Outwith ZTV
LB49	8.5km	LB13850	Swinton House, Dovecot	Scoped In
LB50	1.3km	LB8352	Ladykirk and Norham Bridge	Scoped In
LB51	1.4km	LB8350	Stables and Riding School	Scoped In
Gardens and Designed Landscapes				
GDL01	0.4km	GDL00250	Ladykirk	Scoped In
GDL02	5.6km	GDL00310	Paxton House	Scoped In
GDL03	8.4km	GDL00364	The Hirsel	Scoped In
GDL04	8.9km	GDL00239	Kimmerghame	Scoped In

6.5 Issues Scoped Into the Assessment

While there are a number of features present within the study area, not all of these will have visibility of the site or an outward setting and as such, have been scoped out. The sites outlined in Table 6.6 below have an outward setting and/or theoretical visibility of the Proposed Development and will, therefore, be included in the assessment. The assessment will include 16 Scheduled Monuments, two Grade I Listed Buildings, five Category A Listed Buildings, 36 Grade II Listed Buildings, two Category B Listed Buildings, one Registered Park and Garden, four Gardens and Designed Landscapes, one Conservation Area and one Registered Battlefield.

Table 6.6 – Historic features taken forward for assessment

Ref	Distance from turbine	Schedule/Listing	Name	Description
Features Within England				
Scheduled Monuments				
SM01	0.8km	1006550	Norham Cross	The monument includes a market cross of medieval date with 19th century additions, situated on the village green near the centre of Norham. The cross is constructed from sandstone and includes a clustered shaft with a moulded base and plain plinth supported on a perron of five circular steps.
SM02	0.8km	1009659	Norham Castle, tower keep castle	The monument comprises two areas which together include the remains of the tower keep castle at Norham. The remains are

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Ref	Distance from turbine	Schedule/Listing	Name	Description
				incorporated within three enclosures or wards, each bounded by earthwork defences
SM03	2.9km	1018445	Twizel medieval tower house and village, post-medieval folly and garden	The monument includes a medieval tower house incorporated into a ruined 18th century folly and the earthwork remains of a probable medieval village and former garden located above a river cliff on the north bank of the River Till.
SM05	3.6km	1006622	Duddo stone circle	The monument, also known as Duddo Five Stones, includes a stone circle of Neolithic/Bronze Age date, situated on top of a large knoll overlooking the River Tweed to the west. The monument includes five standing stones forming a rough circle approximately 10.5m in diameter.
SM06	3.8km	1006437	Enclosure on Fadden Hill	The monument includes the remains of a fortlet of Roman date, situated on a prominent ridge on the east slopes of Fadden Hill. The enclosure is rectangular with rounded corners and is preserved as a cropmark. The form of the enclosure indicates it to be a Roman fortlet.
SM07	4.4km	1006435	Horncliffe fort	The remains of a fort thought to be Roman in origin but this is unclear. The fort is located to the north of Horncliffe. The fort survives as cropmarks of threes ditches and two intermediate banks with an enclosed area.
SM09	6.4km	1006422	Murton High Crags settlements	The monument includes the remains of a defended settlement of Iron Age date, hut-circles of Iron Age and Romano-British date and an enclosure, situated on the hilltop of Murton High Crags, the crags themselves forming the steep scarp to the north west.
SM12	7.1km	1006409	Enclosed settlement	The monument includes the buried remains of a multi-phase enclosed settlement of Iron Age/Romano-British date, situated on a north east to south west ridge overlooking the River Tweed.
SM15	7.8km	1002948	Hazely Hill round cairn	The monument includes the remains of a round cairn of Bronze Age date, situated on the summit of Hazely Hill. The round cairn measures approximately 4.9m in diameter and is preserved as a low earthwork.
Listed Buildings				
LB01	0.9km	1303605	Church of St Cuthbert	Parish church. Later C12, probably by Richard of Wolviston for Bishop Puiset. East bay of chancel added early C14. Tower 1837, south porch and aisle 1846, by I. Bonomi. North aisle and transept 1852, by D. Gray. Old parts squared stone, later parts dressed stone with ashlar dressings. Aisles have Welsh slate roofs, other roofs not visible.
LB02	1.0km	1154811	Norham Castle	Ruined castle of the bishops of Durham. Originally a motte-and-bailey castle of 1121 for Bishop Flambard. Rebuilt in stone c.1157 by Richard of Wolviston for Bishop Puiset. Of this period the keep and part of the masonry of walls and west gateway. C13 additions include the south wall of the outer ward and the great hall in the inner ward. The keep was extensively remodelled in 1422-25; finally much rebuilding, especially of the north wall, in 1513-15 for Bishop Ruthal. One of the turrets of south wall encased in Gothick cottage in the late C18 or early C19.

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Ref	Distance from turbine	Schedule/Listing	Name	Description
LB08	0.2km	1155065	Railway Viaduct over Newbiggin Dene	Disused railway viaduct. c.1849 for the York, Newcastle and Berwick Railway. Rock-faced stone with brick soffits to arches. Iron railings. 6 tall, broad segmental arches on battered piers with cornice bands. Low parapet with plain railings. Low end piers with shallow pyramidal caps.
LB09	0.3km	1155048	Signal Box and Signal at Norham Station	Signal box and signal. Said to be 1911, the 1st floor of the signal box re-used from earlier system. For the North Eastern Railway. Brick ground floor in English bond, wood above, Welsh slate roof. Signal iron.
LB10	0.3km	1303572	Coal Cell and Lime Store at Norham Station	Coal cell and former lime store, now used exclusively as coal depot. c.1849 for the York, Newcastle and Berwick Railway. Snecked stone with Welsh slate roof.
LB11	0.4km	1042226	Goods Warehouse and Oil Land at Norham Station	Engine shed built 1849 for the York, Newcastle and Berwick Railway, converted to goods warehouse 1852. Snecked stone with Welsh slate roof. One tall storey. Tall entry in each end with wooden lintel. 4 buttresses with offsets on right return. Gabled roof.
LB12	0.4km	1042225	Houses, Offices, Waiting Room, Platforms and Lamps and Norham Station	Disused station including 2 platforms with 4 lamps, the station master's house, the waiting room, the office and telegraph office, the porter's room and a store, formerly the base of the signal box. 1849 for the York, Newcastle and Berwick Railway. Waiting room, office and store, and the lamps probably late C19. House, platforms and porter's room ashlar, the other buildings wood boarding; Welsh slate roofs.
LB13	0.5km	1303583	East Newbiggin Farmhouse	House. c.1840. Ashlar with Welsh slate roof. 2 storeys, 3 bays. 6-panel door with 3-pane overlight. 12-pane sashes in plain reveals with projecting sills. High, hipped, almost pyramidal roof with square, banded ridge stacks.
Grade II Listed Buildings within Norham Conservation Area				
LB14	0.8km	1042230	43 West Street	House. Early-mid C19. Ashlar with Welsh slate roof and brick chimneys. 2 storeys, 3 bays. Central half-glazed, late C19 door with 3-pane overlight. To left canted bay window with stone pent roof and original 12- and 6-pane sashes of Scottish type with horizontally-set panes. To right renewed tripartite sash. On 1st floor three 12-pane sashes. Gabled roof with flat coping and end stacks.
LB15	0.8km	1155084	41 West Street	House. Early-mid C19. Rendered with Welsh slate roof and brick chimneys. 2 storeys, 2 windows. Pilaster strips. 6-panel door to left with margined overlight in surround with pilaster strips and cornice. To right canted bay window with 12- and 8-pane sashes under stone pent roof. On 1st floor two 12-pane sashes.
LB16	0.8km	1042229	The Masons Arms	Inn. Probably C18, refronted c.1820. Entrance altered c.1900. Painted roughcast; Welsh slate roof. 2 storeys, 4 plus 1 bays.
LB17	0.8km	1154830	Village Cross	Village cross. Medieval and 1870s. Sandstone. Medieval base of 6 high circular steps. Victorian shaft with clustered columns and very tall elongated pyramidal top with weather vane.
LB18	0.8km	1042219	4 Castle Street	House. Mid C18. Scored stucco with pantiled roof and C19 brick chimneys on older brick bases. 2 storeys, 3 bays. Plinth. Half-

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Ref	Distance from turbine	Schedule/Listing	Name	Description
				glazed central door and sash windows in raised stone surrounds. Steeply-pitched gabled roof with raised coping and end stacks.
LB19	0.8km	1303637	6 Castle Street	House. Mid-late C19. Pebbledashed with painted stone dressings, Welsh slate roof and brick chimneys. 2 storeys, 3 bays. Plinth. Central panelled door in raised stone surround. Sash windows in similar surrounds with projecting sills. Similar windows on 1st floor with sill band. Gabled roof with end stacks.
LB20	0.8km	1370983	8 Castle Street	House and shop. Probably mid C19. Roughly-dressed stone with dressings; Welsh slate roof. 2 storeys. On the ground floor 4 irregular bays. Half- glazed door in 3rd bay and two sash windows to left; segmental carriage arch to through passageway on right. Two sash windows above. Gabled roof with end stacks.
LB21	0.8km	1154870	Albion House	House and attached cottage. Probably early C18, the openings altered early C19. Cottage attached to rear, possibly early C17, altered. Random rubble with dressings. Pantiled roof with C19 brick chimneys. 2 storeys, 4 bays. Plinth and raised alternating quoins. Panelled door in 2nd bay in raised stone surround. One 12-pane sash to left and 2 to right in similar surrounds. On 1st floor three gabled half-dormers with similar surrounds. Steeply-pitched roof with end stacks.
LB22	0.8km	1042220	12 Castle Street	Formerly a house and shop, now all used as house. Mid-late C19. Snecked stone with Welsh slate roof did brick chimneys. 2 storeys, 3 bays. Central panelled door with overlight. Left bay has contemporary shop front with panelled door and 4-pane shop window in surround with pilasters and dentil cornice. Elsewhere sash window with projecting sills.
LB23	0.9km	1154840	21 Castle Street	House. Early C19. Ashlar with Welsh slate roof and brick chimneys. 2 storeys, 3 bays. In right bay panelled door with overlight. Sash windows with projecting sills. Gabled roof with flat coping and left end stack.
LB24	0.9km	1370982	23 Castle Street	House. 1810-20. In 2 sections. To left scored stucco with ashlar dressings, to right random rubble with painted ashlar dressings. Welsh slate roof with old brick chimneys. Formerly 2 houses, both 2 storeys, 2 bays.
LB25	0.9km	1154844	25 Castle Street	House. Early C19. Random rubble with ashlar dressings; Welsh slate roof and brick chimneys. 2 storeys, 2 bays. Half-glazed door to left in raised stone surround. 12-pane sash windows in raised stone surrounds. Right end stack.
LB26	0.9km	1042218	The Victoria Hotel	Inn. Early C19. Pebbledashed with painted ashlar. Welsh slate roof and brick chimneys. 2 storeys, 4 bays. Left bay has carriageway to rear of building. Bays 2 and 3 have inn front. It has 2 decorative panelled doors with 2-pane overlights flanking a large tripartite window with panelled apron. The window has a high transom with dentils, arched segmentally over centre light. Over this whole section a corniced fascia on 4 wood brackets. 12-pane sash to right in raised stone surround. On 1st floor 4 similar 12-pane sashes. Gabled roof with brick end stacks.
LB27	0.9km	1370981	1 Castle Street	House. Early C19. Random rubble with painted ashlar dressings; Welsh slate roof and later C19 brick chimneys. 2 storeys, 2 bays. Panelled door with overlight in raised stone surround To left sash window with projecting sill. On 1st floor two 12-pane

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Ref	Distance from turbine	Schedule/Listing	Name	Description
				sashes in raised stone surrounds. Gabled roof with left end stack.
LB28	0.9km	1042224	10 Cross View	House. Mid-late C19. Dressed stone with ashlar dressings; Welsh slate roof and brick chimneys. 2 storeys, 3 bays. Central door, with elaborate Gothic panelling and overlight, under floating cornice. Flanking single-storey canted bay windows with finely-moulded reveals add cornices. On 1st floor, sash windows in alternating-block surrounds. Gabled roof with flat coping and corniced end stacks.
LB29	0.9km	1042223	Alder Side	Cottage. Early Cl9. Rendered with painted ashlar dressings, Welsh slate roof and old brick chimneys. Single storey, 3 bays. Central panelled door with 3- pane overlight in raised stone surround. 12-pane sashes in similar surrounds. Gabled roof with decorative bands of fish-scale slates. Very tall left end stack.
LB30	0.9km	1303581	4 Cross View	House. Early C18 remodelled c.1800. Random pink sandstone with beige ashlar dressings. Pantiled roof. 2 storeys, 3 bays. Central half-glazed door in raised stone surround. Sash windows in similar surrounds. 1st-floor centre window blocked, smaller and without a surround, i.e. from before the remodelling. Steeply-pitched gabled roof with old brick end stacks and raised coping. Projecting wing to rear and single-storey outshut with 12-pane sashes. Interior has staircase with stick balusters, 6-panel doors and one early C19 cast-iron fireplace.
LB31	0.9km	1042222	3 Cross View	House. Probably early C19 with earlier core. Scored stucco with Welsh slate roof and brick chimneys. 2 storeys, 2 windows. On the ground floor half-glazed door to right in raised surround. Two sash windows to left and 2 on 1st floor all in raised stone surrounds. Steeply- pitched roof with banded left end stack and flat coping.
LB32	0.9km	1155055	8 and 9 Pedwell Way	Pair of houses. 1840-50. Ashlar with Welsh slate roof and brick chimneys. 2 storeys, 2 and 3 bays. Raised alternating quoins. No. 8 to right 3 bays. Central panelled door and 2-pane overlight in raised chamfered stone surround with cornice hood on brackets. 12-pane sashes with projecting sills. 1st floor sill bands. No. 9 has similar detail. Hollow-chamfered cornice. Gabled roof with flat coping; 2 end and one ridge stacks.
LB33	0.9km	1042227	Buchan Lodge	House. Mid-late C18. Ashlar with concrete tile roof and C19 brick chimneys. 2 storeys, 3 bays. Rusticated quoins. Central 6-panel door with overlight in broad rusticated surround with keystone tied into cornice. Sash windows in flat raised surrounds. Narrow C19 window to right of door. 1st-floor sill bands. Steeply-pitched gabled roof with kneelers, splayed coping and end stacks.
LB34	0.9km	1439671	Norham War Memorial	The memorial stands on a small triangular green at the north end of Pedwell Way, in close proximity to surrounding buildings listed at Grade II.
LB35	0.9km	1155060	Garden Walls Attached to South of Number 12	Garden walls. Early C19 re-using stone of much earlier date, probably from Norham Castle. Sandstone including big squared-stone blocks. Walls c.5 ft. high round 3 sides of garden. Broken by gateway in middle of south side.
LB36	0.9km	1042228	Drumore House	House, formerly schoolmaster's house. c.1800. Dressed stone with Scottish slate roof and brick chimneys. Square plan. 2

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Ref	Distance from turbine	Schedule/Listing	Name	Description
				storeys, 3 bays. Central doorway with Victorian vertical-panel door, now with glazed panels. 3-pane overlight. 12-pane sashes in plain reveals. Eaves cornice. Hipped roof with 2 stacks on side pitches. 2-bay returns.
LB37	1.0km	1370984	Church Hall Attached to Rear of Number 12	School, now used as village hall. Early C19. Random rubble with Welsh slate roof. 2 storeys, 3 bays. Mullion-and-transom cross windows on ground floor, 2-light mullioned windows above, some with diamond-paned casements. Separate doorways to each floor in wooden lean-to on left return. Blank quatrefoils in each gable.
LB38	1.0km	1042221	Gravestone	Gravestone. Early C18. Sandstone tablet c.3. ft. high with segmental-arched top. Recessed moulded panel with primitive carving of cherub's head and wings. Inscribed beneath:- My loving husband is gone to rest and hopes to rise among the just.
LB39	1.0km	1154901	The Old Vicarage	House, formerly the Vicarage. Rebuilt 1800 for Rev. Atkins, enlarged 1830 for Rev. Darnell. Roughly-coursed sandstone with tooled-and-margined ashlar dressings; Welsh slate roof and brick chimneys. 2 storeys, 3 bays. Raised alternating quoins. Central 2-leaf, half-glazed door with horizontally-set panes in the Scottish style. 12-pane sash above door. Outer bays have shallow 2-storey bows with tripartite windows, the centre lights broad 12-pane sashes, the outer lights very narrow 8-pane sashes. Moulded eaves cornice following the contours of the bows. Hipped roof with C20 ridge stacks.
Registered Parks and Gardens				
PG01	3.0km	1001053	Tillmouth Park	Early and late C19 picturesque pleasure grounds and formal gardens, including the remodelling of mid to late C18 parkland and a medieval castle.
Conservation Areas				
CA01	0.6km	CAREA7	Norham	The Conservation Area covers the entire settlement of Norham, including Norham Castle. The settlement includes a number of Grade II Listed Buildings, two Grade I Listed Buildings and two Scheduled Monuments.
Registered Battlefields				
BF01	7.9km	1000011	Battle of Flodden 1513	The battle was fought over arable fields close to the village and over rough grazing moorland on the hillslopes. Although the appearance of the landscape has changed with Parliamentary enclosure in the eighteenth century, the topography is dramatic and the course of the battle is easily traced.
Features in Scotland				
Scheduled Monuments				
SM16	1.1km	SM4469	Ladykirk House, barrow	The monument is a burial mound of the earlier Bronze Age, about 2500 years old, situated near the E edge of the parkland of Ladykirk House. It is circular, measuring 20m in diameter and 0.75m in height.
SM17	1.5km	SM4470	Ladykirk House, barrow	The monument is a burial mound of the earlier Bronze Age, about 3500 years old, situated in parkland about 60m from the

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Ref	Distance from turbine	Schedule/Listing	Name	Description
				gate of the new Ladykirk House. It is subcircular and measures 25m (NNW-SSE) by 19m transversely.
SM18	2.4km	SM12362	Hamilton House, fort	The monument comprises a small inland promontory fort of later prehistoric or early historic date that survives as buried cropmarked features visible on aerial photographs taken in 1976 and 1984. The monument is preserved in an arable field that is regularly ploughed. The site is a naturally strong defensive position with steep-sided slopes to the east and north with views over the valley of the River Tweed.
SM19	2.9km	SM12932	Horndean Church, church and burial ground	The monument comprises the ruins of a church dedicated to the Holy Rood. The first mention of a church at this location occurs in the 12th century. The church lies within a fenced enclosure at a height of around 40m above sea level. The site is situated at the head of a slope running down to a stream on the east and to the River Tweed approximately 400m to the south.
SM21	4.7km	SM12516	Hilton Church, church and burial ground	The monument comprises the former parish church of Hilton and its burial ground, likely to be late medieval in origin. It is visible as a ruined building, the earthwork remains of the adjacent burial ground and at least 25 burial markers. The church was dedicated by Bishop de Bernham in 1243. It occupies the crest of a small hill at the W end of the hamlet of Hilton, approximately 85m above sea level.
SM24	8.6km	SM12349	Hirsel Law, fort	The monument comprises the remains of a hillfort, visible as the cropmarks of a pair of ditches. The fort occupies the broad-backed summit of Hirsel Law at a height of around 95m above sea level. It is likely to be of late first millennium BC/early first millennium AD (Iron Age/early historic period) and forms part of a wider pattern of Iron-Age or early-historic period settlement.
SM27	9.6km	SM90148	Foulden Old Tithe Barn	The monument consists of an 18th- or early 19th-century barn and its court yard adjacent to the church whose teinds or tithes were stored in it.
Listed Buildings				
LB40	1.7km	LB8349	St Mary's Church, Ladykirk	Triapsidal cross church without aisles, complete and almost unaltered. Said to date from 1500 and to have been dedicated to the Blessed Virgin by James IV.
LB41	2.6km	LB8351	West Lodge Ladykirk	Dated 1799 - centre Corinthian archway topped by lion; flanking columned screen; lodge pavilions with niches. A fine classical composition.
LB43	6.1km	LB10506	Paxton House Estate, Paxton House	Probably John and James Adam, 1757-1763; interior work by Robert Adam, circa 1773; NE wing (picture gallery and library) by Robert Reid, 1811-14; later additions and alterations. Symmetrical, 2-storey with basemen.
LB44	6.2km	LB47697	Paxton House Estate, The Dower House (Former Factor's House)	William J Gray, Coldingham, 1871, with later additions and alterations. Asymmetrical, single storey with attic.
LB49	8.5km	LB13850	Swinton House, Dovecot	Dated 1746; repaired later 20th century. Circular-plan dovecot with conical roof surmounted by conical-capped, part timber, part slated drum.

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Ref	Distance from turbine	Schedule/Listing	Name	Description
LB50	1.3km	LB8352	Ladykirk and Norham Bridge	Dated 1885-7 with inscription; 4 arches with centre bastion; spanning the Tweed. County and Border boundary.
LB51	1.4km	LB8350	Stables and Riding School	Mid 19th century. Large U shaped courtyard range with centre arched opening topped by octagonal ribbed dome on raised drum. Riding School adjoins on east side. Gothic screen wall with pointed arches on west side dated 1824 with initials W R.
Gardens and Designed Landscapes				
GDL01	0.4km	GDL00250	Ladykirk	This is a rare and intact parkland landscape that contains two scheduled prehistoric barrows. Surviving records provide outstanding historic value for documenting estate improvement from the 18th century onwards and suggest the possible early involvement of the designer Robert Robinson. Today, plentiful mature parkland and woodland broadleaves enrich the local scenery of the Tweed valley.
GDL02	5.6km	GDL00310	Paxton House	Paxton forms a major example of 18th-century landscape design that retains many original and important features. The remarkable Home of Wedderburn archive provides outstanding historical value for this site. The parks and woodlands, meanwhile, contribute to the Tweed valley scenery and form the setting for proactive nature conservation projects implemented by the Paxton Trust and volunteer groups.
GDL03	8.4km	GDL00364	The Hirsel	An outstanding designed landscape with a long historical connection to the Home family. In addition to forming an attractive setting for the category-A listed house, the grounds contain nationally important archaeological remains, a designated Site of Special Scientific Interest (SSSI) and two notable heritage trees. The parkland and woodland canopy make a major contribution to local scenery while rhododendrons and azaleas produce an impressive spring display in the Victorian woodland garden.
GDL04	8.9km	GDL00239	Kimmerghame	Kimmerghame is an intact and beautifully-maintained designed landscape, documented by an outstanding collection of 18th and 19th-century estate plans. The policies provide the setting for a good range of architectural features, including a walled garden that retains its traditional layout and function. The Blackadder Water is designated as a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC).

Each of the features listed in **Table 6.6** above will be assessed as part of the EIA. The assessment will be accompanied by wirelines and/or photomontages where appropriate.

6.6 Proposed Visualisations

The following visualisations are proposed as part of the LVIA chapter and will also be relevant to the Cultural Heritage assessment.

- Norham Castle;
- Norham Cross which is located within Norham Conservation Area; and
- Ladykirk and Norham Bridge.

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Any other wirelines as requested by Historic England, Historic Environment Scotland and the Northumberland Council Archaeologist will also be included as part of the assessment.

6.7 Mitigation

Planning guidance states that it is Government policy to protect and preserve archaeological sites and monuments in situ wherever feasible. Where preservation in situ is not possible, planning authorities should ensure that an appropriate level of excavation, recording, analysis, publication and archiving is carried out, before and/or during development. If deemed appropriate a Programme of Archaeological Works including an Archaeological Watching Brief may be required during ground-breaking works associated with the construction phase.

6.7.1 Permanent Land-take and Operation

Current proposals indicate that the turbine locations, access tracks and other aspects of development, avoid the locations of known features of cultural heritage interest and as such direct impacts should be avoided.

This baseline was prepared using data from Historic England, Historic Environment Scotland, Scottish National Record of the Historic Environment and the Northumberland Historic Environment Record, however it is nevertheless possible that additional, unrecorded features do exist within the application area. In the event that archaeological features are encountered, a suitable program of archaeological works will be implemented to the satisfaction of the planning authority.

6.7.2 Restoration

It is not anticipated that any restoration measures are required and the design of the Proposed Development is such that it avoids direct impacts on any features of cultural heritage.

6.8 Summary

The Proposed Development may give rise to some significant effects in terms of indirect impacts on the setting of a number of features of regional and national significance during the operational phase, and there remains potential for direct impact during the construction phase on currently unrecorded/unknown features. As such, a detailed assessment will be undertaken as part of the ES.

6.9 Key Questions for the Council and Consultees

- Q6/1 Do the consultees agree with the proposed methodology and scope of assessment?
- Q6/2 Do the consultees know of any cultural heritage assets in the vicinity of the development which it considers may raise significant issues with the EIA process?
- Q6/3 Do the consultees know of any cultural heritage assets which have not been included within the assessment scope that require inclusion in the final scope?
- Q6/4: Do the council or consultees require wirelines from any other features identified in the baseline?

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7 Noise

7.1 Introduction

Noise impacts could potentially arise during the construction, decommissioning and operational phases of the proposed development. The Proposed Development would consist of a single turbine with a maximum tip height of 67m and Solar Farm with a generating capacity of approximately 8.9MW.

The following information sets out the proposed methodology to be used for the Noise Impact Assessment and is provided to enable the assessment scope to be tailored to the proposed development.

7.2 Legislation, Policy and Guidance

The following sources provide guidance on the assessment of wind turbine noise:

- UK Government: 'National Planning Policy Framework'[2].
- UK Government supplementary guidance for Renewable and Low Carbon Energy[3]

For the assessment of operational wind turbine noise, Planning advice endorses the use of ETSU-R-97 and the Institute of Acoustics 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'.

7.2.1 Guidance – Construction phase noise

Guidance for assessing construction phase noise is given in:

- BS 5228-1:2009+A1:2014 - Code of practice for noise and vibration control on construction and open sites.

The standard provides calculation methodology and indicative sound power data for a wide range of construction plant. Assessment of the significance of impacts can be made through comparison of predicted immission levels with criteria that the standard defines.

7.2.2 Guidance – Operational phase noise

Guidance for assessing operational noise from wind farms is given in the Institute of Acoustics Good Practice Guide[4]. This guidance was developed to standardise the approach to noise assessment of wind farms in the UK. The guidance also provides advice on the form of planning conditions that should be adopted for wind farm projects. The GPG does not address the question of what noise limits should be applied, as this has been determined by the government.

The basis for operational wind farm noise limits that have been adopted in the UK is given in: 'ETSU-R-97: The Assessment and Rating of Noise from Wind Farms (1997)'; the Department of Trade and Industry (usually referred to as the Noise Working Group Recommendations). National planning guidance is clear that the IoA GPG and ETSU-R-97 should be followed in the assessment of operational noise from wind farms.

The International Standard ISO 9613, 'Acoustics – Attenuation of Sound During Propagation Outdoors - Part 2', noise propagation model has been used for the turbine immission calculations.

[2] UK Government (2021), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf - Last Accessed (06/10/2022)

[3] UK Government (2015), https://www.gov.uk/guidance/renewable-and-low-carbon-energy - Last Accessed (06/10/2022)

[4] Institute of Acoustics (2013), 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'.

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IEC/TS 61400-14:2005 - Declaration of apparent sound power level and tonality values is a standard providing a method to derive appropriate sound power level values from several independent sources to improve robustness.

With regards to the solar element of the development, Guidance for assessing the operational phase of the project is given in:

- BS 4142:2014+A1:2019- Methods for rating and assessing industrial and commercial sound.

BS 4142 is used to assess the impact of industrial and commercial sound. The standard details measurements procedures and guidance on collecting suitable data. It acknowledges that the influence of the context in which the sound is heard is a significant modifier of the impact, in line with subjective assessments. The standard supports current UK planning guidance and Environment Agency requirements on noise impact assessments.

Noise source levels are assessed at the location of nearby noise sensitive receptors as Specific Sound Levels ($L_{Aeq,t}$), which are then adjusted for any inherent characteristics to produce a Rating Level. Residual Sound Levels ($L_{Aeq,t}$) are assessed at the same location in the absence of the specific source when active sources are being assessed (as opposed to modelled sources). Representative typical Background Sound Levels ($L_{A90,t}$) are ascribed to each receptor and a differential comparison made with the Rating Level.

When assessing the character of a sound source to determine the Rating Level, the standard provides various methods that may be deemed suitable by the assessor depending on the context and level of detail required. These include the subjective, objective, and reference methods which can be used to verify the prominence/audibility of tones or impulsive sounds.

Source noise characteristics covered by BS4142 are tonality, impulsivity, intermittency or any other distinctive characteristic that readily differentiates the source noise from its acoustic environment.

Differences of +10dB or more may indicate significant adverse impact. Differences of +5dB indicate a degree of adverse impact, depending on the context. The lower the differential, the lower the predicted impact of the source noise on the receptor. A difference of -10dB is considered to be of negligible impact.

7.2.3 Low Frequency Noise

A study[5] carried out in 2006 by Hayes McKenzie, on behalf of the Department for Business, Enterprise and Regulatory Reform, investigated the potential impact of infrasound or low frequency noise arising from wind turbines. The study concluded that infrasound or low frequency noise arising from the operation of wind turbines did not result in adverse health impacts.

A further research study in 2016[6] stated the level of infrasound due to wind turbines is low in comparison to other technical and natural sources. The findings concluded 'that adverse effects relating to infrasound from wind turbines cannot be expected on the basis of the evidence at hand.'

7.2.3.1 Amplitude Modulation

Amplitude Modulation (AM) is an element of turbine noise has been the subject of considerable research in recent years. The University of Salford conducted a study[7] on behalf of the Department for Business, Enterprise and Regulatory Reform to investigate whether noise complaints arising from wind farms were due to the presence of AM. The report found that complaints were highly likely to be caused by AM in 4 out of the 27 wind farms included in the study. However, it concluded, *'that the causes of AM are not fully understood, and that AM cannot be fully*

[5] Hayes McKenzie (2006), 'The measurement of low frequency noise at three UK wind farms'.

[6] Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg (2016), 'Low-frequency noise incl. infrasound from wind turbines and other sources'.

[7] University of Salford, The Department for Business, Enterprise and Regulatory Reform, URN 07/1235, (2007), 'Research into aerodynamic modulation of wind turbine noise'.

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predicted at current state of the art.' The findings of the investigation were reconfirmed in 2013 in an updated research report by Renewable UK[8].

In 2016[9] the IoA produced 'A Method for Rating Amplitude Modulation in Wind Turbine Noise', in which amplitude modulation is defined as the following:

"Wind turbine amplitude modulation is defined as periodic fluctuations in the level of audible noise from a wind turbine (or wind turbines), the frequency of the fluctuations being related to the blade passing frequency of the turbine rotor(s)."

The report acknowledges that certain levels and/or characteristics of amplitude modulation may lead to disturbance and noise complaints. The guidance does not aim to quantify the level at which AM could pose an issue but outlines a proposed methodology to assess and rate AM arising from operational wind farms.

Currently, there is no agreed method of assessment for amplitude modulation, pre-construction. As such, any assessment can only be conducted after the wind farm is operational. A requirement for post-completion assessment of amplitude modulation could be included within an appropriate planning condition, should this aspect of turbine noise be deemed to be excessive by environmental health following a verified noise complaint.

7.3 Methodology

7.3.1 Construction phase noise

The assessment of noise impacts from construction activities includes the installation of ancillary infrastructure as well as the solar panels and wind turbine themselves.

The factors influencing the impact of plant noise are: the number and character of noise sources; the duration of activity and hours of work; the separation distance between source and receptor; and reduction of noise by absorption or screening.

Although BS 5228-1 does not specify absolute noise limits relating to construction activities, it does provide detailed guidance on the steps that can be taken to minimise potential noise effects.

During the construction phase of the Proposed Development, it is expected that noise levels in the area will be greater due to the operation and movement of plant. In BS 5228-1, the ABC method outlined in E3[10] sets out the following for classifying the significance of the construction noise:

"Noise levels generated by construction activities are deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,\ Period}$, from construction noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant impact."

Works and operation of plant on this site are expected to be limited to the daytime periods: Monday to Friday (07.00–19.00) and Saturdays (07.00–13.00). As a result, the cut off value for significant construction noise impact is deemed to be 65dB(A) $L_{Aeq,T}$. It is possible that, due to weather constraints (e.g., the impact of weather on the crane operation), the erection of the turbines could occur outside of the working hours defined above. For this or any other activity that extends beyond daytime periods, the lower cut-off limits of 55dB(A) and 45dB(A) would apply dependent on time of day.

[8] Renewable UK (2013), 'Wind Turbine Amplitude Modulation: Research to improve understanding as to its Cause and effects'.
[9] Institute of Acoustics (2016), 'A Method for Rating Amplitude Modulation in Wind Turbine Noise'.
[10] BS 5228-1 'Code of practice for noise and vibration control on construction and open sites', p119

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The methodology for determining the levels of the construction noise involves calculating the total sound pressure level at the nearest sensitive receptor for a construction task, $L_{Aeq(12hr)}$, [equation 1], by summing the total potential sound power level for a given construction phase [equation 2] and subtracting a correction for its distance from the nearest property, K_S [equation 3]. These three equations are shown below:

[1] $L_{Aeq,T} = L_{WA} - K_S$

[2] $L_{WA} = 10\log\{10^{(Lactivity1/10)} + 10^{(Lactivity2/10)}...\}$

[3] $K_S = 25\log(R)+1$ [for R > 25m]

The calculations assume by default that each activity lasts for the full daytime period at 100% intensity.

7.3.2 Operational phase noise

The assessment of operational noise impacts takes the form of an ETSU-R-97 assessment following the IoA GPG.

The assessment will focus on the highest potential impacts by assessing the nearest affected properties that lie within the study area; the extent of which is determined by mapping a 35dB(A) L_{90} contour based on predicted immission from the proposed development.

7.3.2.1 Noise Limits

The ETSU guidelines recommend that wind turbine noise should be limited to an absolute lower limit between 35 and 40dB(A) [LA90,10min] for quiet daytime periods and 43dB(A) for night-time periods (defined below), or 5dB(A) above the background noise levels, whichever the greater. For locations where the resident has a demonstrable financial involvement in a project, a lower fixed limit of 45dB(A) is applicable, or 5dB(A) above the background noise levels, whichever is the greater.

Table 7.1 ETSU assessment periods

The quiet daytime periods (amenity hours) are:	
18:00 - 23:00	Monday to Friday
13:00 - 23:00	Saturdays
07:00 - 23:00	Sundays
Night-time periods are: 23:00 – 07:00 every day	

For a project whose immission levels are not expected to exceed 35dB(A) at the closest Noise Sensitive Receptors (NSRs), a simplified approach may be taken that allows a project to be approved with a single fixed 35dB(A) noise limit applicable at all times or 45dB(A) where a resident has financial involvement. Where proposed project noise levels exceed 35dB(A), the ETSU-R-97 noise assessment should be undertaken with reference to noise limits derived from measured background noise levels. Full ETSU-R-97 limits will also be required where cumulative turbine noise exceeds applicable lower fixed limits.

7.3.3 Noise Sensitive Receptors (NSRs)

The study area adopted for the identification of NSRs that could potentially be impacted by the project sound levels will be those that lie within a 35dB(A) noise contour as calculated from the proposed turbines.

Noise Assessment Locations (NALs) will be positioned at NSRs, 15m from a dwelling façade in the direction of the nearest turbine or as far in that direction as the curtilage will allow. Where NSRs are located adjacent to each other or readily form a grouping, a single NAL will be selected, representing the closest of the adjacent receptors to the proposed turbines.

This approach follows the ETSU-R-97 principle of assessing nearest receptors; focussing on the highest impacts allows for a more concise assessment.

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7.3.4 Cumulative Assessment Methodology

When considering cumulative impact from two or more developments at a given NSR the IoA Good Practice Guide states:

"If the proposed wind farm produces noise levels within 10dB of any existing wind farm/s at the same location, then a cumulative noise impact assessment is necessary." [11]

Although no fixed criteria are given within ETSU-R-97, a search area radius of 3km from the proposed turbine is considered a suitable distance at which to assess immission contributions from third-party projects, beyond which impacts on receptors would be negligible.

The planning portal for Northumberland Council was reviewed for cumulative wind turbine developments within 3km of the Proposed Development. Presently, no cumulative wind farms have been identified and it is not anticipated that a cumulative impact assessment will be required. Should the baseline scenario change at the time of conducting the Noise Impact Assessment, a cumulative noise assessment would be carried out in accordance with ETSU-R-97.

7.3.5 Propagation Model

The International Standard ISO 9613, 'Acoustics – Attenuation of Sound During Propagation Outdoors - Part 2', sound propagation model will be used for the turbine sound immission calculations. L_{Aeq} sound propagation will be modelled using WindFarm v5.0.1.2 by ReSoft. Predicted wind turbine sound levels will be calculated, inclusive of appropriate allowance for measurement uncertainties.

L_{A90} levels should be derived by subtracting two decibels from the L_{Aeq} values as per the ETSU-R-97 guidance and subsequent IOA GPG. The input parameters shown in **Table 7.2** will be used and are consistent with the IOA Good Practice Guide.

Table 7.2 Propagation input parameters

Atmospheric Attenuation Assumptions	
Temperature (°C)	10
Humidity (%)	70
Ground Attenuation Assumptions	
Attenuation factor, G (all regions)	0.5 (semi-soft ground)
Receptor height (m)	4.0

The attenuation of sound as it travels through the air varies with frequency. The atmospheric attenuation coefficients to be used in the assessment, corresponding to the assumptions in **Table 7.2**, are tabulated in **Table 7.3**.

Table 7.3 Attenuation coefficients used for the noise propagation model

Octave Band (Hz)	63	125	250	500	1000	2000	4000	8000
Attenuation Coefficient (dB/km)	0.12	0.41	1.04	1.93	3.66	9.66	32.77	116.88

7.3.6 Noise Impact Assessment

Predicted turbine sound levels at the nearest receptors resulting from the propagation model will be compared to the applicable noise limits to determine whether those limits would be met. If it is shown that the limits would be met, then the noise impact would be considered acceptable. Should the assessment show an exceedance of

[11] A Good Practice Guide to the Application of ETSU-R-97 For the Assessment and Rating of Wind Turbine Noise, May 2013, page 23, 5.1.4

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noise limits, a scheme of mitigation would be proposed that would allow the Proposed Development to operate in compliance with the noise limits, thereby reducing potential impacts to acceptable levels.

7.4 Baseline

7.4.1 Construction Noise Baseline

At this stage of the project, insufficient information is available to produce an indicative assessment of construction noise. The most significant construction activities for noise would be the construction of an access track, hard-standing area and turbine foundation. The site topography is relatively flat without any significant watercourses running through it and therefore doesn't present any obvious challenges. The scale of the development would suggest that the construction phase would be of limited duration. Should it be deemed appropriate to include an indicative assessment of construction noise impacts, the assessment would follow the methodology outlined in Section 7.3.1.

7.4.2 Operational Noise Baseline

7.4.2.1 Candidate turbine

For the purposes of assessing maximum potential effects the EWT DW54 900kW turbine model has been selected. Noise data provided by the manufacturer for the DW54 turbine shows a declared maximum sound power (L_{WA}) of 102.6dB(A). This level assumes that the turbine would operate in Standard operating mode. Sound power spectra specific to the candidate turbine, as provided by the turbine manufacturer, were increased by 2dB to give an additional margin of safety as no specific margin of tolerance was included in the manufacturer's data.

This data was used to generate an indicative 35dB(A) contour (Figure 7.1) that predicts noise levels for a 10m height (v_{10}) wind speed of 10ms^{-1} when the turbine would be operating at maximum sound power.

7.4.2.2 Study area

The proposed development is located near the settlement of Norham, Northumberland. The land around the site is predominately agricultural with multiple small settlements nearby. The nearest main road is the B6470 which runs west to east approximately 700m north of the site.

An indicative layout for the proposed development is shown in Figure 7.1. The red contour encloses the worst-case area predicted to receive an L90 turbine noise level in excess of 35dB(A).

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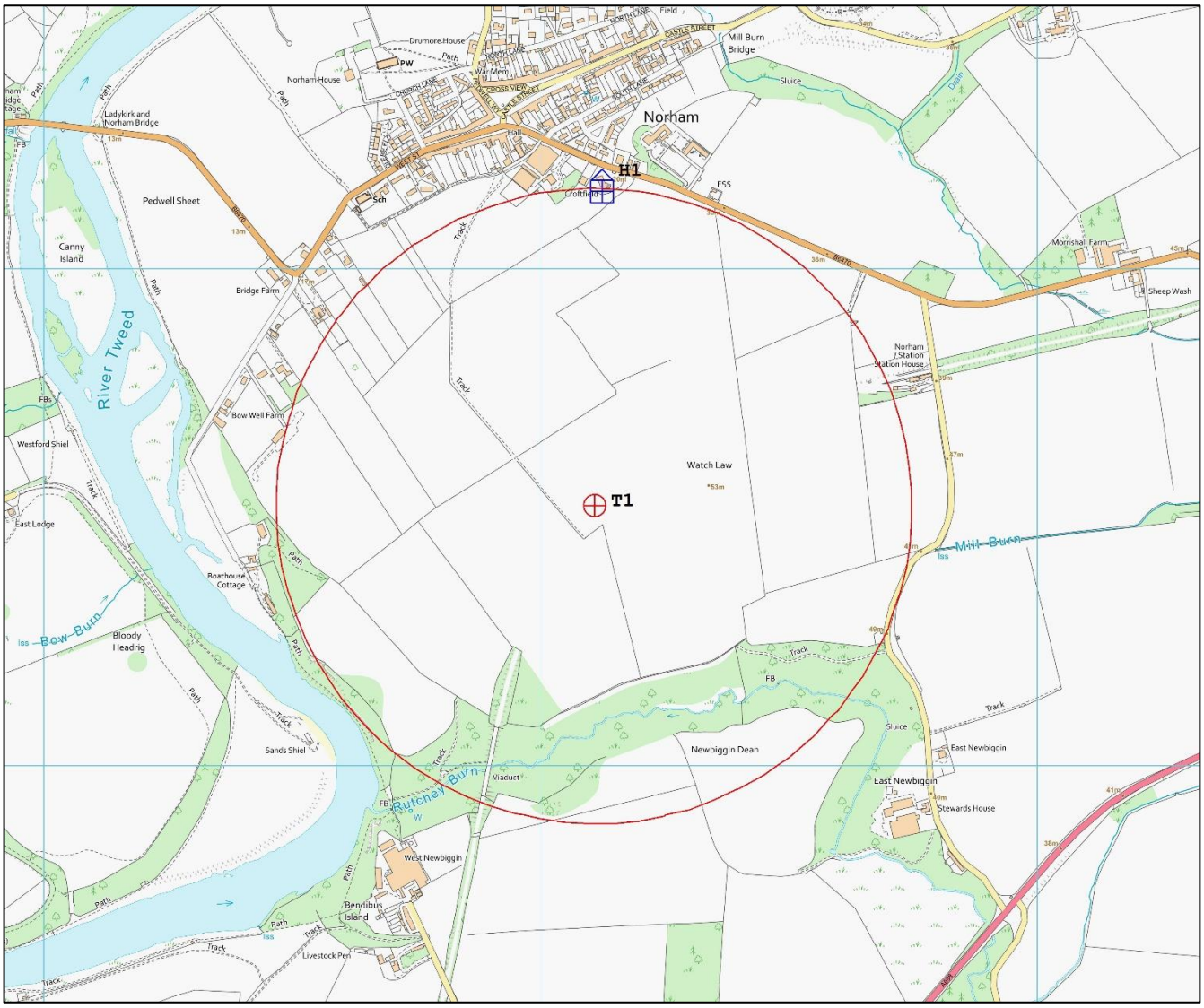

⊕	T1: The Proposed Development
—	LA90 iso-contour at 35dB(A) calculated for v_{10} = 10ms^{-1}
⌂	Noise Sensitive Receptor (H1)

Figure 7.1 – Study area

7.4.2.3 Noise Sensitive Receptors

Presently, one property falls within the study area. This property is financially involved with the project and would be subject to higher ETSU-R-97 noise limits.

No third-party residential receptor falls within the study area as determined by the 35dB(A) L_{A90} iso-contour.

7.4.2.4 Noise Limits

Project specific levels are expected to meet the simplified fixed 35dB(A) noise limit, applicable at all times, or 45dB(A) where a resident has financial involvement.

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7.5 Potential Effects and Mitigation

Noise arising during the construction phase will be for a limited duration and can be suitably controlled by a planning condition specifying standard noise limits.

ETSU-R-97 guidelines for operational noise provide threshold criteria for acceptability, balancing residential amenity with the benefits of wind energy. Provided such limits can be met, it can be concluded that the development would be acceptable in noise terms. Therefore, an unacceptable impact would be noise levels exceeding these threshold limits.

Iterative layout design is expected to result in a Proposed Development that does not require operational mitigation to meet the proposed ETSU-R-97 limits and will consider different turbine models, turbine positions and hub heights.

7.6 Summary of Predicted Impacts and Effects

7.6.1 Construction phase

There are no features of the Site that indicate that construction noise could not be kept to recommended noise limits, as controlled by a suitable planning condition.

7.6.2 Operational phase

An indicative layout has been provided to determine an appropriate study area for the proposed development.

No third-party wind farms have been identified within 3km of the proposed development. Unless the cumulative baseline changes, a cumulative noise impact assessment will not be required.

The assessment of operational immission levels should be based on sound power data provided by the proposed turbine manufacturer inclusive of an appropriate allowance for measurement uncertainty.

Initial sound level contours indicate that the project can meet the simplified ETSU-R-97 limits of 35dB(A) or 45dB(A) where a resident has financial involvement with the project. As such it is expected that layout iterations will result in a project with a low noise impact on residential amenity within the surrounding area.

7.7 Key Questions for the Council and Consultees

- Q7/1: Do the consultees agree that construction noise can be constrained to recommended limits via a suitable planning condition?
- Q7/2: Do the consultees agree with the proposed methodology to determine compliance with the ETSU-R-97 limits?
- Q7/3: Do the consultees agree that a cumulative assessment is not required?
- Q7/4: Do the consultees agree that the noise levels from the solar farm will be insignificant and operational noise from the solar farm is therefore scoped out of the assessment?

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8 Shadow Flicker

8.1 Introduction

This section of the report presents the proposed methodology and baseline information that would inform a shadow flicker impact assessment for the proposed single turbine located near Norham, Northumberland.

Tall structures such as wind turbines cast shadows. The shadows vary in length according to the sun's altitude and azimuthal position. Under certain combinations of geographical position and time of day, the sun may pass behind the rotor of a wind turbine and cast a moving shadow over neighbouring properties. Where this shadow passes over a narrow opening such as a window, the light levels within the room affected will decrease and increase as the blades rotate, hence the shadow causes light levels to 'flicker' - an effect commonly known as 'shadow flicker'.

Whilst the moving shadow can occur outside, the shadow flicker effect is only experienced by indoor receptors where the shadow passes over a window opening. The seasonal duration of this effect can be calculated from the geometry of the machine and the latitude of the site. A single window in a single building is likely to be affected for a few minutes at certain times of the day for limited periods of the year. The likelihood of this occurring and the duration of such an effect depend upon:

- The direction of the residence relative to the turbine(s);
- The distance from the turbine(s);
- The turbine hub-height and rotor diameter;
- The time of year;
- The proportion of hours in which the turbine operates;
- The frequency of bright sunshine and cloudless skies (particularly at low elevations above the horizon); and
- The prevailing wind direction.

The further the observer is from the turbine the less pronounced the effect will be. There are several reasons for this:

- There are fewer times when the sun is low enough to cast a long shadow;
- When the sun is low it is more likely to be obscured by either cloud on the horizon or intervening buildings and vegetation; and,
- The centre of the rotor's shadow passes more quickly over the land reducing the duration of the effect.

At a distance, the blades do not cover the sun but only partly mask it, substantially weakening the shadow. This effect occurs first with the shadow from the blade tip, the tips being thinner in section than the rest of the blade. The shadows from the tips extend the furthest therefore, the strength of the effect decreases with distance.

8.2 Guidance

Specific requirements for the assessment of shadow flicker impacts could not be found within the LPAs guidelines. However, it is common practice for a full assessment of potential shadow flicker impacts to be conducted where residential properties fall within ten rotor diameters of a turbine.

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Department of Environment and Climate Change (DECC)[12] studies have shown that even in UK latitudes, shadows from wind turbines can only be cast approximately 130 degrees either side of north relative to the turbine due to the orientation of the earth's axis and the positioning of the sun. This equates to a region of 50 degrees either side of due south where a wind turbine will never cast a shadow. Properties within this region will experience no shadow flicker effects, regardless of their distance from the turbine. While DECC has now been replaced by the Department for Business, Energy and Industrial Strategy which does not provide guidance on shadow flicker, these findings are still considered relevant.

8.3 Methodology

8.3.1 Candidate Turbine

For the purposes of conducting a shadow flicker impact assessment, the candidate turbine model has been selected as the EWT DW54 with a hub height of 40m and a tip height of 67m. This model has been selected to assess the maximum potential impacts.

8.3.2 ReSoft WindFarm software

ReSoft Windfarm software will be used to model the shadow flicker effects of the development. The program uses simple geometric considerations: the position of the sun at a given date and time; the size and orientation of the windows that may be affected; and the size of the turbine that may cast the shadows. The model calculates the maximum possible duration of flicker effects by assuming that:

- Turbines are facing the sun at all times of the day;
- It is always sunny;
- The turbines are always operating; and
- There is no local screening.

8.3.3 Modelling of Façades

Given that the glazed area will not be known at every property, windows will be modelled conservatively with dimensions of 4m x 4m.

The orientation of each façade will be included in the model, measured in terms of degrees from north. This means, for example, that if a window faces due south, it is 180 degrees from north.

8.3.4 Modifying Factors

The degree of shadow flicker impact that will typically occur in practice is always much less than the maximum possible flicker calculated by the model. Modifying factors take into account actual annual hours of sunlight for the area and hours of turbine operation. These factors have been applied to the modelling results in order to reach a more representative estimate of shadow flicker impact that would typically occur in practice.

The modifying factors are derived from the following:

- The average sunlight hours for the local area have been taken as 1,535 hours, based on meteorological data obtained from Berwick-upon-Tweed (11.5km north-east of the development)[13]. Therefore, on average, it is

[12] Update of UK Shadow Flicker Evidence Base, by PB Power, commissioned by DECC (2011) http://www.decc.gov.uk/assets/decc/What%20we%20do/UK%20energy%20supply/Energy%20mix/Renewable%20energy/ORED/1416-update-uk-shadow-flicker-evidence-base.pdf - Last Accessed (06/10/2022)

[13] https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcyt62suu - Last Accessed (04/04/2023)

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sunny for ~34% of the daylight hours, though this varies from month to month. The monthly hours are provided below in Table 8.1.

- The rotor of a modern wind turbine can be expected to turn approximately 90% of the time.
- No adjustment will be made in regard to wind direction, and it will be assumed that the turbines are always yawed such that flicker is possible.

The monthly sunshine hours expected to occur based on nearby Met-Office records are given below:

Table 8.1 – Average monthly sunshine hours

Month	Mean Hours[13]	Total hours[14]	Sun
January	61	238	26%
February	94	267	35%
March	120	366	33%
April	168	424	40%
May	202	504	40%
June	171	524	33%
July	182	525	35%
August	166	468	35%
September	139	385	36%
October	103	325	32%
November	74	251	29%
December	54	220	25%

8.3.5 Assessment of the Impact

There is currently no standard UK Guidance on acceptable levels of shadow flicker. The only guidance that provides suggested levels is Northern Ireland's Best Practice Guidance to Renewable Energy[15], which recommends that shadow flicker at neighbouring offices and dwellings within 500m should not exceed 30 hours per year. This document also comments that at distances greater than 10 rotor diameters, the potential for shadow flicker is very low. This position is based on research by Predac, a European Union sponsored organisation promoting best practice in energy use and supply which draws on experience from Belgium, Denmark, France, the Netherlands and Germany. In 2017, this research was reviewed by ClimateXChange[16]and remains an industry standard.

8.4 Baseline

Based on the guidance referenced above, a study area of 540m around the proposed turbine will be considered. The resulting study area is shown in Figure 8.1.

[14] Taken from Forsythe et al.(1995) A model comparison for daylength as a function of latitude and day of year. Ecological Modelling. 80: 87 - 95

[15] Best Practice Guidance to Planning Policy Statement 18: Renewable Energy, Department of the Environment (Northern Ireland), (2009). https://www.infrastructure-ni.gov.uk/sites/default/files/publications/infrastructure/Best%20Practice%20Guidance%20to%20PPS%2018%20-%20Renewable%20Energy_0.pdf – Last Accessed (06/10/2022)

[16] Review of Light and Shadow Effects from Wind Turbines, by ClimateXChange, commissioned by Scottish Government, 2017

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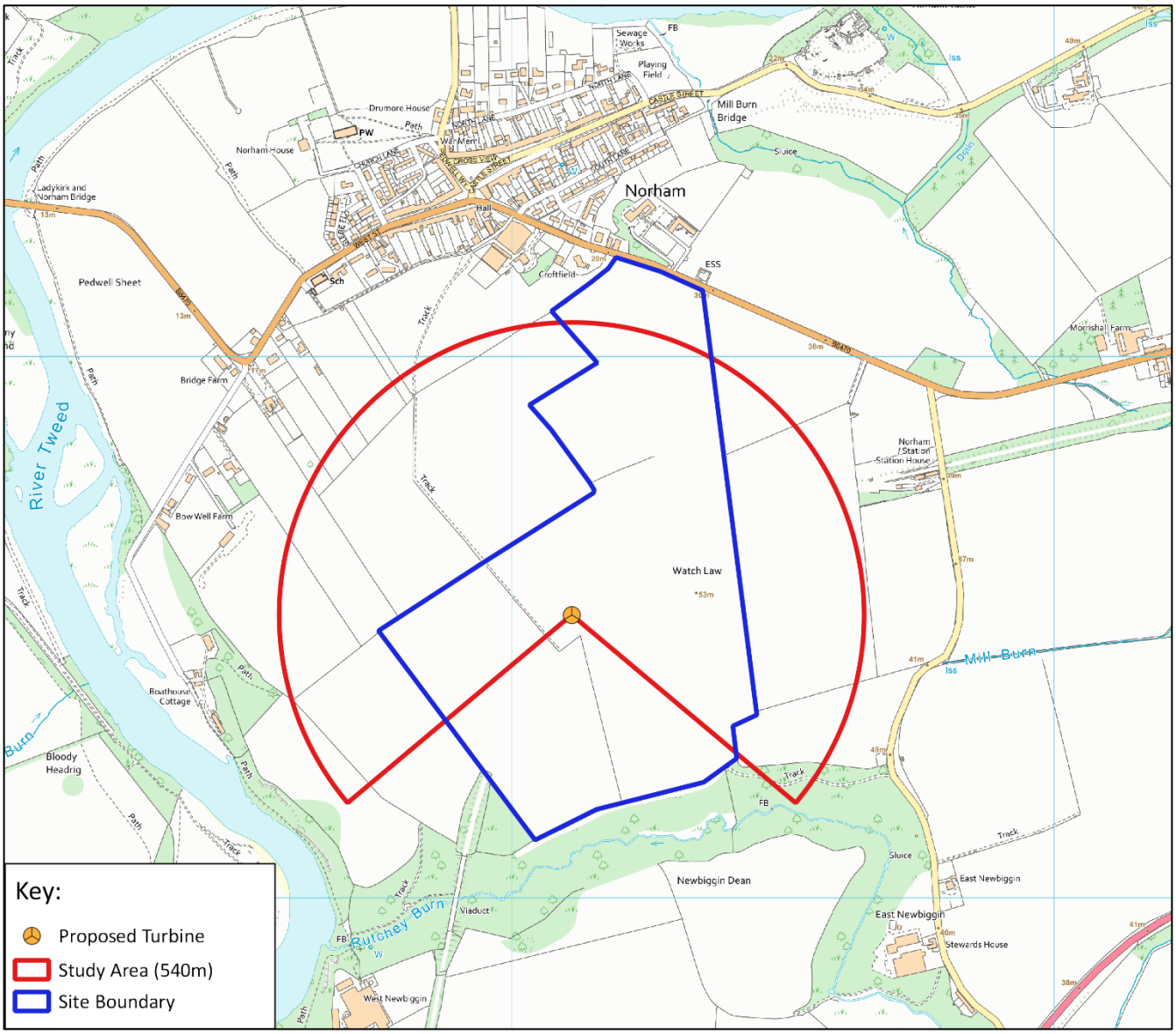

Figure 8.1 – Shadow flicker study area

8.4.1 Sensitive Receptors

It can be seen from **Figure 8.1** that no property falls within the search area. It is therefore proposed that an assessment of shadow flicker impacts can be **scoped out** of any future ES.

8.4.2 Cumulative Impact

No third-party wind developments were found within the vicinity of the proposed turbine locations. As such, an assessment of cumulative shadow flicker impacts can be **scoped out**.

8.5 Mitigation

As no property is situated within 10 rotor diameters of the proposed turbine, potential impact is low and no mitigation is expected to be required.

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Should shadow flicker prove to be problematic in practice, the turbine can be fitted with a shadow stop system that can be programmed to automatically shut down when environmental conditions are conducive to shadow flicker at affected properties. This means that the turbine would be equipped with a light level sensor, to detect periods when there is sufficient light to generate shadow flicker.

Shadow flicker impacts could be managed through a suitable planning condition that would require a mitigation scheme to be submitted to, and approved by, the local Planning Authority in response to a complaint.

8.6 Conclusion

A shadow flicker study area has been defined that encompasses any property within 10 rotor diameters of the proposed turbine. No property has been identified within the search area. Therefore, an assessment of potential shadow flicker impact can be scoped out of any future report.

Third-party wind developments have not been found within the vicinity of the proposed turbine. As such, a cumulative impact assessment can be scoped out.

A suitable planning condition could be used to mitigate any potential adverse shadow flicker effects in response to a complaint by means of incorporating a turbine shutdown strategy.

8.7 Key Questions for the Council and Consultees

- Q8/1: Do the Council and consultees agree with the proposed shadow flicker assessment methodology?
- Q8/2: Do the Council and consultees agree that the shadow flicker impact assessment can be scoped out of any future EIA and be controlled via suitable planning condition?

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9 Hydrology and Hydrogeology

9.1 Introduction

This assessment will present the impact of potential effects of the construction and operation of the Proposed Development on hydrology and hydrogeology.

Understanding surface and groundwater environments is critically important to designing a successful project. Surface water includes watercourses, water bodies, and runoff. It provides an important resource for: potable and other uses; amenity; aesthetic value; conservation; ecological environments; and for recharge to groundwater systems. Groundwater is also an important resource. It proves more than a third of the potable water supply in the UK and includes all water stored in permeable underground strata (or aquifers). In addition, it provides essential baseflow to rivers and wetland areas, often supporting important ecological systems.

9.2 Policy and Legislation

Guidance for assessing the potential impact of the Proposed Development on the hydrological and hydrogeological features of the development site will be based on the following statutory, general, and national guidance. Any appropriate local policy and guidance will also be considered.

Table 9.1: Policy, Legislation & Guidance

SEPA Guidance Documents/ Applicable Good Practise Guidance (N.B The GPP, PPG, and SEPA documents are not government guidance in England however, they provide useful on-site information that is applicable to the Proposed Development)	PPG 1 General Guide to the Prevention of Pollution GPP 2 Above Ground Oil Storage Tanks PPG 3 Use and design of oil separators in surface water drainage systems GPP 4 Treatment and disposal of wastewater where there is no connection to the public foul sewer GPP 5 Works and maintenance in or near water PPG 6 Working at Construction and Demolition Sites GPP 8 Safe Storage and Disposal of Used Oils GPP 21 Pollution Incident Response Planning Managing River Habitats for Fisheries, 2002 Special Requirements for Civil Engineering Contracts for the Prevention of Pollution, Version 2, SEPA, 2006 Culverting of Watercourses, WAT-PS-06-02, 2015 Natural Flood Management Handbook, 2015 Indicative River & Coastal Flood Map (Scotland) Planning advice on wastewater drainage, 2011 Temporary Construction Methods, WAT-SG-29, 2009 SEPA Flood Risk and Planning Briefing Note, 2009 Groundwater Protection Policy for Scotland, v3, 2009 SEPA Position Statement 'The role of SEPA in Natural Flood Management', 2012 Technical flood risk guidance for stakeholders, SS-NFR-P-002, 2015 SEPA Regulatory Position Statement – Developments on peat, 2010 Engineering in the water environment: good practice guide; River crossings, 2010 Environmental Standards for River Morphology, WAT-SG-21, 2012

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	The Water Environment (Controlled Activities) (Scotland) Regulations 2011; A practical guide, Version 8.3 February 2019 Land Use Planning System SEPA Guidance Note 31: Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems, 2017 Land Use Planning System SEPA Guidance Note 4: Planning guidance on onshore windfarm developments, 2017 SEPA Water quality classification interactive database (2019 data) National Flood and Coastal Erosion Risk Management Strategy for England, updated 2022 A framework for the production of Drainage and Wastewater Management Plans, 2021
Other Guidance Documents	CIRIA C515 Groundwater Control - Design and Practice CIRIA C532 Control of Water Pollution from Construction Sites CIRIA C648 Control of Water Pollution from Linear Construction Projects CIRIA C689 Culvert Design and Operation Guide CIRIA C741 Environmental Good Practice on Site CIRIA C753 SUDS Manual A handbook on environmental impact assessment; Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland. NatureScot, 2018 River Crossings and Migratory Fish: Design Guidance, A Consultation Paper, The Scottish Executive Good Practice During Windfarm Construction, 2019 (4th Edition), Scottish Renewables (SR), NatureScot, SEPA, Forestry Commission Scotland (FCS), Historic Environment Scotland and Marine Scotland Science Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland, on-line version only Forestry & Water Scotland (2018) Protecting Private Water Supplies During Forestry Activities Safeguarding our soils: A strategy for England, 2009
English Government Policy, Advice and Legislation Documents	Water Framework Directive (2000/60/EC) as implemented in England via the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. The Groundwater Directive (GWD) (2006/118/EC) as implemented by the Groundwater (Water Framework Directive) (England) Direction 2016 The Groundwater Daughter Directive to WFD (2006/118/EC) as implemented Environmental Permitting (England and Wales) Regulations 2016 The Bathing Water Directive (2006/7/EC) as implemented by the Bathing Water Regulations 2013 Flood and Water Management Act 2010 Land Drainage Act 1991 National Planning Policy Framework, as revised in 2021
Scottish Government Policy, Advice and Legislation Documents	The Housing Scotland (Act) 1987 (Sect 86) PAN 79: Water and Drainage, 2006 Planning Advice Note (PAN) 61: Planning and SUDS, 2001 Scottish Government (2017) Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments Scottish Planning Policy (SPP) 2014

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	Water Environment and Water Services (Scotland) Act 2003 The Flood Risk Management (Scotland) Act 2009 The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations, 2017 The Public and Private Water Supplies (Miscellaneous Amendments) (Scotland) Regulations 2017 The Pollution Prevention and Control (Scotland) Regulations, 2000
Retained European Legislation	Freshwater Fish Directive 2006/44/EC Water Framework Directive (WFD) 2000/60/EC Dangerous Substances Directive 76/464/EEC

9.3 Method of Assessment and Reporting

The assessment of the potential impact of the proposal on hydrology and hydrogeology was carried out by the general method described in the following Sub-Sections.

9.3.1 Desk Study Assessment Methodology

It is important to initially establish the baseline conditions so that an accurate hydrological context map can be developed for the site. This will be done by identifying any features within a 1.2km search radius around the proposed infrastructure locations that have potential to be impacted by the proposals. This baseline can then be used to inform the site design.

The following sources of information will be consulted as part of the desk study:

- BGS – Geology of Britain Viewer https://www.bgs.ac.uk/map-viewers/geology-of-britain-viewer/
- BGS – Hydrogeological Map 1:625,000
- Environment Agency 'Catchment Data Explorer' https://environment.data.gov.uk/catchment-planning/
- Environment Agency's Risk of Flooding from Rivers and Sea Dataset https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/RiskOfFloodingFromRiversAndSea&Mode=spatial
- Magic Maps https://magic.defra.gov.uk/magicmap.aspx
- NatureScot Sitelink https://sitelink.nature.scot/map
- Ordnance survey 1:10,000 and 1:50,000 map data
- Ordnance survey digital terrain model (DTM)
- Scotland's Environment Map https://map.environment.gov.scot/sewebmap/?layers=riverClass
- Scotland's soils, Carbon and Peatland 2016 Map https://map.environment.gov.scot/Soil_maps/?layer=10
- SEPA Flood Maps https://map.sepa.org.uk/floodmap/map.htm
- SEPA River Basin Management Plan (RBMP) interactive Map https://www.sepa.org.uk/data-visualisation/water-environment-hub/
- Soilscapes Map http://www.landis.org.uk/soilscapes/
- UK Government's Flood Map for Planning https://flood-map-for-planning.service.gov.uk/
- Consultation with statutory and non-statutory organisations, including SEPA, Environmental Agency, NatureScot, Natural England and Norham Parish Council's Environmental Health Department.

The desk study will also include a review of relevant historical maps, soil maps, and aerial photographs.

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9.3.2 Field Survey Methodology

Following the desk study and initial concept of the site, a site visit will be undertaken across the study area and the following actions carried out:

- Verification of any information collected during the desk study;
- Establishment of a first-hand understanding of the study area, including watercourses and ground conditions, to assess the relative location of all the components of the Proposed Development; and
- Identification of potential constraints to the Proposed Development from topography and ground conditions.

9.3.3 Consultation

Consultation will be carried out with:

- Environment Agency (EA);
- Natural England;
- Tweed Foundation;
- River Tweed Commission District Salmon Fisheries Board;
- Norham Parish Council and Northumberland County Council;
- SEPA; and
- NatureScot.

9.3.4 Assessment Criteria

The criteria set out in the Tables below will be used in the assessment of any potential effects of the Proposed Development on hydrology and hydrogeology.

With the baseline established, sensitive receptors can be determined. Table 9.2 outlines the various factors taken into account when assessing the sensitivity of a variety of receptors.

Table 9.2: Sensitivity Table

Sensitivity	Definition
High	Receptor of high quality, rarity of a regional or national scale, and limited potential for substitution or replacement. This includes: • Sites of Special Scientific Interest (SSSI), Special Protection Areas (SPA) or Special Area of Conservation (SAC) • EA/SEPA Water Quality defined as High • Abstraction for public water supply • Private water supplies – 0 to 100m from construction activities • Designated salmonid fishery and/or salmonid spawning grounds present • Watercourse widely used for recreation, directly related to watercourse quality (e.g., swimming, salmon fishery) <1.2km downstream of development • Active flood plain area (important in relation to flood defence) • Groundwater - public drinking water supply • Groundwater aquifer productivity classed as 1A or 2A in the BGS 1:625000 Hydrogeology Map • Geology that is rare or of national importance as defined by SSSI or Regional Important Geological Site (RIGS)

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Sensitivity	Definition
	• Peat defined as Class 1 and Class 2 • Peat Slide Risk likelihood of 'probable' or 'almost certain'
Medium	Receptor of medium quality, rarity of a local, regional, or national scale, and limited potential for substitution/replacement. This includes: • EA/SEPA Water Quality defined as Good • Surface water abstractions for private water supply for more than fifteen people • Private Water Supplies – Surface water abstractions within 100 – 600m of construction activities, groundwater spring abstractions within 100 – 400m of construction activities, and groundwater borehole abstractions within 0 – 200m of construction activities • Designated salmonid fishery and/or cyprinid fishery • Watercourse widely used for recreation, directly related to watercourse quality (e.g., swimming, salmon fishery) >1.2km downstream of development • Groundwater aquifer productivity classed as 1B or 2B in the BGS 1:625000 Hydrogeology Map • Peat Slide Risk of 'Likely'
Low	Receptor of low quality, rarity of a local, regional, or national scale, and limited potential for substitution/replacement. This includes: • EA/SEPA Water Quality defined as Moderate or Poor • Occasional or local recreation (e.g., local angling clubs) • Conveyance of flow and material, main river <10 m wide or ordinary watercourse >5 m wide • Existing flood defences • Private Water Supplies – Surface water abstractions >600m from construction activities, groundwater spring abstractions within 400 – 800m of construction activities, and groundwater borehole abstractions within 200 – 600 m of construction activities • May be subject to improvement plans by the Environment Agency • Designated cyprinid fishery, salmonid species may be present and catchment locally important for fisheries • Watercourse not widely used for recreation, or recreation use not directly related to watercourse quality • Groundwater aquifer productivity classed as 1C or 2C in the BGS 1:625000 Hydrogeology Map • Peat Slide Risk of 'Unlikely'
Negligible	Receptor of low quality, rarity of a local scale, and limited potential for substitution/replacement. Environmental equilibrium is stable and is resilient to changes that are greater than natural fluctuations, without detriment to its present character. This includes: • EA/SEPA water quality defined as Bad • Fish sporadically present or restricted, no designated features • Receptors not used for recreation, e.g., no clubs or access route associated with watercourse • Watercourse <5 m wide – flow conveyance capacity of watercourse low - very limited floodplain as defined by topography, historical information and the Environment Agency's Risk of Flooding from Rivers and Sea map • Private Water Supplies – groundwater spring abstraction >800 m from construction activities, and groundwater borehole abstractions >600 m from construction activities • No public drinking water supplies • Groundwater aquifer productivity classed as 3 in the BGS 1:625000 Hydrogeology Map

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Sensitivity	Definition
	• Receptor heavily engineered or artificially modified and may dry up during summer months • Geology not designated under a SSSI or RIGS or protected by specific guidance • Peat defined as Classes 3, 4 and 5 • Peat Slide Risk of 'Negligible'

The significance of each impact on a receptor is based on its magnitude. The magnitude of impact includes the timing, scale, size and duration of the potential impact. For the purposes of this assessment the magnitude criteria are defined as follows.

Table 9.3: Magnitude of Impact Table

Magnitude	Criteria	Description and Example
Large	Results in loss of attribute	• Fundamental (long term or permanent) changes to geology, hydrology, water quality and hydrogeology • Loss of designated Salmonid Fishery • Loss of national level designated species/habitats • Changes in WFD water quality status of river reach • Loss flood storage/increased flood risk • Pollution of potable source of abstraction compared to pre-development conditions
Medium	Results in impact on integrity of attribute or loss of part of attribute	• Material but non-fundamental and short to medium term changes to the geology, hydrology, water quality and hydrogeology • Loss in productivity of a fishery • Contribution of a significant proportion of the discharges in the receiving water, but insignificant enough to change its water quality status
Small	Results in minor impact on attribute	• Detectable but non-material and transitory changes to the geology, hydrology, water quality and hydrogeology
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use/integrity	• No perceptible changes to the geology, hydrology, water quality and hydrogeology • Discharges to watercourse but no loss in quality, fishery productivity or biodiversity • No significant impact on the economic value of the receptor • No increase in flood risk

The sensitivity of the receptor together with the magnitude of impact defines the significance of the impact.

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Table 9.4: Significance of Impact Matrix

		MAGNITUDE			
		LARGE	MEDIUM	SMALL	NEGLIGIBLE
SENSITIVITY	HIGH	Major	Major	Moderate	Negligible
	MEDIUM	Major	Moderate	Minor	Negligible
	LOW	Moderate	Minor	Minor	Negligible
	NEGLIGIBLE	Negligible	Negligible	Negligible	Negligible

Where the significance of an impact is defined to be minor, moderate, or major - mitigation is required to reduce those impacts to a non-significant level.

9.4 Preliminary Baseline

9.4.1 Preliminary Baseline Conditions

The Proposed Development is situated on the south western flanks of the Watch Law, approximately 0.7km to the south of Norham village, Northumberland, England. The development site comprises arable fields, with the wider area being a mix of arable farmland, livestock grazing land, and small pockets of forestry. The Rutchey Burn passes along the southern border of the landholding before flowing into the River Tweed. The River then travels along the northern and eastern sides of Norham, marking the border between Scotland and England, as illustrated in Figure 9.1 – Hydrological Context Map.

The B6470 road runs along the northern landholding boundary, leading into Norham, and an unnamed minor road stems from the B670 to the west of the development site. This road passes in a southern trajectory and will be utilised for site access.

The terrain within the site reaches a topographic hight at the Watch Law summit (53m AOD), which then gradually descends to meet the Rutchey Burn to the south and Norham to the north. The elevations within the landholding range between c.30-53m AOD.

9.4.2 Hydrology

The Proposed Development is fully located in England however, a portion of the western study area traverses the Scottish border. As such, the appropriate environmental regulators' data sources will be utilised to establish the baseline conditions.

All significant waterbodies for England and Scotland are managed, assessed, and classified by EA and SEPA, respectively, under the Water Framework Directive (WFD). The nearest significant waterbody to the Proposed Development is the River Tweed (ID: 5200[17]), and is the main hydrological feature within the study area. It lies within the Solway Tweed River basin district catchment, with the main stem measuring approximately 18.6km in length as it runs in an eastern trajectory. According to SEPA Water Classification Hub, the River has been classed as 'good' for its overall status with no limiting parameters[18].

[17] https://map.environment.gov.scot/sewebmap/?layers=riverClass (Accessed 18/10/22)
[18] https://www.sepa.org.uk/data-visualisation/water-classification-hub/ (Accessed 18/10/2022)

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The Rutchey Burn runs directly south of the Proposed Development, adjacent to the proposed solar site. It travels in a western direction and feeds into the River Tweed. The EA notes that this watercourse lies within the Newbiggin Dean Catch (Trib of Tweed) waterbody. It was classed as 'good' for all parameters, except for its chemical status for which it received a 'fail'[19].

The Mill Burn flows away from the proposed develop to the west before heading north. It traverses through farmland before issuing into the River Tweed, and is an unclassified waterbody.

The SEPA Flood Hazard and Risk Map illustrates the indicative flood extents of high likelihood (1 in 10-year probability), medium likelihood (1 in 100-year probability), or low likelihood (1 in 200-year probability) of coastal, surface, and river floods. According to the map, the River Tweed has a high likelihood of river flooding within its main channel, with sections of medium and low notable within the northern/western portion of the study[20]. Similarly, the Rutchey Burn to the south of the site is mostly identified to have a high likelihood of river flooding, however this is largely confined to the watercourse channel. According to the UK Government's Flood Map for Planning, the Proposed Development lies within Flood Zone 1[21], meaning there is less than 0.1% chance of flooding in any year.

The River Tweed is well-known for its recreational fishing opportunities, and is known to support salmon species. Fishing activities are primarily managed by the River Tweed Commission (RTC), and the Tweed Foundation. The RTC by law protects and manages the salmon and other freshwater fish in the River Tweed and its tributaries[22].

9.4.3 Geology

The British Geological Survey (BGS) 1:50,000 map indicates that the area immediately within the Proposed Development is underlain with Ballagan Formation bedrock, consisting of sandstone, siltstone, and dolomitic limestone.

The BGS 1:50,000 map also illustrates the superficial deposits. This map shows that the area to the north of the Proposed Development is underlain with River Terrace deposits of gravel, sand, and silt, intercepted by smaller areas of Head - diamicton, gravel, sand and silt deposits and Alluvium - gravel, sand and silt deposits. The southern section of the study area is predominantly located on Till, Devensian – diamicton deposits, with smaller parcels of Glaciofluvial Ice Contact Deposits, Devensian – sand and gravel deposits to the south west.

According to the Carbon and Peatland Map 2016 and the BGS Map, the study area is comprised of mineral soils, which can be described as 'no peatland vegetation'. As such, there is no known peatland within the study area.

9.4.4 Hydrogeology

The BGS Aquifer Classification Dataset for Scotland classifies the potential for bedrock to supply groundwater and describes potential groundwater flow mechanism.

The bedrock underlying the study area is in the Inverclyde Group (2B) which can largely be classed as a moderately productive aquifer. It is multi-layered with fracture flow yielding up to 10L/s with flow being carried almost completely through fractures and other discontinuities[23].

SEPA have classified the quality of all groundwater bodies in Scotland, and the EA for England, under the Water Framework Directive (WFD). The study area falls within two groundwater areas. The Lower Tweed Sand and

[19] https://environment.data.gov.uk/catchment-planning/WaterBody/GB102021073060 (Accessed 18/10/2022)
[20] https://map.sepa.org.uk/floodmap/map.htm (Accessed 18/10/2022)
[21] https://flood-map-for-planning.service.gov.uk/flood-zone-results?easting=390110&northing=646523&location=390110%20646523&fullName=%20&recipientemail=%20 (Accessed 18/10/2022)
[22] https://www.rivertweed.org.uk/river-tweed-commission/about-the-river-tweed-commission/ (Accessed 18/10/2022)
[23] https://mapapps2.bgs.ac.uk/geoindex/home.html?layer=BGSHydroMap&_ga=2.163966198.810925067.1665656416-247464657.1665656416 (Accessed 18/10/2022)

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Gravel[24]groundwater unit is located in the southwest of the study area, and the Coldstream [25]groundwater to the northwest of the site. Both have an overall status of "good" for all measured parameters.

9.4.5 Designated Sites

The River Tweed Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC) encompass the River Tweed watercourse as it passes through the study area. This watercourse is noted for supporting populations of River lamprey, Brook lamprey, Sea lamprey, Sea lamprey, Otter, Atlantic salmon, river habitat with floating vegetation and rare plants, and invertebrate assemblages.

9.4.6 Potential Sensitive Receptors

The Proposed Development is fully located within the watershed of the River Tweed. There are two watercourses that run adjacent to the development site before emptying into the River Tweed: the Rutchey Burn and the Mill Burn. The river has been designated as a SSSI and SAC site, is known to support a population of salmon, making it a popular destination for recreational fishing. With construction and operation, there is potential for runoff to enter the River Tweed and its tributaries and impact water quality and ecology, as well as to elevate any existing flood risks. As such, these watercourses will be treated as sensitive receptors and form a focus of the hydrological assessment.

Should the ecological surveys identify any groundwater dependent terrestrial ecosystems (GWDTE) on the site, these will be treated as sensitive receptors in the EIA not currently known whether there are any private water supplies (PWS) located within the 1.2km study area. Should any PWS be identified, they will be classed as a sensitive receptor in the EIA.

Peat has the potential to be degraded as a result of construction activities. Class 1 and Class 2 peat is regarded of national importance however, no areas of carbon-rich soil were recoded within the study area. The study area was identified to be underlain mineral soil. As such, peat such will not be included as a sensitive receptor.

Due to the hydrological connectivity via the Mill Burn and Rutchey Burn, there is potential for the Proposed Development to have an adverse effect on the integrity of the River Tweed SSSI and SAC. As such, these designated sites and their qualifying features will be considered during the hydrological assessment and will be included as a sensitive receptor.

9.4.7 Potential Sources of Impact

The potential impacts this development may have on the water environment of the site and the surrounding area are likely to include:

- Increase in run-off;
- Sedimentation, erosion, and silt-laden runoff;
- Chemical pollution of watercourses or groundwater;
- Disruption to the surface and subsurface runoff and watercourses;
- Increased flood risk to areas downstream; and
- Drop in the water table.

[24] https://www.sepa.org.uk/data-visualisation/water-classification-hub/ (Accessed 18/10/2022)
[25] https://www.sepa.org.uk/data-visualisation/water-classification-hub/) (Accessed 18/10/2022)

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9.5 Assessment and Mitigation

9.5.1 Assessment of Effects

Potential impacts on the water and ground environment, including environmental receptors dependent upon these resources, will be identified.

A qualitative risk assessment will be used to assess potential impacts on the identified receptors whereby the probability of an effect occurring and the magnitude of the effect, if it were to occur, are considered. This approach provides an established process for identifying the areas where mitigation measures are required.

Mitigation measures required to address these impacts will be proposed in accordance with best practice guidance.

The assessment will consider the construction, operational, and decommissioning stages of the Proposed Development.

9.5.2 Mitigation

Mitigation measures, where required, will be identified and based on best practice techniques appropriate to site conditions. It is foreseen that the following types of measures could be relevant:

- Avoidance of sensitive areas;
- Appropriate location of proposed infrastructure;
- The implementation of general pollution prevention measures to protect the water quality of the surrounding waterbodies and groundwater; and
- Suitable surface water management and appropriate design of drainage features.

9.6 Summary

Given the presence of sensitive watercourses, the River Tweed SSSI and SAC, the potential for PWS(s) and GWDTE communities, there is potential for significant hydrological effects to occur during the construction, operational, and decommissioning phases of the development.

As such, these receptors will be scoped in to inform the EIA.

Due to the Proposed Development being located upon mineral soils, carbon-rich soils will be scoped out of the hydrological assessment undertaken to inform the EIA.

9.7 Key Questions for the Council and Consultees

- **Q9/1:** Do the Council and Consultees agree with the proposed methodology?
- **Q9/2:** Do the Council and Consultees agree with the proposed study area?
- **Q9/3:** Do the Council and Consultees have any further information that would assist in the preparation of the assessments?
- **Q9/4:** Are the Council or Consultees aware of any further guidance or policy documents not mentioned within the report that are relevant to the assessment?

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10 Ecology

10.1 Introduction

The ecology chapter will consider the potential impacts of the Proposed Development on the ecological (non-avian) features present within the site. They will summarise the methods used to establish the baseline conditions within the site and its surroundings, the results of the baseline surveys, and the process used to determine the sensitivity of the habitats and species' populations present. The ways in which habitats or species might be affected (directly or indirectly) by the construction, operation and decommissioning of the Proposed Development will be assessed, prior to and after any mitigation measures are considered. In addition, any cumulative effects will be considered, taking together impacts of other renewable projects in the area, whether operational, consented or at the application stage, along with the significance of any predicted effects of the Proposed Development.

All ecology personnel working on the project are members of the Chartered Institute of Ecology and Environmental Management (CIEEM) and have extensive experience of wind farm development. The assessment of effects presented within the ES will be based on current Chartered Institute of Ecological and Environmental Management (CIEEM) guidance (2018)[26].

10.2 Policy and Legislation

Guidance for assessing the potential impact of the Proposed Development on the ecological features of the development site will be based on the following statutory, general, and national guidance listed in Table 10.1. Any appropriate local policy and guidance will also be considered.

Table 10.1: Policy, Legislation & Guidance

	Legislation or Guidance Document
Legislation	The Town & Country Planning (Environmental Impact Assessment) Regulations 2017 (Statutory Instrument 2017 No. 571) (as amended)[27] ; Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (The Habitats Directive)[28]; 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)[29]; The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations), which transposes the Habitats Directive into UK law[30]; Environmental Impact Assessment Directive 85/337/EEC (the EIA Directive)[31];

[26] Guidelines for Ecological Impact Assessment (EcIA) https://cieem.net/resource/guidelines-for-ecological-impact-assessment-ecia/
[27] https://www.legislation.gov.uk/uksi/2017/571/contents/made
[28] European Commission (1992) Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (The Habitats Directive) https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN
[29] 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); https://eur-lex.europa.eu/resource.html?uri=cellar:5c835afb-2ec6-4577-bdf8-756d3d694eeb.0004.02/DOC_1&format=PDF
[30] The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations), which transposes the Habitats Directive into UK law: https://www.legislation.gov.uk/uksi/1994/2716/contents/made
[31] Environmental Impact Assessment Directive 85/337/EEC (the EIA Directive: https://ec.europa.eu/environment/eia/eia-legalcontext.htm

	Legislation or Guidance Document
	The Wildlife and Countryside Act 1981 (as amended)[32]; The Protection of Badgers Act 1992[33] The Environment Act 2021[34]; Countryside and Rights of Way Act 2000[35]; The Invasive Alien Species (Enforcement and Permitting) Order 2019[36];
Policy	Northumberland Biodiversity Action Plan[37]; Natural England European Protected Species Policies[38]; Hedgerow Regulations 1997; https://www.legislation.gov.uk/uksi/1997/1160/contents/made Natural Environment and Rural Communities (NERC) Act (2006)[39]; The National Planning Policy Framework 2 (NPPF2, 2021)[40]; 'Birds of Conservation Concern 5' (Stanbury et al., 2021)[41]; The United Kingdom Biodiversity Action Plan (UK BAP)[42]; The Bat Conservation Trust - Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd Ed.). (Collins et al., 2016); Collins et al. (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines. 3rd edition, BCT: London BS 8683:2021 Process for designing and implementing Biodiversity Net Gain. Specification; Biodiversity Net Gain. Good practice principles for development[43]; UK Post-2010 Biodiversity Framework (2012)[44]; EIA (Agriculture) regulations: apply to make changes to rural land[45].
Guidance	Averis et al., (2014). An Illustrated Guide to British Upland Vegetation. Joint Nature Conservation Committee. Peterborough; Bang and Dahlstrøm. (2001). Animal Tracks and Signs. Oxford University Press, Oxford; Chanin (2003a) Monitoring the Otter (*Lutra lutra*). Conserving Natura 2000 Rivers: Monitoring Series No. 10. English Nature, Peterborough; Chanin (2003b). Ecology of the European Otter. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough;

[32] The Wildlife and Countryside Act 1981 (as amended); UK Government (1981) Wildlife and Countryside Act 1981, Chapter 69. Part 1: http://www.legislation.gov.uk/ukpga/1981/69/section/1
[33] The Protection of Badgers Act 1992; https://www.legislation.gov.uk/ukpga/1992/51/contents
[34] https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted
[35] https://www.legislation.gov.uk/ukpga/2000/37/contents
[36] https://www.legislation.gov.uk/uksi/2019/527/contents/made
[37] https://www.nwt.org.uk/sites/default/files/2018-10/Nland_Biodiversity_Action_Plan.pdf
[38] https://www.gov.uk/guidance/european-protected-species-policies-for-mitigation-licences
[39] https://www.legislation.gov.uk/ukpga/2006/16/contents
[40] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1004408/NPPF_JULY_2021.pdf
[41] Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D., and Win I. (2021) The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. British Birds 114, pp. 723-747
[42] https://jncc.gov.uk/our-work/uk-bap/
[43] https://cieem.net/resource/biodiversity-net-gain-good-practice-principles-for-development-a-practical-guide/
[44] UK Post-2010 Biodiversity Framework (2012); https://jncc.gov.uk/our-work/uk-post-2010-biodiversity-framework/
[45] https://www.gov.uk/guidance/eia-agriculture-regulations-apply-to-make-changes-to-rural-land

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	Legislation or Guidance Document
	CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine.[46]; Collins, J.(ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn)[47]; Cresswell et al., (2012). UK BAP Mammals Interim Guidance for Survey Methodologies, Impact Assessment and Mitigation. Published by The Mammal Society; Dean et al., (2016). The Water Vole Mitigation Handbook. (The Mammal Society Mitigation Guidance Series). Eds Fiona Mathews and Paul Chanin. The Mammal Society, London; DEFRA (2016). Understanding the Risk to European Protected Species (bats) at Onshore Wind Turbine Sites to inform Risk Management. University of Exeter; European Commission (2011). Wind energy developments and Natura 2000[48]; European Commission (2011). EU Biodiversity Strategy[49]; Gurnell et al., (2009). Practical Techniques for Surveying and Monitoring Squirrels. Forestry Commission Scotland, Edinburgh; Harris S., Cresswell P and Jefferies D., (1989). Surveying Badgers. The Mammal Society, London; Harris and Yalden. (2008). Mammals of the British Isles: Handbook. , 4th Edition. The Mammal Society, Southampton; Hundt (2012). Bat Surveys: Good Practice Guidelines (2nd Edition), BCT, London; Joint Nature Conservation Committee (2010). Handbook for Phase 1 Habitat survey: a technique for environmental audit; Joint Nature Conservation Committee (2013). Guidelines for selection of biological Sites of Special Scientific Interest (SSSI); Joint Nature Conservation Committee (2004) Common Standards Monitoring Guidance for Reptiles and Amphibians, Version February 2004. JNCC, Peterborough; Rodwell (2006). National Vegetation Classification: Users' handbook; Strachan et al., (2011). The Water Vole Conservation Handbook; The Herpetological Conservation Trust (2007). National Amphibian and Reptile Recording Scheme, Habitat Recording Guide; BS 42020:2013 Biodiversity: Code of Practice for Planning and Development: BSI Standards Publication. Countryside Stewardship Scheme 2016 Management Options (England)[50]; The Northumberland Local Plan 2016 – 2036: (NLP Policy ENV 2: Biodiversity and geodiversity. Page 195) [51]

10.3 Description of Site

The Proposed Development is located in the north of England, 380m east of the River Tweed and 700m south of Norham village at NT 90204 46384 (central location), approximately 9.5km south west of Berwick upon Tweed.

[46] CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 3rd edition. Chartered Institute of Ecology and Environmental Management, Winchester: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.1Update.pdf
[47] Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good practice Guidelines (3rd edition). The Bat Conservation Trust, London: https://www.bats.org.uk/resources/guidance-for-professionals/bat-surveys-for-professional-ecologists-good-practice-guidelines-3rd-edition
[48] European Commission (2011). Wind energy developments and Natura 2000: https://ec.europa.eu/environment/nature/info/pubs/docs/leaflets/windfarm/en.pdf
[49] European Commission. (2011). EU Biodiversity Strategy. http://ec.europa.eu/environment/nature/biodiversity/strategy/index_en.htm
[50] https://naturalengland-defra.opendata.arcgis.com/datasets/Defra::countryside-stewardship-scheme-2016-management-options-england/explore?location=55.695079%2C-2.160726%2C12.95
[51] https://www.northumberland.gov.uk/NorthumberlandCountyCouncil/media/Planning-and-Building/planning%20policy/Local%20Plan/Northumberland-Local-Plan-Adopted-March-2022.pdf

There is riparian deciduous woodland at the south boundary of the Site and the Rutchey Burn. The land use of the site is agricultural land. The surrounding area is agricultural land, with land to the south of the Rutchey Burn being part of the Countryside Stewardship Scheme[52]. The site is 433m to the east of a Great Crested Newt Strategic Area, where great crested newts have been predicted.

The development site is comprised of c.14.5 ha of agricultural cropland. Three sides of the site are bound by hedges and agricultural fields with woodland on the southern boundary.

The terrain within the landholding consists of mostly flat ground that slopes slightly from the west towards the north and the east of the site, with elevation ranging from approximately 40 - 45 AOD. The Proposed Development is discussed in further detail within **Section 2 – the Proposed Development.**

10.4 Method of Assessment and Reporting

The assessment of the potential impact of the proposal on ecology and nature conservation was undertaken by the general method described in the following Sub-Sections.

10.4.1 Desk Study Assessment Methodology

The desk study undertaken to inform the scoping report will be extended to inform the EIA.

The desk study will seek to identify any data relating to statutory and non-statutory sites, protected and notable species and invasive non-native species. The desk study will cover a distance of 5km from the site boundary and extended to 10kms for bats. Constraints will be identified and used to inform the final development of the turbines and infrastructure layout.

The following sources of information will be consulted as part of the desk study:

- Existing data on statutory designated sites available through Natural England website[53];
- Magic Map DEFRA[54];
- Northumberland Local Plan (NLP[55]);
- Records of Ancient Woodland;
- Forestry Commission Open Map Viewer[56]; and
- The UK Biodiversity Action Plan (UKBAP)[57].

The site is within England, however it is very close to the border with Scotland, and geographically share the same designated sites along the River Tweed, which is the Tweed Catchment Rivers - England: Lower Tweed and Whiteadder SSSI[58] with an overlapping designation with the River Tweed SAC[59].

[52] Countryside Stewardship Scheme 2016 Management Options (England). https://naturalengland-defra.opendata.arcgis.com/datasets/Defra::countryside-stewardship-scheme-2016-management-options-england/explore?location=55.696070%2C-2.157842%2C12.95

[53] https://designatedsites.naturalengland.org.uk/

[54] MAGIC Map; https://magic.defra.gov.uk/home.htm

[55] https://www.northumberland.gov.uk/NorthumberlandCountyCouncil/media/Planning-and-Building/planning%20policy/Local%20Plan/Northumberland-Local-Plan-Adopted-March-2022.pdf

[5656] National Forest Inventory Woodland England 2020 https://data-forestry.opendata.arcgis.com/datasets/30cf3ba3df444b6695cdafe250ed2172_0/explore?location=55.705878%2C-2.139457%2C13.15

[57] https://jncc.gov.uk/our-work/uk-bap-priority-species/

[58]https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S2000455&SiteName=tweed&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=

[59]https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK0012691&SiteName=tweed&countyCode=&responsiblePerson=&unitId=&SeaArea=&IFCAArea=

The desk study will also include a review of relevant historical maps, soil maps and aerial photographs. Multiple woodlands designated under the Ancient Woodland Inventory Scotland and The National Forest Inventory Woodland[60], were identified.

Table 10.2 details the designated sites located within 5 km of the Proposed Development that have ecological interests.

Table 10.2: Ecologically designated sites within 5km of the Proposed Development boundary.

Designated Site	Distance from site (approx.)	Description/Qualifying Features of Interest only	Condition (at last assessed date)
Tweed Catchment Rivers - England: Lower Tweed and Whiteadder SSSI[61]	368m	The site is of international importance for its estuary, intertidal mud and sandflats and its riverine floating vegetation communities often dominated by water-crowfoot *Ranunculus* species. It also supports internationally important populations of river lamprey *Lampetra fluviatilis*, sea lamprey *Petromyzon marinas*, Atlantic salmon *Salmo salar* and common otter *Lutra lutra*. The site lies within the SSSI Impact Risk Zone (England).	Mostly unfavourable with no change[62] (17/12/2010)
River Tweed SAC[63]	368m	Atlantic salmon *Salmo salar* Brook lamprey *Lampetra planeri*, River lamprey *Lampetra fluviatilis* Sea lamprey *Petromyzon marinus* Annex 1: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	

10.4.2 Field Survey Methodology

Baseline ecology field surveys will comprise the following:

- Terrestrial habitat & vegetation survey, and
- Terrestrial mammal survey (protected species).

10.4.3 Habitat Survey

The UK Habitat Classification (UKHab[64]) will be utilised to provide a rapid system for recording and classifying habitats. The surveys included searches for scarce or rare plants.

[60] https://data-forestry.opendata.arcgis.com/datasets/eb05bd0be3b449459b9ad0692a8fc203_0/explore?location=55.208415%2C-2.724655%2C6.86
[61] Tweed Catchment Rivers - England: Lower Tweed and Whiteadder SSSI
[62] https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteCode=S2000455&ReportTitle=Tweed%20Catchment%20Rivers%20-%20England:%20Lower%20Tweed%20and%20Whiteadder%20SSSI
[63] River Tweed SAC
[64] https://ukhab.org/

To ensure the collation of complete and current baseline habitat information, a targeted National Vegetation Classification (NVC) survey will be undertaken for the whole site, within the optimum survey window (May to September) following the industry standard survey methodology (Rodwell, 2006).

10.4.4 Mammal Surveys

Surveys will be undertaken within a buffer of up to 100 or 250m of the planned infrastructure, to take into account variations in micrositing. Surveys for terrestrial mammals will follow current Natural England guidance[65] and will comprise walkover searches for evidence of presence or the potential presence of bats, badger, otter, water vole, red squirrel and great crested newt. The surveys will include checks for any suitable bat roost structures and static recorders will be used as per the guidance for bat surveys[66].

10.4.4.1 Bats

In Britain all bat species and their roosts are legally protected, by both domestic and international legislation which includes Wildlife and Countryside Act 1981[67] and The Conservation of Habitats and Species Regulations 2017[68].

For any wild bat species, it is an offence to deliberately or recklessly:

- Capture, injure or kill a bat;
- Harass a bat or group of bats;
- Disturb a bat in a roost (any structure or place it uses for shelter or protection);
- Disturb a bat while it is rearing or otherwise caring for its young;
- Obstruct access to a bat roost or otherwise deny an animal use of a roost;
- Disturb a bat in a manner or in circumstances likely to significantly affect the local distribution or abundance of the species; and
- Disturb a bat in a manner or in circumstances likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young.

It is also an offence to:

- Damage or destroy a breeding site or resting place of such an animal (whether or not Deliberately or recklessly), and
- Keep, transport, sell or exchange, or offer for sale or exchange any wild bat (or any part or derivative of one) obtained after 10 June 1994.

This means that if bats could be affected in these ways by a development, and no action is taken to prevent it, an offence may be committed.

(a) Bat Survey

Project planning needs to allow sufficient time to undertake the bat surveys at the appropriate spatial and temporal scale.

[65] https://www.gov.uk/government/organisations/natural-england

[66] Bat Surveys for Professional Ecologists: Good Practice Guidelines 3rd edition (2016); https://www.bats.org.uk/resources/guidance-for-professionals/bat-surveys-for-professional-ecologists-good-practice-guidelines-3rd-edition

[67] https://www.legislation.gov.uk/ukpga/1981/69

[68] https://www.legislation.gov.uk/uksi/2017/1012/contents/made

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Bat activity varies considerably both between and within years and on a nightly basis. It is evident that multiple nights of surveying are required to determine accurately species presence and distribution within a site and to correctly categorise the relative level of activity of each species.

Pre-application surveys will take place over a full season of bat activity. To avoid any unnecessary delays to licence and planning applications, surveys will be:

- No more than 18 months old;
- Carried out in line with the Bat Surveys for Professional Ecologists: Good Practice Guidelines (BCT, Collins 2016); and
- Following the guidance within Bats & Onshore Wind Turbines: Survey, Assessment and Mitigation, 2019[69].

(b) Bat Activity Survey

Surveys will capture a sufficient number of nights with appropriate weather conditions for bat activity (i.e., temperatures of 10°C and above, or 8°C in Scotland) at dusk, maximum ground level wind speed of 5m/s and no, or only very light, rainfall to fulfil the minimum requirements.

Full spectrum automatic detectors will be deployed, as per current guidance. Automated detector surveys will commence half an hour before sunset and finish half an hour after sunrise to ensure that bat species that emerge early in the evening and return to roosts late, such as noctules, are recorded.

(c) Roost Survey

Key features that could support maternity roosts and significant hibernation and/or swarming sites (both of which may attract bats from numerous colonies from a large catchment) within 200m plus rotor radius of the boundary of the Proposed Development will be subject to further investigation. The search area may need to be extended if there is a high level of habitat connectivity in the surrounding area and this is considered likely to attract bats into the wind farm area from further afield. The survey will establish presence or absence of roosts and if bats are present the species, numbers (or estimated numbers), function of the roost and flight lines away from the roost. See Collins (BCT, 2016).

(d) Ground-level Static Surveys

The minimum level of pre-application survey required using static detectors is 10 nights in each of: spring (April-May), summer (June-mid-August) and autumn (mid-August-October). Surveys in adjacent seasons should not be contiguous, i.e. they should be spaced out to include a reasonable time gap between them and should aim to include periods when migration could be taking place. Ideally, surveys will aim for 10 consecutive nights.

(e) Walked transect Surveys

Either/both of these survey methods can be used to complement the information gained from static detectors and other sources, but their applicability is discretionary and site-specific. Static detectors provide an overview of how bat activity is broadly distributed over the site and which species are present but are less suited to identifying flight lines and understanding the numbers of bats present. Information on these can be collected at certain times i.e. dusk and dawn, using these observational methods.

The choice of method used at sites must be appropriate to identify connections between nearby roosts, linear features (or other potential flight paths, e.g. as used by *Nyctaloid* species) and potential key foraging areas across the development footprint. The existence of such routes might be inferred from other available information, such

[69] Bats & Onshore Wind Turbines: Survey, Assessment and Mitigation, 2019 https://www.nature.scot/bats-and-onshore-wind-turbines-survey-assessment-and-mitigation

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as the presence of a linear feature within the development footprint linked to a known roost site nearby, and such field knowledge should be incorporated into the survey design. Transect point surveys enable the surveyor to see a long way and across the landscape at early dusk when bats are still visible. They are particularly useful for observing early commuting and foraging species such as noctule bats whilst it is still light.

(f) Assessing bat activity levels

Anabat Static recorders will be used at the site, and along with the roost survey will determine the following information:

- The species assemblage. Bats will be identified to species, or where these cannot be separated with confidence, to species group e.g. *Myotis* sp. or *Nyctaloid* bats (see Collins, 2016) using the site;
- The locations of roosts (particularly maternity and hibernation) and swarming sites in the surrounding area that could be affected by the wind farm proposals at the site;
- The location and extent of commuting or foraging habitat used by bats. This needs to include not only the site itself, but also flight paths and habitats in the surrounding landscape that are likely to bring bats to the site. The information may also be useful where habitat management is considered as a mitigation measure for predicted impacts on other species (e.g. raptors); and
- The amount of bat activity on the site, and its spatial and temporal distribution.

A measure of relative bat activity will be obtained using the online tool Ecobat[70].

10.4.4.2 Badgers

Both badgers and their setts are protected by law. The Protection of Badgers Act 1992 (Scottish Version) brings together all the previous legislation specific to badgers (except their inclusion on Schedule 6 of the 1981 Wildlife and Countryside Act, as amended Nature Conservation (Scotland) Act 2004). As a result, it is an offence to:

- Willfully kill, injure, possess or cruelly ill-treat a badger, or attempt to do so;
- To intentionally or recklessly interfere with a sett;
- To disturb a badger when it is occupying a sett;
- Damage or destroy a sett; and
- To obstruct access to, or any entrance of a badger sett.

A badger sett is defined in the legislation as ‘any structure or place, which displays signs indicating current use by a badger’. 'Current use' does not simply mean 'current occupation' and for licensing purposes it is defined as 'any sett within an occupied badger territory regardless of when it may have last been used'. A sett therefore, in an occupied territory, is classified as in current use even if it is only used seasonally or occasionally by badgers, and is afforded the same protection in law.

(a) Badger Survey Methodology

The development area (red line boundary) plus a buffer around the site will be surveyed. A standard buffer around the site will be 100m to give consideration to setts outwith, but close to, the development. This buffer will only be increased to larger distance around the site if the works within the site may be disturbing (e.g. blasting).

All land within the survey area will be surveyed for badgers. This involves viewing all areas of the survey area for setts or other field signs. Badgers will commute from setts to foraging areas along paths, and they will demarcate

[70] http://www.mammal.org.uk/science-research/ecostat/)

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their territories using dung in pits, often positioned along linear features which form the boundaries of their territory. Open areas such as grazed fields/edges of plantations will be surveyed.

Transects lines will be walked through the habitat to ensure full ground coverage. The distance between the transect lines will be dependent on the density of the vegetation cover. For example, transect lines in coniferous plantation such as Sitka spruce will need to be positioned at 5m intervals, whereas in open broadleaved woodland, ground cover may permit transects to be 20m apart. Linear landscape features such as walls and fences will also be walked along in order to identify any territory markings or badger crossing points.

A total sett survey will be conducted on site, including determination of where the badgers roam, feed, and obtain water. This information will ensure that any future development, will not interfere with the mammal's pathway to its food & water supply, as well as the setts.

The sett survey will include the total number of holes within a sett; number of well used holes & disused holes, which can give a guide to the level of activity of the sett.

Classification of the sett will also be determined into Main, Annex, Subsidiary or Outlier setts. During the survey, each sett entrance will be classified according to its degree of usage:

- Well Used (WU) are clear of debris and vegetation, sides worn smooth but not necessarily excavated recently;
- Partially used (PU) are not in regular use and have debris e.g. twigs and leaves in the entrance. They could be used after only a minimal amount of clearance; and
- Disused (D) not in use for some time, are partially blocked and could not be used without considerable effort. If the hole has been disused for some time all that may be visible is the overgrown spoil heap and a depression in the ground where the hole used to be. Rabbits and foxes may take over part of a sett and keep disused entrances open.

Field signs of badgers will also be recorded such as path networks, latrines and larger territorial latrines at boundary edges.

Evidence of badger activity searched for will include the following:

- Setts: badger setts typically have characteristic shapes and dimensions;
- Paw prints and badger hair caught on hedges and fences;
- Scratching posts
- Foraging signs: foraging badgers leave distinctive marks when foraging, such as diggings or snuffle holes (where badgers have inserted their snouts into the ground to search for earthworms and insects);
- Characteristic worn pathways and Paths linking setts and foraging areas; and
- Latrines: badgers defecate in pits, often clustering several pits into a latrine.

10.4.4.3 Otters

As a European protected species, the otter is fully protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). It is an offence to deliberately or recklessly:

- Capture, injure or kill an otter;
- Harass an otter or group of otters;
- Disturb an otter in a holt or any other structure or place it uses for shelter or protection;
- Disturb an otter while it is rearing or otherwise caring for its young;
- Obstruct access to a holt or other structure or place otters use for shelter or protection, or otherwise deny the animal use of that place;

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- Disturb an otter in a manner or in circumstances likely to significantly affect the local distribution or abundance of the species; and
- Disturb an otter in a manner or in circumstances likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young.

It is also an offence to:

- Damage or destroy a breeding site or resting place of such an animal (whether or not deliberately or recklessly), and
- Keep, transport, sell or exchange, or offer for sale or exchange any wild otter (or any part or derivative of one) obtained after 10 June 1994.

Otter shelters are legally protected whether or not an otter is present. Otters could be affected by a development proposal close to a water course, wetland, coastline, or estuary.

(a) Otter Survey Methodology

An otter survey will be carried out for the proposal within 200m of suitable habitat. Otter surveys can be carried out at any time of year but will avoid periods following prolonged heavy rainfall and/or high water when spraints and other signs of otter may have been washed away. Heavy frost or recent snow can also make finding spraints difficult.

All suitable otter habitat within 200m of the proposed works will be surveyed, including a systematic search for:

- Spraints or otter faeces. Often found on boulders, under bridges, elevated positions, fallen trees or on piles of grass;
- Paw prints in muddy or silted areas along the burn edges;
- Hairs;
- Characteristic worn pathways/slides or haul out areas;
- Food remains;
- Sleeping and resting places/shelters including holts, couches and natal dens; and
- Breeding sites.

Type of otter activity (Holts & Couches) explained further:

- Holts: otter holts are often found in various situations. These include cavities in a riverbank, hollow trees, between roots, rocky clefts, rabbit burrows or tunnels in peat. The entrance may be underwater with an air vent into the chamber, which is lined with dry vegetation; and
- Couches: otters often have resting spots or couches whey they lay up. An otter may have many holts or resting sites within its home range.

Field signs for recognising a natal den can include:

- A heavily used path or paths from the water into dense cover or an enclosed structure;
- Bedding within the structure which may consist of grass, ferns or reeds (bedding may also be present in other types of resting places);
- A latrine containing a large number of spraints at the den or within 2m of it (this is not always the case – sometimes the female will excrete in the water to ensure that there are no signs of occupation near the natal den);
- A cub play area which may be a well-worn area around a tree or on a bank; and

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- Different sized otter prints.

Habitat types associated with breeding sites are:

- Extensive reed beds;
- Ponds and lakes;
- Deciduous woodlands;
- Young conifer plantations; and
- Extensive areas of scrub.

10.4.4.4 Water Vole

The water vole receives partial protection under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). See the Wildlife and Countryside Act 1981 Schedules 5 and 6 for full details.

In Scotland, this legal protection is currently restricted to the water vole's places of shelter or protection and does not extend to the animal itself, but are listed on the UK BAP. Full protection, to also cover the animal, is proposed. It is an offence to intentionally or recklessly:

- Damage, destroy or obstruct access to any structure or place that water voles use for shelter or protection, and
- Disturb a water vole while it is using any such place of shelter or protection.

(a) Water Vole Survey Methodology

Timing: The water vole breeding season runs from April to September. This is the ideal time to carry out a water vole survey as the water voles will be highly active and leave many signs, such as latrines (conspicuous piles of droppings) which can be used to confirm their presence during a survey. Habitat assessments can also be undertaken during winter. Surveys at that time can determine presence, although absence of water voles can only be confirmed by spring or summer surveys.

Habitat Assessment: As part of the water vole survey, the habitat suitability for this species will be assessed. This will include an assessment of the foraging resources, the suitability of the banks for burrowing and the presence of adequate cover/shelter.

Surveying for Water Vole Evidence: A water vole survey will involve searching the banks of the watercourse for evidence of water vole, including: burrows, latrines, footprints, runs in the vegetation, grazed 'lawns', feeding remains and actual sightings.

The following field signs include:

- Faeces- these are 8- 12mm long and 4- 5 mm wide, cylindrical with blunt ends. The colour is variable, though often green, and they are generally odourless or have a faint musky smell;
- Latrines- the majority of droppings are deposited at latrine sites, used to mark range boundaries or favoured spots close to burrows. Latrines are typically maintained between February and November and often consist of a flattened mass of old droppings topped with fresh ones;
- Feeding stations- water voles often bring pieces of cut vegetation to favoured feeding stations close to the water's edge and leave remains in neat piles;
- Burrows- many burrows can be found in riverbanks, but those constructed by water voles are typically wider than they are high, with a diameter of 4- 8cm. Around these holes, well-grazed 'lawns' can often be found, where the water voles have chewed the vegetation short; and
- Footprints- these can easily confused with rat footprints.

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Many of these signs may be obliterated by heavy rain or high water levels, so negative surveys carried out in these circumstances should be treated with caution.

10.4.4.5 Red Squirrel

Red squirrels and their dreys (resting places) receive full protection under Schedules 5 and 6 of the Wildlife and Countryside Act 1981 (as amended). It is an offence to intentionally or recklessly:

- Kill, injure or take a red squirrel;
- Damage, destroy or obstruct access to a drey or any other structure or place which a red squirrel uses for shelter or protection; and
- Disturb a red squirrel when it is occupying a structure or place for shelter or protection.

This protection does not apply to areas where red squirrels only feed. It is also an offence to possess or control, sell or offer for sale, or possess or transport for the purpose of sale any living or dead red squirrel or any derivative of such an animal. This means that if red squirrels could be affected in these ways by a development, and no action is taken to prevent it, an offence may be committed.

(a) Red squirrel Survey Methodology

Field Survey Methodology: The optimum time to undertake red squirrel surveys is during the months of October, February or March, when the squirrels are most active and foliage on the trees is not too dense. Two survey methods will be employed, Visual Counts and Drey Counts.

Visual Counts: Visual surveys involve making standardised time-area counts of squirrels. This will involve walking along predetermined transect lines, recording all the squirrels seen. The methodology according to Gurnell et al (2001) requires that between 6 and 12 survey lines at a density of approximately one line per 10-20 ha are marked out. Each line will be situated along rides or inspection tracks, or between rows of trees in suitable squirrel habitat. The surveyors will stop at 50m intervals along the transects for 5 minutes, taking about 5 minutes to walk between each intervening 50m.

Drey Counts: The presence of active dreys can be used reliably to indicate the presence of squirrels and the density of dreys can give an indication of squirrel numbers. However there is no obvious difference between a drey built by a red squirrel and a drey built by a grey squirrel. Dreys tend to be semi-permanent when squirrels are resident, thus the number of dreys tend to reflect squirrel numbers over a season, year or even longer. Sometimes squirrels use holes in trees to nest in, called dens. Dreys will be searched for by surveyors whilst walking along the set transects. Any dreys identified will be recorded on a map of the area. The total number of dreys can be related to the area of forest searched. The density of dreys can be used as a crude index of squirrel density and it may useful as a relative measure of habitat use.

Field signs include:

- Dreys that are;
  - Constructed of compacted twigs in a tree fork.
  - Spherical (approx. 30cm in diameter).
  - Usually located above 6m and exceptionally below 3m. - Usually close to the main trunk of a conifer.
  - Lined with soft hair, moss and dried grass.
- Feeding remains;
  - Stripped cores and scattered scales of cones.
  - Hazel shells split neatly in two with a small chip at the apex.

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- Husks of acorns.
- Bark stripping;
- Footprints;
  - Only visible in soft ground or snow.
  - Distinctive pattern of smaller fore prints (4 toes) behind larger hind prints (5 toes).
  - Approximately 60mm or smaller in diameter.

10.4.4.6 Great Crested Newt

Great crested newts are fully protected under UK and European law. Great crested newts are fully protected under the Conservation of Habitats and Species (amendment) (EU Exit) Regulations 2019 as European Protected Species.

It is an offence to:

- kill, injure, capture or harass a great crested newt;
- disturb a great crested newt whilst it is using any structure or place for shelter or protection (e.g. a pond or hibernation site), or in any way that impairs its ability to survive or breed, or significantly affects the local distribution or abundance of great crested newts; and
- obstruct access to a great crested newt breeding site or resting place, or otherwise prevent their use.

And whether or not deliberate or reckless:

- to damage or destroy a great crested newt breeding site or resting place.

(a) Great Crested Newt Survey Methodology

Great Crested Newt have been recorded within the area and survey methods will follow the methods and survey standards are provided in Great Crested Newt Mitigation Guidelines (English Nature 2001[71]).

Prior to undertaking the field work any water bodies will be identified from Ordnance Survey maps and a site walkover, within 500m of the footprint of the Proposed Development. Experienced ecologists will visit each water body and assess its suitability to support newt species, specifically Great Crested Newt using the Habitat Suitability Index (HSI) Assessment method, Oldham et al. (2000). The HIS takes into account ten data variables to determine suitability for any pond to support Great Crested Newts.

Dependent on the HSI results further survey work may be required and can include:

- presence or absence surveys, (utilising eDNA sampling or bottle trapping, torching);
- population size surveys of water bodies; and
- terrestrial and aquatic habitat surveys.

[71] English Nature (2001). Great Crested Newt Mitigation Guidelines. English Nature, Peterborough https://cieem.net/resource/great-crested-newt-mitigation-guidelines/

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10.5 Assessment and Mitigation

10.5.1 Assessment of Effects

The assessment of effects on the ecological features presented within the ES will consider the potential for significant effects upon important features, as a result of the construction, operational and decommissioning phase of the Proposed Development.

Assessment will be based on current Chartered Institute of Ecological and Environmental Management (CIEEM) guidance (2018) and will include the following stages:

- Determination and evaluation of important ecological features;
- Identification and characterisation of impacts;
- Outline of mitigating measures to avoid and reduce significant impacts;
- Assessment of the significance of any residual effects after such measures;
- Identification of appropriate compensation measures to offset significant residual effects; and
- Identification of opportunities for ecological enhancement.

10.5.2 Mitigation

The adoption of embedded mitigation measures to avoid or minimise adverse impacts upon ecological features will be part of the iterative design process for the Proposed Development.

Measures to avoid or otherwise minimise potentially adverse impacts upon ecological features during scheme design will include:

- Land-take- Development infrastructure will be designed to minimise the requirement for land-take;
- Construction Environmental Management Plan- A Construction Environmental Management Plan (CEMP) will be in place during the construction, operational and decommissioning phases of the development. The CEMP will include all good practice construction measures, pollution prevention controls and monitoring to be implemented over the course of the development in line with current guidance; and
- Bat Habitat Features- A minimum 50m buffer (from blade tip) will be applied to watercourses and woodland as far as possible having regard to other ecological and non-ecological constraints.

Full details of embedded and site-specific mitigation measures in relation to ecology will be detailed within the ES.

10.6 Reporting

The final report will provide commentary across each phase of the development process construction, operation, and decommissioning.

10.6.1 Construction Phase

During the construction phase of the Proposed Development, in the absence of mitigation, adverse effects upon ecological features to be addressed within the EIA may arise from:

- Habitat loss, fragmentation, severance or change as a result of the delivery and installation of development infrastructure; and
- Disturbance, inadvertent killing or injuring of protected or otherwise notable species or inadvertent damage to their breeding sites or resting places.

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The site lies within the SSSI Impact Risk Zone and has the potential to have direct impacts on the designated site for nature conservation, and its tributary (the Rutchey Burn).

The potential for direct and indirect effects upon ecological features, including designated sites, as a result of the potential spillage and/or mitigation of pollutants during the construction phase will be considered however, potentially significant effects are considered to be highly unlikely on the basis of spatial separation and on the basis of best practice construction methods and pollution prevention controls.

10.6.2 Operational Phase

During operation of the Proposed Development, in the absence of mitigation, adverse effects upon ecological features to be addressed within ES may arise from:

- Disturbance to protected or otherwise notable species as a result of operational activities such as vehicular traffic and maintenance works;
- Habitat loss or change, inadvertent killing or injuring of protected or otherwise notable species resulting from the potential spillage and/or mitigation e of pollutants; and
- Interaction of bats with operational turbine blades leading to mortality due to collision or barotrauma.

Such effects are however, considered highly unlikely to be significant due to the nature of the Proposed Development, requiring low levels of continued human presence after commissioning and the incorporation of best practice pollution prevention controls.

The incorporation of buffers from bat habitats features (e.g. woodland and watercourses) will also form part of the iterative design process.

10.6.3 Decommissioning Phase

Potential impacts associated with the decommissioning phase are likely to be similar to those identified for the construction phase.

10.6.4 Presentation of sensitive information

Ecological data considered sensitive (e.g. that pertaining to the locations of breeding and/or resting places of protected species) will be included in a confidential appendix to the ES. This will not be made publicly available but will be issued to Natural England.

10.6.5 Consultation

Consultation will be carried out with:

- Natural England;
- Northumberland Council.

10.7 Questions for Consultees

- Q10/1: Do consultees agree that the range of ecological surveys proposed is sufficient and proportionate to inform the design and assessment of the Proposed Development?
- Q10/2: Do consultees agree that the full range of likely effects to be assessed within the ES has been adequately identified and is proportionate to the nature of the Proposed Development?
- Q10/3: Are there any other relevant consultees who should be contacted with respect to the ecology assessment and scope of baseline information gathering?

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11 Ornithology

11.1 Introduction

This chapter will consider the potential impacts of the Proposed Development on the ornithological features present within the site. They will summarise the methods used to establish the baseline conditions within the site and its surroundings, the results of the baseline surveys, and the process used to determine the sensitivity of the bird species' populations present in their habitats. The ways in which bird species and their habitats might be affected (directly or indirectly) by the construction, operation and decommissioning of the Proposed Development will be assessed, prior to and after any mitigation measures are considered. In addition, any cumulative effects will be considered, taking together impacts of other wind farm projects in the area, whether operational, consented or at application stage, along with the significance of any predicted effects of the Proposed Development.

All ornithological personnel working on the project are members of the Chartered Institute of Ecology and Environmental Management (CIEEM) and have extensive experience of wind farm development. The assessment of effects presented within the ES will be based on current Chartered Institute of Ecological and Environmental Management (CIEEM) guidance (2018)[72].

11.2 Policy and Legislation

Guidance for assessing the potential impact of the proposed development on the ornithology of the development site will be based on the following statutory, general, and national guidance listed in Table 10.1. Any appropriate local policy and guidance will also be considered.

Table 11.1: Policy, Legislation & Guidance

	Legislation or Guidance Document
Legislation	The Town & Country Planning (Environmental Impact Assessment) Regulations 2017 (Statutory Instrument 2017 No. 571) (as amended)[73] ; Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (The Habitats Directive)[74]; 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)[75]; The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations), which transposes the Habitats Directive into UK law[76];

[72] Guidelines for Ecological Impact Assessment (EcIA) https://cieem.net/resource/guidelines-for-ecological-impact-assessment-ecia/
[73] https://www.legislation.gov.uk/uksi/2017/571/contents/made
[74] European Commission (1992) Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (The Habitats Directive) https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN
[75] 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); https://eur-lex.europa.eu/resource.html?uri=cellar:5c835afb-2ec6-4577-bdf8-756d3d694eeb.0004.02/DOC_1&format=PDF
[76] The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations), which transposes the Habitats Directive into UK law: https://www.legislation.gov.uk/uksi/1994/2716/contents/made

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	Legislation or Guidance Document
	Environmental Impact Assessment Directive 85/337/EEC (the EIA Directive)[77]; The Wildlife and Countryside Act 1981 (as amended)[78]; The Protection of Badgers Act 1992[79] The Environment Act 2021[80]; Countryside and Rights of Way Act 2000[81]; The Invasive Alien Species (Enforcement and Permitting) Order 2019[82];
Policy	Northumberland Biodiversity Action Plan[83]; Natural England European Protected Species Policies[84]; Hedgerow Regulations 1997; https://www.legislation.gov.uk/uksi/1997/1160/contents/made Natural Environment and Rural Communities (NERC) Act (2006)[85]; The National Planning Policy Framework 2 (NPPF2, 2021)[86]; 'Birds of Conservation Concern 5' (Stanbury et al., 2021)[87]; The United Kingdom Biodiversity Action Plan (UK BAP)[88]; The Bat Conservation Trust - Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd Ed.). (Collins et al., 2016); Collins et al. (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines. 3rd edition, BCT: London BS 8683:2021 Process for designing and implementing Biodiversity Net Gain. Specification; Biodiversity Net Gain. Good practice principles for development[89]; UK Post-2010 Biodiversity Framework (2012)[90]; EIA (Agriculture) regulations: apply to make changes to rural land[91].
Guidance	CIEEM (2018). Guidelines for ecological impact assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (2nd Edition); Joint Nature Conservation Committee (2013). Guidelines for selection of biological Sites of Special Scientific Interest (SSSI); Assessing the impact of small-scale wind energy proposals on the natural heritage: Scottish Natural Heritage (2016);

[77] Environmental Impact Assessment Directive 85/337/EEC (the EIA Directive: https://ec.europa.eu/environment/eia/eia-legalcontext.htm
[78] The Wildlife and Countryside Act 1981 (as amended); UK Government (1981) Wildlife and Countryside Act 1981, Chapter 69. Part 1: http://www.legislation.gov.uk/ukpga/1981/69/section/1
[79] The Protection of Badgers Act 1992; https://www.legislation.gov.uk/ukpga/1992/51/contents
[80] https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted
[81] https://www.legislation.gov.uk/ukpga/2000/37/contents
[82] https://www.legislation.gov.uk/uksi/2019/527/contents/made
[83] https://www.nwt.org.uk/sites/default/files/2018-10/Nland_Biodiversity_Action_Plan.pdf
[84] https://www.gov.uk/guidance/european-protected-species-policies-for-mitigation-licences
[85] https://www.legislation.gov.uk/ukpga/2006/16/contents
[86] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1004408/NPPF_JULY_2021.pdf
[87] Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D., and Win I. (2021) The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. British Birds 114, pp. 723-747
[88] https://jncc.gov.uk/our-work/uk-bap/
[89] https://cieem.net/resource/biodiversity-net-gain-good-practice-principles-for-development-a-practical-guide/
[90] UK Post-2010 Biodiversity Framework (2012); https://jncc.gov.uk/our-work/uk-post-2010-biodiversity-framework/
[91] https://www.gov.uk/guidance/eia-agriculture-regulations-apply-to-make-changes-to-rural-land

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	Legislation or Guidance Document
	Recommended bird survey methods to inform impact assessment of onshore wind farms, Scottish Natural Heritage, 2017; European Commission (2010). Natura 2000 Guidance Document 'Wind Energy Developments and Natura 2000'. European Commission, Brussels; Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015). Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 108, 708–746; Gilbert, G., Gibbons, D.W., & Evans, J. (1998) Bird Monitoring Methods: A Manual of Techniques for UK Key Species. The Royal Society for the protection of Birds, Sandy, Bedfordshire, England. European Commission (2011). Wind energy developments and Natura 2000[92]; European Commission (2011). EU Biodiversity Strategy[93]; BS 42020:2013 Biodiversity: Code of Practice for Planning and Development: BSI Standards Publication. Countryside Stewardship Scheme 2016 Management Options (England)[94]; The Northumberland Local Plan 2016 – 2036: (NLP Policy ENV 2) [95] UK Government: Wild birds: surveys and monitoring for onshore wind farms[96] UK Government: Wild birds: advice for making planning decisions[97] JNCC: Birds of the wider countryside and at sea[98]

11.3 Survey Methodologies & Assessment

11.3.1 Key Target Species

Key target species for an assessment on the sensitivity of a Site have been identified following guidance using the following criteria:

- Species listed on Annex 1 of the EU Birds Directive;
- Species listed on Schedule 1 of the 1981 Wildlife & Countryside Act;
- Red-listed species on the Birds of Conservation Concern list (Eaton et al. 2015).

The ornithological assessment will, therefore, give particular consideration to all species recorded during the baseline surveys, if required, at the site that meet any of these criteria.

11.3.2 Breeding Bird Survey Methodology

Three breeding bird survey (BBS) visits will be carried out between April and June, targeting all areas of suitable habitat within 500m of the Proposed Development.

[92] European Commission (2011). Wind energy developments and Natura 2000: https://ec.europa.eu/environment/nature/info/pubs/docs/leaflets/windfarm/en.pdf
[93] European Commission. (2011). EU Biodiversity Strategy. http://ec.europa.eu/environment/nature/biodiversity/strategy/index_en.htm
[94] https://naturalengland-defra.opendata.arcgis.com/datasets/Defra::countryside-stewardship-scheme-2016-management-options-england/explore?location=55.695079%2C-2.160726%2C12.95
[95] https://www.northumberland.gov.uk/NorthumberlandCountyCouncil/media/Planning-and-Building/planning%20policy/Local%20Plan/Northumberland-Local-Plan-Adopted-March-2022.pdf
[96] https://www.gov.uk/guidance/wild-birds-surveys-and-monitoring-for-onshore-wind-farms
[97] https://www.gov.uk/guidance/wild-birds-advice-for-making-planning-decisions
[98] https://jncc.gov.uk/our-work/ukbi-c5-birds-of-the-wider-countryside-and-at-sea/

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11.3.2.1 Scarce Breeding Bird Survey Methodology

Three raptor surveys for scarce raptors within a 2km radius of the site from April to June, looking for signs of scarce breeding species with a combination of fixed-point watches and walkovers, following guidance from Hardey 2013.

11.3.3 Ornithological Survey Timelines

It is considered that one season of survey effort is sufficient to allow a robust characterisation of the baseline ornithological assemblage and usage of the Proposed Development site and surrounding area, when used in combination with the information and data sets collated from other sources.

11.4 Assessment Methodology

The assessment of effects on the ecological features presented within the ES will be consider the potential for significant effects upon important features, as a result of the construction, operational and decommissioning phase of the Proposed Development.

Assessment will be based on current Chartered Institute of Ecological and Environmental Management (CIEEM) guidance (2018) and will include the following stages:

- Determination and evaluation of important ecological features;
- identification and characterisation of impacts;
- Outline of mitigating measures to avoid and reduce significant impacts;
- assessment of the significance of any residual effects after such measures; and
- Identification of appropriate compensation measures to offset significant residual effects; and
- Identification of opportunities for ecological enhancement.

11.5 Baseline

The Proposed Development is located in the north of England, 380m east of the River Tweed and 700m south of Norham village at NT 90204 46384 (central location), approximately 9.5km south west of Berwick upon Tweed. There is riparian deciduous woodland at the south boundary of the Site and the Rutchey Burn. The land use of the Site is agricultural land. The surrounding area is agricultural land, with land to the south of the Rutchey Burn being part of the Countryside Stewardship Scheme[99].

The development site is comprised of c.14.5 ha of agricultural cropland. Three sides of the Site are bound by hedges and agricultural fields with woodland on the southern boundary.

The terrain within the landholding consists of mostly flat ground that slopes slightly from the west towards the north and the east of the site, with elevation ranging from approximately 40 - 45 AOD. The proposed development is discussed in further detail within Section 2 – the Proposed Development.

Baseline ornithological conditions to inform the design and assessment of the Proposed Development, will be established by means of:

- Desk-based assessments of existing available data and information;
- Consultations with stakeholders; and

[99] Countryside Stewardship Scheme 2016 Management Options (England). https://naturalengland-defra.opendata.arcgis.com/datasets/Defra::countryside-stewardship-scheme-2016-management-options-england/explore?location=55.696070%2C-2.157842%2C12.95

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- Field surveys and monitoring.

The process will identify sensitive receptors, particularly those that are the subject of statutory or local designations. Constraints will be identified and used to inform the final development of the turbines and infrastructure layout.

The ornithological desk study will include a review of, but not limited to:

- Existing data on statutory designated sites available through Natural England website[100]; specifically, where the qualifying feature is related to birds;
- Magic Map DEFRA;
- Northumberland Local Plan (NLP[101]); specifically, where the qualifying feature is related to birds;
- Ornithological specific records from the Northumberland Council Biodiversity Officer;
- Records from the Local Raptor Study Group;
- The UK Biodiversity Action Plan (UKBAP).

11.5.1 Designated Sites

No sites with ornithological interest are within 20km of Site.

11.5.2 Survey Requirements

Ornithological surveys will follow the standard guidance for onshore wind farms. Baseline ornithological field surveys will comprise of the following:

- Breeding Bird Surveys: from April-June; and
- Breeding Raptor Surveys: April-June within the Proposed Development site and with a 2 km buffer, as listed on Annex 1 of the Birds Directive, or Schedule 1 of the Wildlife & Countryside Act 1981 (as amended).

11.6 Mitigation

The adoption of embedded mitigation measures to avoid or minimise adverse impacts upon ecological and ornithological features will be part of the iterative design process for the Proposed Development.

Measures to avoid or otherwise minimise potentially adverse impacts upon ornithological features during scheme design will include:

- Land-take- Development infrastructure will be designed to minimise the requirement for land-take and the number of watercourse crossings;
- Construction Environmental Management Plan- A Construction Environmental Management Plan (CEMP) will be in place during the construction, operational and decommissioning phases of the development. The CEMP will include all good practice construction measures, pollution prevention controls and monitoring to be implemented over the course of the development in line with current guidance.

[100] https://designatedsites.naturalengland.org.uk/

[101] https://www.northumberland.gov.uk/NorthumberlandCountyCouncil/media/Planning-and-Building/planning%20policy/Local%20Plan/Northumberland-Local-Plan-Adopted-March-2022.pdf

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Full details of embedded and site-specific mitigation measures in relation to ornithology will be detailed within the ES.

11.7 Reporting

The final report will provide commentary across each phase of the development process construction, operation, and decommissioning.

11.7.1 Construction Phase

During the construction phase of the Proposed Development, in the absence of mitigation, adverse effects upon ornithological features to be addressed within the EIA may arise from:

- Habitat loss, fragmentation, severance or change as a result of the delivery and installation of development infrastructure; and
- Disturbance, inadvertent killing or injuring of protected or otherwise notable species or inadvertent damage to their breeding sites or resting places

11.7.2 Operational Phase

During operation of the Proposed Development, in the absence of mitigation, adverse effects upon ornithological features to be addressed within EIA may arise from:

- Disturbance to protected or otherwise notable species as a result of operational activities, such as vehicular traffic and maintenance works;
- Habitat loss or change, inadvertent killing or injuring of protected or otherwise notable species resulting from the potential spillage and/or mitigation e of pollutants; and;
- Interaction of birds with operational turbine blades leading to mortality due to collision. Such effects are however, considered highly unlikely to be significant due to the nature of the Proposed Development, requiring low levels of continued human presence after commissioning and the incorporation of best practice pollution prevention controls.

11.7.3 Decommissioning Phase

Potential impacts associated with the decommissioning phase are likely to be similar to those identified for the construction phase.

11.7.4 Presentation of sensitive information

Ornithological data considered sensitive (e.g. that pertaining to the locations of breeding and/or resting places of protected bird species) will be included in a confidential appendix to the ES. This will not be made publicly available but will be issued to Natural England.

11.7.5 Enhancement

Suitable principles for biodiversity enhancement to be delivered as part of the Proposed Development will be outlined within the ES. The appropriateness and feasibility of principles will be confirmed in consultation with Natural England and relevant consultees, as necessary, over the course of the EIA process.

11.7.6 Further Consultation

Further consultation with Natural England is proposed in relation to the scope of ornithological baseline information gathering at the earliest convenience.

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11.8 Questions for Consultees

- Q11/1: Do consultees agree that the range of ornithological surveys proposed is sufficient and proportionate to inform the design and assessment of the Proposed Development?
- Q11/2: Do consultees agree that the full range of likely effects to be assessed within the EIA has been adequately identified and is proportionate to the nature of the Proposed Development?
- Q11/3: Are there any other relevant consultees who should be contacted with respect to the ornithology assessment and scope of baseline information gathering?

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12 Traffic and Transport

12.1 Introduction

This assessment will outline the accessibility of the site and will consider the potential effects of traffic generated during the construction and operation of the works, including the identification of possible measures to minimise any disruption to the local and strategic road network.

12.2 Consultation

No consultation pertaining to Traffic and Transport has been undertaken to date. The following local authorities and statutory bodies will be consulted to provide opinions on the scope and method of assessment proposed for the Traffic and Transport chapter.

- Northumberland County Council; and
- Highways England.

12.3 Baseline

The Proposed Development is situated approximately 700m to the south of Norham, east of the River Tweed in Northumberland.

The A698 is the main transport route in the area, which links to the A1. The road is a single carriageway, two-lane road subject to a 60mph speed limit.

The Study Area for the purposes of the Traffic and Transport chapter has been defined as the public road network in the vicinity of the Proposed Development, which will be used by vehicles to access the Site in relation to the construction activities. Access from the A698 will be achieved via an unmarked road running north to the B6470, the B6470 intersects the A698 at the Salutation Inn junction. It is proposed that the following road section will form the Study Area: The A698 between The Salutation In Caravan Park and the A1.

12.4 Mitigation

12.4.1 Construction

Construction materials will be delivered to the site using standard HGV's. It is likely there would be an increase in the local traffic volumes. Traffic management, such as circular routes for vehicles, can greatly reduce any impact on local road users.

Traffic management for any offsite works, such as temporary road widening, may be required on 'A', 'B', 'C' and 'U' classes of road. In such case, two-way temporary traffic lights would be implemented to minimise disruption to road users.

In the event that non-motorised users are not segregated from vehicular traffic, temporary measures to improve safety for pedestrians, cyclists and equestrians will be implemented, if required, through discussions with Northumberland County Council.

The results of the assessment will determine the appropriate mitigation measures. The measures proposed will be incorporated into a Construction Traffic Management Plan (CTMP).

12.4.2 Operation

It is not considered that there will be a noticeable increase in traffic volumes during the operational phase of the Development and as such there is no requirement for any further mitigation to be investigated at this time.

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12.4.3 Decommissioning

As noted, the decommissioning phase will follow the broad principles of the initial construction phase with the removal of the turbine components from site.

12.5 Issues Scoped Out

Traffic impacts associated with the operational phase will be low with small service vehicles accessing the Site as required for programmed maintenance on wind turbines. Therefore, further assessment of the traffic impacts of the Proposed Development during the operational phase is not considered necessary.

12.6 Potential Effects

The majority of potential effects would arise during the construction and decommissioning phases of the Proposed Development.

During operation, traffic movements would be minimal and given the location of the site next to a main arterial roadway, these are considered to be negligible.

12.6.1 Construction

During the construction phase of the Proposed Development, there would be an increase in the number of vehicles accessing the site. The majority of these vehicles will be standard road vehicles, including HGV's.

The transportation of turbine components will utilise specialist HGV trailers, which will require liaison with Highway Development Management and Highways England as the use of a convoy system will be required to ensure the safety of road users and the delivery vehicles. During the transportation of these larger components, there is the potential for slow-moving traffic between the point of origin and the site. There may be a requirement for temporary widening works on the public highway to enable the transportation of abnormal loads.

The infrastructure associated with the solar elements will be delivered using standard HGV's, no specialist delivery equipment is required.

There may be pinch points where non-motorised users are not segregated from vehicular traffic. This is a common scenario in rural locations due to the increases in HGV traffic. Temporary measures will be implemented to ensure public safety.

12.6.2 Operation

During the operation of the Proposed Development, maintenance and unplanned maintenance visits will be required at regular intervals as stipulated by the maintenance schedules of the wind turbine and solar infrastructure manufactures, typically once every 6 months, as well as the DNO who will require access to the substation.

These visits will be undertaken using standard road vehicles likely to be a long wheelbase van. There will be a negligible increase in traffic flows in the area due to the ongoing operational maintenance requirements of the Development.

12.6.3 Decommissioning

The decommissioning of the site will follow a similar pattern to that of the construction phase. The turbines will be disassembled and transported from site. It is the current intention that these component parts may be reconditioned and sold as second hand machines.

The remainder of the site will be reinstated using a standard plant, delivered to site either under their own engine power or delivered via flatbed HGV's.

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Again, during this phase, there may be the need for minimal traffic management to facilitate the removal of the turbines from the site area. Out with this, the increase in traffic volumes is considered to be negligible. It is expected that decommissioning related traffic will be conditioned.

12.7 Methodology

12.7.1 Policy and Legislation

The assessment will be undertaken in line with the Environmental Assessment guidance (Institute of Environmental Assessment (IEA), 1993), and best practice, with reference to:

- Northumberland Local Plan 2016 – 2036; and
- National Planning Policy Framework 2017;

The assessment will reference any other suitable reports or documents outlined during the scoping process.

12.7.2 Assessment

The assessment will focus on the potential impacts on local roads and local road users and identify sections of road that have an increase in traffic higher than 30% and identify mitigation. A finalised route will be subject to an investigation into the suitability to accommodate the turbines under consideration for the Proposed Development. If available, traffic count data will be sourced from the Local Authority to inform the assessment.

The significance of the effects on receptors will be evaluated against the IEA guidance and where possible, in line with the criteria used for the other environmental topic areas covered in the ES.

In order to assess the traffic impacts during the construction phase, estimated vehicle movements for all major construction vehicle trip generators will be calculated. Where information is available, these will be based on site specific information and turbine manufacturers' construction guidelines.

Daily vehicle movements during the peak period of the construction phase will be assessed against the baseline conditions. Any changes in traffic levels on the study network links during the construction phase will be assessed in terms of percentage change and compared against the maximum vehicle capacity of the link.

12.8 Summary

For the Proposed Development, with the anticipated volume of construction traffic and size of abnormal loads, it is considered that this element should be scoped in to the EIA. A Traffic and Transport chapter would detail proposed construction movements and abnormal load routing for the consideration of Northumberland County Council and key Stakeholders.

A Traffic Management Plan, including details of Abnormal Load Transportation, will be provided prior to the commencing of works on site for the consideration of Northumberland County Council and key Stakeholders.

The effects on transport during the operation of the Development are expected to be negligible. Operation effects are therefore scoped out of this assessment.

12.9 Questions for Consultees

- Q12/1 Are the consultees satisfied with the proposed methodology and scope of the traffic and transport assessments?
- Q12/2 Are consultees content to scope out operational traffic from further assessment?

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13 Socio-Economics, Tourism and Recreation

13.1 Introduction

This section of the Environmental Impact Assessment (EIA) evaluates the potential socio-economic, tourism and recreational impacts associated with the Proposed Development. The specific effects considered within this assessment are those affecting:

- The economy;
- Tourism; and
- Recreational facilities.

13.2 Legislation, Policy and Guidance

The following legislation, policy and guidance is expected to be utilised for the purposes of this assessment:

- National Planning Policy Framework
- Scottish Planning Policy (2020);
- Northumberland Local Plan 2016-2036 (2022);
- Scottish Borders Council Local Development Plan: Adopted (2016);
- Scottish Borders Council Local Development Plan: Proposed (2022);
- Onshore Wind Turbines: Planning advice (2014);
- Office for National Statistics, Wind Energy in the UK: June 2021;
- Renewable UK, Onshore Wind: Economic Impacts in 2014;
- BVG Associates, Economic Benefits from Onshore Wind Farms (2017);
- Ramblers, Public Rights of Way (2022);
- UK Government, The Tourism Recovery Plan (2021);
- BiGGAR Economics, Wind Farms and Tourism Trend in Scotland (2021);
- Onshore Wind – Policy Statement Refresh (2021);
- VisitBritain, Our Five-Year Strategy 2020-2025 (2020);

13.3 Methodology

There are no recognised standards or methodologies for assessing the socio-economic, tourism or recreational effects of wind farms. The methodology will be informed by previous experience and established EIA best practice. It will include:

- Consultation with relevant statutory and non-statutory bodies;
- Baseline assessments for socio-economics, tourism and recreation within their assigned study area;
- The anticipated magnitude of effect on all identified socio-economic, tourism and recreational receptors; and
- Identification of possible measures to avoid, and mitigate against, any significant effects.

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Socio-economic impacts will be considered at a local (Northumberland and Scottish Borders) level. Impacts at a national/regional (North-East England, Scotland) level will also be considered where applicable. Impacts on tourism and recreation will be considered within a 5km study area, as significant effects are not anticipated beyond this.

13.3.1 Socio-Economics

This assessment will aim to provide the likely employment opportunities, Local Value Added (LVA)/Gross Value Added (GVA) contributions and project spend as a result of the onshore wind aspect of the Proposed Development. This assessment will be undertaken on the basis of the largest anticipated MW output of the Proposed Development to create a best case scenario using the RenewableUK (2015) study 'Onshore Wind: Economic Benefits in 2014'. In this assessment, a 'best case' scenario represents the maximum output and maximum turbine size, which is often a worst case scenario for other topics within the ES. For the purposes of the Proposed Development, the 'best case' scenario will be based on one turbine with a potential generating capacity of up to 0.9MW and solar farm of up to 8.9MW giving a total generating capacity for the site in the region of 9.8MW.

Local population and employment data will be reviewed, identified and described using sources such as the National Online Manpower Information system (NOMIS), National Records of Scotland/Office for National Statistics (ONS) and the Scottish Index of Multiple Deprivation (SIMD)/The English Indices of Deprivation. This socio-economic data will be used to understand how each council's socio-economic data aligns with national averages in order to make more targeted assumptions about the number of jobs, GVA/LVA contributions and project spend to be estimated as the RenewableUK study is based on national averages.

The assessment will also make reference to BVG Associates study 'Economic Benefits from Onshore Wind Farms (2017)' to understand how the output per MW installed capacity compares with the one generated from the Renewable UK study.

The socio-economic opportunities created by solar will also be considered using International Renewable Energy Agency's (2014) report, The Socio-Economic Benefits of Solar and Wind Energy.

13.3.2 Tourism

A review of national and regional tourism strategies, as well as visitor statistics will be undertaken. Accommodation and tourist attractions within 5km of the site will be identified using public sources such as Visit Britain and Visit Scotland. A qualitative assessment will be undertaken based on the changes of availability, accessibility and amenity on tourist receptors during the construction and operational maintenance phases. For the purposes of this assessment, amenity is considered to be a combination of visual amenity and noise levels experienced by the users of tourist attractions and accommodation. Air quality has been scoped out of the EIA as it is not considered to have a significant effect on tourism receptors.

13.3.3 Recreation

This section of the assessment will assess the significance of effects on recreation. Any recreational facilities within 5km of the site will be identified and assessed for any potential effects. These will be based on any estimated changes to recreational facilities in the local area. This includes changes in the accessibility and amenity of recreational receptors, which will include core paths, cycle routes and other recreational activities. For the purpose of this assessment, amenity refers to a combination of visual amenity, air quality and noise levels experienced by the users of recreational facilities. Air quality has been scoped out of the EIA as it is not considered to have a significant effect on recreational receptors.

13.3.4 Significance Assessment

The sensitivity and magnitude of effect on each receptor will be assessed in order to determine the magnitude of effect. A description of the different significance levels is noted below. In the context of this ES, a moderate or

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major effect is considered significant within the scope of this chapter. A description of each magnitude of effect is listed below:

- Major – The value of the receptor and the magnitude of effect is predicted to give rise to major, detectable impacts and may be fundamental in the decision-making process;
- Moderate – The value of the receptor and the magnitude of effect is predicted to give rise to moderate, detectable impacts but alone will not be fundamental in the decision-making process;
- Minor – The value of the receptor and the magnitude of effect is predicted to give rise to minor, detectable impacts but will not be fundamental in the decision-making process; and
- Not significant- The value of the receptor and the magnitude of effect is not predicted to give rise to any discernable or detectable impacts outside the norm of typical variation.

13.4 Consultation

At this stage of the project, no consultation has been undertaken in relation to socio-economics, tourism or recreation. It is anticipated that the following consultees will be contacted:

- Northumberland Council;
- Relevant Community Councils;
- British Horse Society;
- Scottish Rights of Ways Access Society (ScotWays);
- Scottish Borders Council;
- Visit Britain; and
- Visit Scotland;

13.5 Baseline

13.5.1 Socio-Economics

Table 13.1 shows the population, working age population (those aged 16-65) and the percentage of working age population in employment in Northumberland and the Scottish Borders.[102,103,104] Population and working age population data is from 2020, and economically active population data is from 2022.

Table 13.1 – Population, Working Age Population and Economically Active Population Data (NOMIS 2020-2022)

	Population (no)	Working Age Population	Working Age Population (%)	Economically Active (no)	Economically Active (%)
Northumberland	323,800	190,400	58.8	145,200	74.6
Scottish Borders	115,200	67,300	58.4	57,300	81.0

[102] NOMIS (2022) Labour Market Profile – Scottish Borders
[103] NOMIS (2022) Labour Market Profile – Northumberland
[104] NOMIS (2022) labour Market Profile – North East England

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North-East England	2,680,800	1,655,700	62.1	1,257,000	74.8
Scotland	5,466,000	3,493,100	63.9	2,804,000	78.1

Table 13.1 shows that the Northumberland and Scottish Borders both have a slightly smaller proportion of people that are of working age in their populations. The Scottish Borders have a higher percentage of people that are economically active, and Northumberland has an almost equivalent proportion of people who are economically active. This suggests that despite the Scottish Borders having a slightly smaller proportion of people who are of working age, there will be a larger than average supply of people who are economically active to take advantage of employment-based opportunities presented by the Proposed Development; however, Northumberland may experience slightly fewer employment-based opportunities as less people are of working age and slightly less people are economically active.

Of importance to this assessment are the numbers of people employed in sectors that could potentially benefit from the construction, operation and decommissioning of the Proposed Development. These sectors are 'Construction', 'Electricity, Gas, Steam and Air Conditioning Supply (EGSAC)' and 'Accommodation and Food Services.'

Table 13.2 shows the percentage of people employed in those sectors in 2021 compared to the national averages.

Table 13.2 – People Employed in Socio-Economically Beneficial Sectors for Wind Development (NOMIS, 2022)

	Construction (No)	Construction (%)	EGSAC (no)	EGSAC (%)	Accommodation & Food (no)	Accommodation & Food (%)
Northumberland	6,000	5.8	225	0.2	13,000	12.5
Scottish Borders	3,000	7.5	125	0.3	2,5000	6.2
North-East England	N/A	5.0	N/A	0.4	N/A	8.7
Scotland	N/A	4.9	N/A	0.4	N/A	7.5

Table 13.2 shows that there is a larger than average supply of construction workers in the Scottish Borders and Norham which will present the Proposed Development with an opportunity to provide local employment-based opportunities for this sector. There is also a much larger proportion of people employed in the accommodation and food sector in Northumberland than the regional average. This sector will be able to benefit from workers who will need to utilise accommodation and hospitality venues while on-site.

The EGSAC sector has a smaller than average supply of workers than the national/regional average. This suggests that this sector may see slightly less employment-based opportunities from the Proposed Development. The same will apply to the accommodation and food sector in the Scottish Borders.

13.5.2 Project Incentives

Norham Development Trust (NDT) are the Applicants for the Proposed Development. They are a community-owned organisation that is managed by a volunteer board of Directors. NDT was formed in February 2019 and its objectives are to stimulate public benefit regeneration in Norham and the surrounding areas. This regeneration is brought through supporting community services and facilities, preservation of buildings or providing facilities for recreation.

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Proposed projects are designed to create local socio-economic benefits, and where possible, to generate revenue sustainably. The Development Trust is keen to build on their portfolio of community projects, with the goal of achieving further financial self-sufficiency and re-investing any income generated into the local communities.

Developing a community-owned renewable energy project would complement the long-term objectives of NDT, providing a sustainable source of green energy that will generate revenue to support local projects within Norham and the wider communities whilst also contributing to national carbon reduction targets. As such, any income could potentially fund educational, recreational, environmental and sustainability-related improvement projects within the local communities.

13.5.3 Nearby Settlements

There are scattered properties, small communities and towns within 5km of the Proposed Development. These include:

- Ladykirk – 1.4km North-West;
- Horndean – 2.3km North;
- Horncliffe – 3.9km North-East; and
- Castle Heaton – 4.3km South.
- Duddo – 4.9km South-East.

13.5.4 Tourism

13.5.4.1 Northumberland

From 2021 to 2019, Northumberland's overnight tourism significantly decreased to 1.49 million visitors per year, a 23% decrease, and day visitor numbers fell significantly to 7.8 million, a decrease of 27%.[105] Tourist expenditure also dropped by 21% to £859 million per year. These numbers are largely due to the impact of the COVID-19 pandemic as the majority of businesses only had the capacity to operate for 6 months of the year.[106]

In 2021, there were 11,179 people directly employed by the tourism industry, which had decreased by 15% since 2019. This, again, was due to the knock-on effects tourism felt from COVID-19, that resulted in the loss of jobs in multiple sectors, particularly tourism.

13.5.4.2 Scottish Borders

Between 2017 and 2019, overnight tourism in the Scottish Borders grew considerably. There were 369,000 overnight trips (9% increase), 1.26 million bednights (25% increase) and £72 million in tourist spend (13% increase).[107] Day tourism decreased slightly with 2.7 million day visitors (8% decrease); however, tourist spend still increased to £72 million (18% increase).

Tourism employed approximately 4,100 people in 2018, which increased by 2% from the previous year. The Gross Value Added (GVA) generated from tourism decreased by 13% from 2017 to £79.8 million in 2018.

13.5.4.3 Tourist Attractions in the Study Area

There are a small number of tourist attractions within the study area. They are listed below with their proximity to the Proposed Development:

[105] Northumberland STEAM Review (2021)
[106] STEAM (2021) The Economic Report
[107] Visit Scotland (2020) Scottish Borders Factsheet 2019

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- Ladykirk (0.4km West);
- Norham Castle (0.6km North-East);
- Ladykirk and Norham Bridge (1.1km North-West);
- Tillmouth Park (3.0km South-West);
- Duddo Five Stones (3.7km South-East);
- Twizel Castle (3.1km South-West);
- Royal Border Bridge (3.7km North-East);
- Heaton Castle (4.4km South);
- Union Suspension Bridge (4.9km North-East);
- Chain Honey Bridge Farm (4.9km North-East).

13.5.4.4 Tourist Accommodation

There are various types of accommodation within the study area. These include:

- 3 Bed and Breakfasts, with the nearest venues located 0.3km North of the Proposed Development (0.8km North from the proposed turbine location); and
- 27 rental cottages, with the nearest venue located 0.1km North of the Proposed Development (0.8km North from the proposed turbine location).

13.5.5 Recreation

There are no core paths or cycle paths within the 5km study area in the Scottish Borders. There are number of public rights of way withing the 5km study area in Northumberland. There are:

- 14 public rights of way in the Norham Area, with the closest following the outline of the site boundary;
- 11 public rights of way in the Horncliffe area with the closest 3.5km North-East of the Proposed Development;
- 3 public rights of way in the Shoreswood area, with the closest being 3.8km East of the Proposed Development;
- 16 public rights of way in the Duddo area, with the closest 1.3km South-West of the Proposed Development; and
- 6 public rights of way in the Cornhill on Tweed area, with the closest being 4.2km South-West of the Proposed Development.

13.6 Sensitive Receptors

13.6.1 Socio-Economics

Sensitive receptors include:

- The economy of Northumberland;
- The economy of the Scottish Borders;
- The economy of North-East England; and
- The economy of Scotland.

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13.6.2 Tourism

All tourism features and tourist accommodation within 5km of the Proposed Development are considered to be sensitive receptors.

13.6.3 Recreation

All recreational features and tourist accommodation within 5km of the Proposed Development are considered to be sensitive receptors.

13.7 Mitigation

13.7.1 Construction

Depending on the magnitude of effect determined in the environmental statement against socio-economics, tourism and recreation, some of the following mitigation measures may be considered during the construction phase:

- Issuing public notices to inform local residents, recreational users and businesses of dates and the duration of works;
- Avoiding certain accommodation types at their busiest times, in favour of ones who have a higher occupancy rate, to avoid increasing demand for tourist accommodation;
- Providing alternative paths and/or access routes, where possible, if access to any core path is restricted;
- Contractors shall ensure ongoing safe access to all key cycling and walking routes and provide alternatives when feasible.

13.7.2 Operation

Depending on the magnitude of effect determined in the ES against socio-economics, tourism and recreation, some of the following mitigation measures may be considered during the operational phase:

- Avoiding certain accommodation types at their busiest times, in favour of ones who have a higher occupancy rate, to avoid increasing demand for tourist accommodation.

13.8 Potential Significant Effects

13.8.1 Socio-Economics

There is potential for beneficial impacts on the local and regional economy during the construction and operational phases of the Proposed Development in the form of jobs, local value added (LVA), gross value added (GVA) and increased use of local facilities throughout all phases of the Proposed Development.

There will also be the potential for lasting benefits to the local community through NDT. These benefits include using the revenue generated to advance future community projects, benefit the local community and achieve further financial self-sufficiency. It will also help to reduce offset emissions in the local area and contribute towards national carbon reduction targets.

13.8.2 Tourism

There is potential for some temporary, adverse effects during the construction and operational phases of the Proposed Development which may affect the accessibility and amenity of local tourist attractions. Improved access arrangements may be considered as part of the assessment. The possibility and suitability for incorporating such arrangements will be explored within the ES.

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The availability of tourist accommodation may be impacted due to increased demand from on-site workers for accommodation.

13.8.3 Recreation

There is the potential for temporary, adverse effects on access to recreational facilities during the construction phase of the Proposed Development. This would be due to any temporary restrictions on the surrounding area.

During the construction and operational phases, the amenity value of recreational facilities and activities may be affected which may cause an adverse impact on user experience. Improved access arrangements for recreational facilities and activities may be considered as part of the Proposed Development, which may result in a beneficial effect. The possibility, and suitability, for incorporating such arrangements will be explored within the ES.

13.9 Issues Scoped Out

No issues have been scoped out of the ES.

13.10 Questions for Consultees

- **Q13/1:** Do you agree with the proposed approach for the chapter Socio-Economics, Recreation, and Tourism. This includes baseline data collection, prediction of effect, significant receptors and significance assessment?
- **Q13/2:** Are there any other receptors that should be included within the scope of the assessment?
- **Q13/3:** Should any other parties be consulted with for the purpose of these assessments?

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14 Aviation and Radar

14.1 Aviation and Radar

This section considers the issues and potential concerns associated with aviation and radar, resulting from the Proposed Development during the construction, operation and decommissioning phases. The Proposed Development has the potential to cause a variety of adverse effects on aviation during wind turbine operation only. These include but are not limited to:

- Physical obstruction;
- Generation of unwanted returns on Primary Surveillance Radar (PSR); and
- Adverse effects on overall performance of Communications, Navigations and Surveillance (CNS) equipment.

14.1.1 Legislation, Policy and Guidance

Civil Aviation Authority (CAA) guidance, within CAP 764 (CAA Policy and Guidance on Wind Turbines), sets out recommended consultation and assessment criteria for the impacts of wind turbines on all aspects of civil aviation.

The CAA involvement in the Wind Farm Pre-Planning Consultation Process has ceased; CAP 764 now states that "developers are required to undertake their own pre-planning assessment of potential civil aviation related issues" and that "it is incumbent upon the developer to liaise with the appropriate aviation stakeholder to discuss – and hopefully resolve or mitigate – aviation related concerns without requiring further CAA input."

The primary planning policy document is the Scottish Planning Policy document (SPP), which states a requirement to assess impacts on aviation, other defence matters and seismological recording. As well as this primary document reference will be made, where appropriate to:

- CAA guidance, within CAP 764 (CAA Policy and Guidance on Wind Turbines), sets out recommended consultation and assessment criteria for the impacts of wind turbines on all aspects of civil aviation;
- Planning Circular 2/03, Safeguarding of Aerodromes, Technical Sites and Military Explosives Storage Areas, contains annexes which describe the formal process by which planning authorities should take into account safeguarding, including in relation to wind energy developments.
- As a statutory consultee, the Ministry of Defence (MOD) will be consulted through the scoping application. They publish a guidance document called 'Wind farms: MOD safeguarding', Updated 21 Jul 2021. The MOD wind energy team liaises with a broad range of experts to formulate a comprehensive MOD response. Where the MOD has concerns about a development, the team will work with the developer to look for ways to mitigate them.

14.1.2 Proposed Assessment Methodology.

The acceptability of the Proposed Development, in terms of net effects on aviation related interests, is established through direct consultation with all relevant stakeholders within the consenting process. The initial task is to independently assess the potential effects and, where significant effects may occur, to enter into a dialogue with the affected stakeholders. Where impacts are of concern additional analysis may be required and where impacts are deemed unacceptable, further mitigation solutions would be identified and explored with the goal of reducing impacts to acceptable levels. While the aim of this dialogue is to avoid objection from all stakeholders before submission of the planning application, this is not always possible where stakeholders will only engage once the application has been submitted.

An obstacle lighting scheme will be designed to minimise the visual impacts. Approval for a lighting scheme will be sought from the CAA.

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14.2 Potential Effects and Baseline Conditions

The nearest licenced aerodrome to the Proposed Development is Edinburgh Airport which is c.78km to the north west. Preliminary online data from NERL suggest that the Proposed Development are not visible from their Primary Surveillance Radars (PSR).

Mitigation is anticipated to be available to manage any impacts to the satisfaction of NATS. This is likely to be the blanking and in-fill used to mitigate other wind farms in the immediate area, subject to detailed discussions with NATS.

As the turbine will be below 150m tall, there is no requirement for aviation obstacle lighting. However, infra-red lighting will likely be required to manage impacts to military low flying training.

Overall, there is potential for aviation impacts, but they will likely be manageable with the appropriate mitigation. As such, an Aviation assessment will be scoped in to the ES.

14.3 Questions for Consultees

- Q14/1 Do the Council and consultees agree with the proposed methodology?
- Q14/2 Do the Council and Consultees have any further information that would assist in the preparation of the assessments?
- Q14/3 Are the Council or consultees aware of any further guidance or policy documents not mentioned within the report that are relevant to the assessment?

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15 Telecommunications

15.1 Introduction

Wind turbines have the potential to interfere with point-to-point microwave links such as fixed link telecommunications infrastructure. This section considers the following potential interference from the Proposed Development:

- Physical Obstructions;
- Adverse effects on overall performance of Communications;
- Interfere with electro-magnetic signals and potentially affecting television reception and fixed telecommunication links.

15.2 Legislation, Policy and Guidance

Guidance for assessing the potential impact of wind turbines on infrastructure is given in:

- UK Government 'National Planning Policy Framework';
- Ofcom (2009) 'Tall Structures and their Impact on Broadcast and other Wireless Systems;
- BBC & Ofcom (2006) 'The Impact of Large buildings and Structures, including Wind Farms, on Terrestrial Television Reception';
- Healthy and Safety Executive – GS 6 (2012) 'Avoiding Danger from Overhead Powerlines';
- Healthy and Safety Executive – HSG 47 (2014) 'Avoiding Danger from Underground Services'.

The potential effects of the Proposed Development will be assessed with reference to these documents.

15.3 Methodology

As a general rule wind developments will seek to avoid impacts on telecommunication infrastructure where possible. Consultation will be undertaken with appropriate stakeholders to identify any potential impacts and discuss appropriate mitigation should effects be identified.

15.4 Telecommunications

Wind farms produce electromagnetic radiation which has the potential to interfere with broadcast communications and signals. In order to determine the potential impact of the Proposed Development, initial consultation will be undertaken with the following consultees:

- Ofcom;
- Joint Radio Company Windfarm Co-ordinations;
- Atkins Global;
- British Telecom;
- Vodafone;
- EE; and
- O2.

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The potential for a significant impact on any fixed radio links within the vicinity of the Site will be determined through the consultation with these key stakeholders.

15.5 Television

Since the digital switchover was completed the potential impacts on television signals from wind farm developments has been significantly reduced as these digital signals are much better at coping with the signal reflections which could cause ghosting effects on an analogue signal.

However, if the Proposed Development is found to cause interference to TV signals there are a number of options available to mitigate the effects, such as re-aligning the aerial or installing a satellite dish. As potential television reception problems are difficult to predict and identify, assurance that the Applicant will rectify any problems is normally formalised in a planning condition which is now fairly standard practice with approved wind applications.

15.6 Baseline

From the initial consultation with Ofcom Spectrum information portal on 12 November 2022, there appears to be no fixed links within the Site of the Proposed Development. However, there are fixed links in the surrounding area. These will be identified through the consultation process, and individually consulted to ensure there are no impacts to unregistered or presently planned fixed links. The potential impact on these will be assessed and mitigation proposed as required. In the first instance, the mitigation will be to design the Proposed Development to avoid the telecommunication links, however, where unavoidable, the telecommunication link operator will be contacted directly in relation to the acceptance of the Proposed Development.

15.7 Mitigation

In the event that a significant impact on a telecommunication link is identified, the first mitigation will be to seek to avoid any direct impacts by micrositing the wind turbines. Where micrositing does not mitigate the potential impacts a more detailed impact assessment will be undertaken using Fresnel Zone calculations to ascertain the potential for interference on the link resulting from the proposed wind turbines. In cases where these mitigation proposals are not acceptable to the link operator, it may be possible to re-route the link, at the Applicant's expense, to follow a different communications tower, avoiding the impact from the Proposed Development.

15.8 Summary

The Proposed Development may give rise to some significant effects on telecommunication links. As such, a full assessment of the potential impacts will be scoped in to the ES.

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16 Carbon Balance

16.1 Introduction

This chapter considers the potential impact of the proposed wind turbines on climate change. The UK and local Governments have developed ambitious targets for tackling climate change:

- The UK Government, in the 2008 Climate Change Act committed to reducing the UK's emissions of CO_2 by 34% (on 1990 levels) by 2020 and 80% (net zero) by 2050.
- The UK Government amended the Climate Change Act of 80% reduction, to 100% reduction by 2050.[108] These targets will be achieved through an investment in energy efficiency and clean technologies such as renewable energy generation.
- The UK Government, in 2021 added a new target of reducing CO2 by 78% (on 1990 levels) by 2035, whilst currently working towards the target of 68% CO2 reduction by 2030.[109]

In 2019, Northumberland County Council agreed to declare a Climate Emergency. This included a commitment to reduce CO2 by 50% (on 2018 levels) by 2023 and to achieve net zero by 2030. The Council's Climate Change Action Plan outlines the commitment to lead on the transition to cleaner and greener technologies with a significant increase in support for the installation of renewable energy where; it is technically, socially and environmentally feasible. [110]

Renewable electricity generated by wind turbines is already considered to be the cheapest form of new electricity generation[111] and as such, has a vital role to play in achieving the ambitious targets set by the UK Government.

The manufacturing, construction, and installation of the wind turbines on site has an associated carbon cost, and carbon losses are also generated by the requirement for extra capacity to back up wind power generation. Carbon losses associated with reduced carbon fixing potential and loss of soil organic matter occur through the excavation of peat for construction and drainage effects.

Turbine blades currently make up approximately 13% of the carbon impact of a wind turbine and are the hardest section of the turbine to be recycled. However, there are options for recycling or disposal, such as burning the epoxy which generates energy, which can be recovered. The residues from the fibreglass incineration can be used in other secondary applications such as cement production. The carbon cost of the blades is incorporated into the lifecycle emission of the turbine. [112]

The Department for Business Energy and Industrial Strategy (BEIS) anticipates the UK solar deployment to increase five-fold, taking overall volume to 70GW.[113] Recycling solar panels is key to reducing carbon losses associated with end-of-life disposal. There are established methods for recycling solar panels which include technical treatment processes to extract ferrous, and non-ferrous metals and plastic semiconductor material. Some solar panels are made up of different compound metals and therefore require additional techniques to extract materials. Thin-film panels require an extra treatment process when compared to silicon panels, with additional steps such as

[108] https://www.legislation.gov.uk/ukpga/2008/27/section/1 (Accessed February 2023)
[109] https://www.gov.uk/government/news/uk-enshrines-new-target-in-law-to-slash-emissions-by-78-by-2035 (Accessed February 2023)
[110] https://www.northumberland.gov.uk/Climate-Change/Climate-Change.aspx (Accessed February 2023)
[111] https://www.renewableuk.com/general/custom.asp?page=WindEnergy – (Accessed February 2023)
[112] https://www.siemensgamesa.com/-/media/siemensgamesa/downloads/en/products-and-services/offshore/brochures/siemens-gamesa-environmental-product-declaration-epd-sg-8-0-167.pdf (Accessed February 2023)
[113] https://www.gov.uk/government/statistics/solar-photovoltaics-deployment (Access February 2023)

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shredding and vibration. Care should be taken in procuring the most recycling-friendly solar panels to reduce end-of-life carbon losses.[114]

16.2 Guidance

To provide the carbon calculations for the assessment, the Scottish Government's Carbon Calculator Tool V1.6.1[115] will be used to inform the discussion in the ES chapter, in lieu of English specific guidance.

16.3 Electricity Mix

The UK electricity factor is prone to fluctuate from year to year as the fuel mix consumed in UK power stations (and auto-generators) and the proportion of net imported electricity changes.

These annual changes can be large as the factor depends very heavily on the relative prices of coal and natural gas as well as fluctuations in peak demand and renewables.

In the 2019 greenhouse gas (GHG) Conversion Factors, there was a 10% decrease in the UK Electricity $CO2_e$ factor compared to the previous year. In the 2020 update, the $CO2_e$ factor decreased again by 9% (compared with 2019). In the 2021 update, the $CO2_e$ factor has again decreased by 9% (in comparison to the 2020 update). The above decreases are all due to a decrease in coal use in electricity generation and an increase in renewable generation.[116]

The most recent emissions factor for 2021 grid mix electricity is 0.21tCO_2 per MWh.

16.4 Methodology

Once a design has been established, and the excavation and construction parameters are obtained, the Carbon Calculator will present results based on the input variables entered. The data delivered will inform the quantity of tCO_2 eq over its lifetime. The following activity will be calculated from the calculator:

- Losses due to turbine life (e.g. manufacture, construction, decommissioning)
- Losses due to backup
- Losses due to reduced carbon fixing potential
- Losses from soil organic matter
- Losses due to DOC & POC leaching
- Losses due to felling forestry

16.5 Baseline

The Proposed Development is situated on an area with no peat. Therefore, there will be no extraction of carbon rich soils.

No forestry is anticipated to be removed as part of the Proposed Development therefore, there will be no carbon lost due to felling.

The Proposed Development will consist of a single 67m to tip wind turbine, and approx. 13 hectares of solar ancillary infrastructure. The Proposed Development has an overall site capacity of up to 9.8MW. This generation

[114] https://www.sciencedirect.com/science/article/pii/S2211467X19301245 (Accessed February 2023)
[115] https://informatics.sepa.org.uk/CarbonCalculator/index.jsp - (Accessed February 2023)
[116] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021 - (Accessed February 2023)

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will positively contribute to meeting local and national renewable energy targets by producing clean energy to be distributed to the local grid network.

16.6 Mitigation

Given the proposed development will significantly reduce the CO_2 released by the electricity generation system as well as the avoidance of any significant removal or disturbance of peatlands, it is not considered that any further mitigation is required.

The Applicant will seek to incorporate any additional enhancements at the construction phase with their appointed contractor through the provision of a Construction and Environmental Management Plan, to be agreed upon during the discharging of planning conditions. The document will be produced in line with best practice guidance and appropriate consultation with key stakeholders.

16.7 Summary

Given the current challenges to deliver net-zero, it is considered that the Proposed Development will deliver an overall positive effect on carbon savings, contributing to the decarbonisation of the electricity sector. There will be low levels of emissions produced during construction and net emissions savings over the life of the Proposed Development. Therefore, the Carbon Balance should be scoped into the EIA.

16.8 Questions for Consultees

- Q16/1 Do the Council and consultees agree with the proposed methodology?
- Q16/2 Do the Council and Consultees have any further information that would assist in the preparation of the assessments?
- Q16/3 Do the Council or consultees agree that Scottish guidance should be used in lieu of English specific guidance?

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17 Other Issues

17.1 Emission and Pollutants

17.1.1 Dust and Air Quality

During construction and decommissioning works, there is the potential for the creation of airborne dust. The site would be classed as a small scale works site, with the settlement of dust from the source considered to be deposited within 50m from emission sources.

During the construction phase best practice mitigation measures, applied on construction projects across the country, would be applied across the whole site. These methods will be detailed within a Construction Environmental Management Plan (CEMP), which will be produced prior to construction.

Construction vehicle exhaust emissions will be limited to the construction and decommissioning phases of the development lifespan. Given the site location, bordered by two main 'A' roads south of Aberdeen, it is not expected that the modest increase in vehicle movements will have any impact on the current level of air quality in the local area.

Given the limited potential impacts on the local air quality associated with dust and vehicle emissions during the construction and decommissioning phases of the development, it is proposed that this element is **scoped out** of the EIA.

17.1.2 Vibration

The potential for ground borne vibration may arise during the construction of the proposed development, primarily if a borrow pit is required for the purpose of winning stone and rock for the construction of the access track. While the need for an on-site borrow pit is under review, it is not considered that there will be any vibration effects arising from the proposed development and this will be **scoped out** of the EIA.

17.1.3 Lighting

Dependent on the time of year construction is undertaken, there may be a requirement for temporary lighting to be used on site, as well as on vehicles for safety. This will be governed by stringent project management procedures and undertaken in line with best practice guidance, as such, it is not considered that this will create any significant effects during the construction or decommissioning phases of the development and will be **scoped out** of the EIA.

17.2 Population and Human Health

Potential impacts on the local and wider population and impacts on their health and amenity are considered throughout the assessment process and assessed as part of the EIA process, these include the following:

- Visual Impacts;
- Residential and Settlements
- Noise;
- Shadow Flicker;
- Glint and Glare;
- Hydrology and Hydrogeology; and
- Traffic and Transportation;

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A summary table will be included within the ES outlining the potential population and human health effects, which are incorporated within the separate technical chapters.

17.3 Safety, Major Accidents and Disasters

The EIA Regulations state that an EIA must identify, describe and assess in an appropriate manner the expected effects deriving from the vulnerability of the development to risks, so far as relevant to the development, of major accidents and natural disasters.

Renewable energy developments have an exemplary safety record, with stringent best practice guidance to minimise risk during the construction, operation and decommissioning phases of the development.

Given the development is not located in an area that is known to be prone to natural disasters, it is considered that this element can be scoped out of the EIA.

During the construction phase, the site will be under the supervision of a suitably qualified team governed by Health and Safety legislation and best practices. This will include the induction of all staff to the site and the publication of all appropriate H&S practices applicable to the working site.

17.4 Glint and Glare

Given the distance from the proposed development and any registered aerodromes, it is considered that Glint and Glare will not require any further assessment, and as such will be scoped out.

17.5 Questions for Consultees

- Q17/1 Do the Council and consultees agree to scope out the above aspects?
- Q17/2 Are there any other elements/assessments not noted within the Scoping Report that the Council/consultees think should be included?

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