CAIRNMORE HILL **WIND FARM**

Environmental Statement

July 2020

Volume 2: Main Report



power for good

VOLUME 2 MAIN REPORT: TABLE OF CONTENTS

1 Introduction

1.1 Introduction

1.1.1 This Environmental Statement (ES)[1] has been prepared by Ramboll UK Limited (Ramboll) on behalf of Renewable Energy Systems Limited ('RES') ('the Applicant') in support of an application for Planning Permission to construct and operate a wind farm and associated infrastructure of between 20 MW and 50 MW (the 'proposed development'). The proposed development would comprise of up to 8 turbines on a site located approximately 4.5 km northwest of Thurso, on the north coast of Caithness in the Scottish Highlands. The site location is shown in Figure 1.1.

1.1.2 This chapter is supported by the following figures and technical appendices:

- Figure 1.1: Site Location; and
- Technical Appendix 1.1: Consultation Register.

1.1.3 Figures and technical appendices are referenced in the Main Report where relevant.

1.1.4 This ES comprises four volumes:

- Volume 1: Non-Technical Summary (NTS);
- Volume 2: Main Report;
- Volume 3a: Figures;
- Volume 3b: Visualisations; and
- Volume 4: Technical Appendices.

1.2 Purpose of the ES

1.2.1 The Applicant is seeking detailed planning permission for the proposed development under the Town and Country Planning (Scotland) Act 1997, as amended.

1.2.2 The ES has been prepared to accompany the planning application, in accordance with the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (the EIA Regulations). An ES is required where a development is an EIA development, that is a development which is "likely to have significant effects on the environment by virtue of factors such as its nature, size or location". The ES demonstrates how the Applicant has taken these consenting requirements into account throughout the siting and design of the proposed development and has included reasonable mitigation measures.

1.2.3 The Applicant has considered the proposed development in light of the EIA Regulations and concluded that, due to the nature and scale of the proposed development and the potential for significant environmental effects, this is an EIA development.

1.2.4 Each of the technical chapters provides the specific criteria, including sources and justifications, for quantifying the different levels of effect. Where possible, this has been based upon quantitative and accepted criteria together with the use of value judgements and expert interpretations to establish to what extent an effect is environmentally significant. The

[1] As the request for an EIA Scoping Opinion was submitted in July 2016, the EIA has been prepared in accordance with Town and Country Planning (EIA Regulations) (Scotland) 2011 and the outcomes are presented in an 'Environmental Statement' as opposed to an 'EIA Report'. The latter is the reporting terminology used within the Town and Country Planning (EIA) (Scotland) Regulations 2017, which do not apply in relation to this application.

threshold at which effects are likely to be "significant" is defined in each of the technical chapters.

1.3 Other Planning Documents

1.3.1 Additional documents that are submitted with this application include:

- Planning Application Form (including Ownership Notification Certificates);
- Planning Statement;
- Design and Access Statement;
- Pre-application Consultation Report;
- Cover Letter, confirming deposit locations for the ES; and
- Proposed Processing Agreement between The Highland Council (THC) and the Applicant.

1.4 Environmental Impact Assessment ("EIA") Process

1.4.1 EIA is a process that identifies the potential environmental effects (both positive and negative) of a proposed development and proposes mitigation to avoid, reduce and offset any adverse environmental effects. EIA is required where a proposed development is 'likely to have significant effects on the environment by virtue of factors such as its nature, size or location'. The key stages in the EIA process adopted for the proposed Cairnmore Hill Wind Farm are summarised below.

Screening

1.4.2 Screening is the term in the EIA regulations used to describe the process by which the need for EIA is considered. A request for a screening opinion can be submitted to the planning authority prior to submitting an application; however, there is no obligation to do so.

1.4.3 RES has volunteered to undertake an EIA rather than request a formal screening opinion to confirm whether likely significant effects may arise.

Scoping

1.4.4 The Applicant submitted a request for a Scoping Opinion to THC on 6 July 2016. This request was accompanied by a Scoping Report, prepared by the Applicant, which set out a summary of the proposal; identified the likely significant environmental effects, and summarised the proposed scope of the EIA. The Scoping Report was simultaneously issued to statutory and non-statutory consultees.

1.4.5 A Scoping Opinion was received from THC on 8 August 2016. The contents of this and other consultation responses received are summarised in Technical Appendix 1.1: Consultation Register, along with a list of all bodies consulted during the scoping exercise.

Consultation

1.4.6 In addition to seeking a Scoping Opinion, the Applicant conducted four public exhibitions, to seek the views of the local community. Exhibitions were held, as follows:

- 22nd November, 2016, Caithness Horizons, Thurso;
- 23rd November, 2016, Forss Village Hall, Forss;
- 3rd April, 2019, Pentland Hotel, Thurso; and
- 4th April, 2019, Forss Village Hall, Forss.

1.4.7 The events in 2016 were advertised in advance in the John O'Groat Journal; Northern Times; and Caithness Courier on 11 November 2016. Newsletters were issued to Local MSPs, Councillors and Community Councils notifying them of the event and newsletters were distributed to around 1,000 properties located within a 4.5 km radius of the site centre in November 2016. A project website (http://www.cairnmorehill-windfarm.co.uk/) was also set up to allow access to further information on the proposal and to allow comments to be made online. These events were attended by 80 people. Further update events were held in April 2019 to introduce the 8-turbine site. These events were advertised in the Caithness Courier and Northern Times on 13 March 2019 and again information was distributed to the stakeholders aforementioned. The update events were attended by 75 people.

1.4.8 In addition, the Applicant engaged with the local community councils (Thurso and Caithness West) via written correspondence.

1.4.9 RES also produced project newsletters to help keep people informed about the proposed development. Three newsletters have been published on the project website and distributed to around 1,000 properties located within a 4.5 km radius of the site during:

- Autumn 2016;
- Spring 2018; and
- Spring 2019.

1.4.10 A summary of the representations received during the public exhibitions is provided in the Pre-Application Consultation Report.

1.4.11 Further detail on the key issues identified through the scoping and consultation process are described in Chapter 3: Design Evolution and Alternatives.

Project Update Letter

1.4.12 The applicant submitted a project update letter to THC on 11 March 2019. The letter described the principal refinements to the proposed development since the request for an EIA Scoping Opinion, set out why the EIA Scoping Opinion remained appropriate; and explained relevant adjustments in approach to the EIA process as a result of either consultation feedback or the proposed design amendments.

1.4.13 A response was received from THC on 2nd May 2019. The contents of this and other consultation responses received are summarised in Technical Appendix 1.1: Consultation Register.

1.4.14 Subsequent to the project update letter, there was a further design iteration. This is fully described in Ch.3: Design Evolution and Alternatives.

Baseline Characterisation

1.4.15 Baseline characterisation is the process by which the environmental conditions now, and in the future assuming no development on the site, are established. The process has included a combination of desk research, site survey and empirical study and projection.

1.4.16 The environmental baseline adopted for the purposes of the EIA is stated in each of the technical assessment chapters provided in the ES. The baseline is normally taken as the current character and condition of the site and surrounds, and the likely significant environmental effects of the development are then assessed in the context of the current conditions.

Mitigation by Design and Consideration of Alternatives

1.4.17 Following the baseline characterisation, the information collected on environmental constraints was used to inform the consideration of design alternatives. An iterative process was followed, whereby the Applicant considered a range of turbine layout, height and access proposals. The aim of the design element of the EIA process was to develop an optimal solution which seeks to maximise potential renewable energy generation, within technical and environmental constraints. The main aim has been to avoid likely significant environmental effects through the design. Further details on the design process adopted for the proposed development are set out within Chapter 3: Design Evolution and Alternatives.

Impact Assessment

1.4.18 The next stage in the EIA process was to complete an impact assessment to address the likely significant effects remaining following the implementation of mitigation by design. An assessment chapter has been provided for each issue where it is considered that there are likely significant effects associated with the construction, operation, decommissioning or restoration phases of the proposed development. Each assessment chapter considers primary, secondary, direct, indirect, short, medium, long, permanent, temporary, positive, negative and cumulative effects and defines the assessment methodology used and the criteria by which a significant effect is defined.

Additional Mitigation

1.4.19 The impact assessment is used to identify where additional mitigation is required to address likely significant effects, where it has not been possible to avoid the effect through design of the turbine or infrastructure layout. Mitigation has been considered following a hierarchy of first seeking to avoid effects, followed by seeking a reduction in effects to level not considered significant, and finally where possible, offsetting or compensatory measures are considered.

Statement of Competence

1.4.20 The ES has been compiled and approved by professional ES practitioners at Ramboll, holding relevant undergraduate and post-graduate degrees, membership of the Institute of Environmental Management and Assessment (IEMA) and Chartered Environmentalist status with the Society for the Environment. The ES meets the requirements of the IEMA EIA Quality Mark Scheme. This is voluntary scheme operated by IEMA that allows organisations to make a commitment to excellence in EIA and to have this commitment independently reviewed on an annual basis.

1.4.21 The project team comprises the specialist companies presented in Table 1.1 below.

Table 1.1: Project Team

Team Member	Role & Responsibility
RES	Project Developer, Project Engineers, Noise, Aviation, Shadow Flicker and AIL Route Survey
Ramboll	EIA Project Management and Landscape and Visual Impact Assessment
JLL	Planning
MacArthur Green	Hydrology, Peat, Ecology and Ornithology
CFA	Archaeology
AECOM	Transport

Environmental Statement

1.4.22 The process and outcomes of the assessment are presented in a single document, known as the ES. This ES has been prepared to provide clear and concise information on the likely significant environmental effects associated with the proposed development. The ES is focussed on the residual effects that remain following the implementation of mitigation. The aim is to provide proportionate environmental information, as required in accordance with EIA regulations, to support the determination of the planning application.

1.4.23 In this case, the ES is submitted to THC.

1.5 Copies of the ES

1.5.1 Further information is available on the project website (http://www.cairnmorehill-windfarm.co.uk/) and hard copies of the ES and other documentation can be viewed at the following locations:

The Highland Council

Thurso, Strathy and Mey Service Point and Registration Office

Rotterdam Street

Thurso

KW14 8AB

1.5.2 An electronic version of the reports supporting the application, including the ES, will be available to download from http://www.cairnmorehill-windfarm.co.uk/the-project/. This document is available at a cost of £400 in hard copy format (including postage and packaging) or on CD-ROM (price £15). A Non-Technical Summary of the ES is available free of charge from the Applicant on request.

Copies of the ES can be obtained from:

Renewable Energy Systems Limited

3rd Floor

STV

Pacific Quay

Glasgow

G51 1PQ

1.6 Commenting on the Application

1.6.1 Once the planning application for the proposed development is lodged with THC, THC will place a notice of the ES and the application in a local newspaper and the Edinburgh Gazette, providing details of by when representations should be made and where the ES may be inspected.

1.6.2 Any representations in relation to the application should be made by email to the Highland Council, Planning & Development Services mailbox at eplanning@highland.gov.uk or by post to The Highland Council, Planning & Development Services, Glenurquhart Road, Inverness, IV3 5NX identifying the proposal and specifying the grounds for representation. Written or emailed representations should be dated, clearly stating the name (in block capitals), full return email and postal address of those making representations.

2 Development Description

2.1 Introduction

2.1.1 This chapter provides a description of the proposed development for the purposes of identifying and assessing likely significant effects. Information is provided on:

- the location of the proposed development;
- the physical characteristics of the operational proposed development;
- typical activities associated with the construction and commissioning of the proposed development;
- typical activities associated with the operation of the proposed development; and
- typical activities associated with the decommissioning of the proposed development.

2.1.2 This chapter is supported by:

- Technical Appendix 2.1: Outline Construction Environmental Management Plan (CEMP);
- Technical Appendix 2.2: Draft Peat Management Plan;
- Technical Appendix 2.3: Peat Landslide Hazard and Risk Assessment (PLHRA);
- Technical Appendix 2.4: Phase 1 & 2 Peat Depth and Coring Survey Report;
- Technical Appendix 2.5: Hydrological Sensitivities;
- Technical Appendix 2.6: Carbon Balance Assessment;
- Technical Appendix 2.7: Outdoor Access Management Plan; and
- Technical Appendix 2.8: Shadow Flicker Assessment.

2.1.3 Figures 2.1-2.13 are referred to in the text where relevant and include the following:

- Figure 2.1: Site Layout;
- Figure 2.2: Wind Turbine Elevation;
- Figure 2.3: Wind Turbine Foundations;
- Figure 2.4: Typical Crane Hardstanding;
- Figure 2.5: Typical Access Track Detail;
- Figure 2.6: Typical Watercourse Crossing;
- Figure 2.7: Substation and Control Building Layout;
- Figure 2.8: Typical Substation and Control Building Elevation;
- Figure 2.9: Typical Temporary Construction Compound Layout;
- Figure 2.10: Typical Temporary Enabling Works Compound Layout;
- Figure 2.11: Typical Cable Trench Detail;
- Figure 2.12: Typical Battery Energy Storage Unit Layout; and
- Figure 2.13: Potential Grid Connection Corridor.

2.2 Site Location

2.2.1 The proposed development site ('the site') covers an area of approximately 3.58 km² and is located approximately 4.5 km northwest of Thurso (Figure 1.1: Site Location). The spot height named 'Cairnmore Hillock' at 135 m AOD is within the site boundary. The highest point at Hill of Forss, within the centre of the site is lying 138 m AOD. The only major watercourses on site are the two tributaries of the Burn of Brims, flowing from both the east and west of the site before their confluence to form the main Burn of Brims channel. There are a number of minor watercourses including the Thusater Burn to the northeast and the Burn of Brimside to the south of the site.

2.2.2 The A836 runs parallel with the northern boundary of the site with neighbouring agricultural land adjoining to the east, south and west. The majority of the site comprises rough grazing land with a number of tracks running through and adjacent to the site.

2.2.3 There are seven properties located within the site boundary, two are privately occupied, two belong to landowners of the proposed development and three have been identified as unoccupied. The Applicant has visited these properties with the opinion being formed that these wouldn't offer the immediate opportunity for habitation due to state of disrepair. There are more properties along major roads surrounding the site.

2.2.4 The operational Baillie Wind Farm is located c.5 km to the west of the site and the consented Limekiln Wind Farm is located c.10 km to the south-west of the site.

2.3 Project Description

2.3.1 The proposed development comprises up to eight horizontal axis turbines, each up to a maximum tip height of 138.5 m[1] and with a total installed capacity of between 20 MW and 50 MW. The proposed development has an indicative capacity of 33.6 MW[2]. Key elements of the proposed development include associated access tracks, crane hard standings, control building and substation compound and underground cabling. During construction and commissioning there would be a number of temporary works including construction compounds and welfare facilities. A detailed plan of the proposed development is shown in (Figure 2.1). (Figure 2.2) presents the maximum wind turbine elevations.

2.3.2 Permission is sought for the proposed development comprising:

- Up to eight three-bladed horizontal axis wind turbines, of a maximum ground to tip height of up to 138.5 m[1] (Figure 2.2);
- Turbine foundations (Figure 2.3);
- Crane hardstanding area at each turbine base with a maximum permanent area of 1350 m² (Figure 2.4);
- A total of approximately 4.14 km of new on-site access track and turning points with associated watercourse crossings (Figures 2.5 and 2.6), the proposed development would also make use of approximately 1.12 km of existing tracks within the site boundary;
- A wind farm control building/substation compound, with a maximum total area of 2,773.5 m² containing provision for battery energy storage (Figures 2.7 and 2.8);
- Temporary site construction compound with a maximum area of 4,000 m² (Figure 2.9);
- One temporary enabling works compound with maximum area of 900 m² (Figure 2.10);
- Underground cabling linking the turbines with the substation (Figure 2.11);
- Public access and heritage enhancement measures including installation of noticeboards/information boards and signage, restoration of existing historic sheepfold,

[1] Maximum tip height of 138.5 m is being used in the ES for assessment purposes only

[2] 8 turbines with an indicative capacity of 4.2 MW each.

use of dry-stone walling and seating, and car parking using the temporary enabling works compound area located close to the site entrance[3];

- Associated ancillary works; and
- Engineering operations.

Site Layout and Flexibility

2.3.3 A plan of the proposed development showing the positions of the turbines, access tracks, hardstanding areas and control building/substation compound is shown in Figure 2.1. The coordinates of the proposed turbines are set out in Table 2.1.

Table 2.1: Turbine Coordinates

Turbine ID	Easting	Northing
T1	305838	967654
T2	305658	968216
T3	306169	967828
T4	306001	968398
T5	306509	968101
T6	306302	968713
T7	306702	968395
T8	306979	968632

2.3.4 Although the design process seeks to combine environmental and economic requirements with the best data available at the time, the Applicant would nevertheless wish some flexibility, where necessary, in micrositing the exact positions of the turbines and routes of on-site access tracks and associated infrastructure (50 m deviation in plan from the indicative design). This would allow the accommodation of possible variations in ground conditions across the site, which would only be confirmed once trial pits and boreholes for detailed site investigations are dug during the detailed infrastructure design prior to the commencement of construction. Any repositioning should not further encroach into environmentally constrained areas. Therefore, 50 m flexibility in turbine and infrastructure positioning would help mitigate any potential environmental effects e.g. avoidance of archaeological features not apparent from current records.

Permanent Land Take

2.3.5 The site area is approximately 3.58 km^2 (Figure 2.1). Within this area the permanent[4] land take would be limited to the wind turbine plinths and paths, access tracks, permanent crane hardstandings, control building and substation hardstandings which account collectively for about 1.04% of the total area within the site boundary.

2.3.6 The turbine foundation (Figure 2.3) is made up of a central excavation of approximately 20 m diameter and an approximate depth of 3.5 m subject to prevailing ground conditions. Sloping batters would increase the excavated area to approximately 35 m diameter at ground level; possibly greater where poor ground conditions are encountered. The completed foundation would be covered with soil approximately 1.5 m - 3.0 m deep, leaving only the concrete plinth exposed at ground level to which the steel tower would be attached.

[3] It is proposed that these measures are conditioned, and a final design approved by THC

[4] In the context of the proposed development, permanent land take means for the life of the wind farm.

2.3.7 Each turbine requires a crane hardstanding to facilitate construction and maintenance. At each turbine there would be a 1,350 m^2 permanent hardstanding (Figure 2.4).

2.3.8 Following completion of the turbine installation, the permanent hardstanding remaining would be approximately 1,470 m^2 at each turbine site (includes the concrete plinth to which the steel tower is attached and a 5 m wide maintenance track/path around the base of the turbine (Figures 2.3 and 2.4).

2.3.9 The proposed development would result in the construction of approximately 4.14 km of new track. The running width of the track would be 4.5 m on straight sections, with 0.25 m wide shoulders on each side. Tracks would be wider on bends. Typical access track details are presented in Figures 2.5 and 2.6. The total permanent hardstanding area for the new track would be 20,726 m^2, which includes the hardstanding area for turning heads. The proposed development would utilise approximately 1.12 km of existing track within the site boundary. The existing track has a typical width of 3 m and would therefore need to be widened to 4.5 m with 0.25 m shoulders on each side.

2.3.10 The substation compound would take up an area of approximately 64.5 m x 43 m (2,773.5 m^2) (Figure 2.7). Typical elevations are presented in (Figure 2.8). The wind farm control building would require an approximate area of 450 m^2 within the substation compound. It is anticipated that there would be distribution network operator's equipment located here. The exact size and requirements would be dependent upon the network operator, but the area identified would be sufficient to contain this equipment.

2.3.11 The temporary enabling works compound would require a hardstanding area of approximately 900 m^2 (30 m x 30 m) (Figure 2.10). It is proposed that the enabling works compound would subsequently form part of the public access and heritage enhancement proposals outlined in 2.3.2 to minimise further land take.

2.3.12 In order to match on-site energy generation to energy demand, as well as facilitate options such as a reduction in any possible grid constraint requirements, the proposed development also includes for the provision of an energy storage device. Permanent containers, mounted on small concrete pad foundations would house an energy storage device, inverters and other ancillary equipment. The proposed design would be a compact and low-key containerised scheme within the substation compound.

Temporary Land Take

2.3.13 In addition to the permanent crane hardstanding, an additional 630 m^2 of temporary hardstanding for assist crane and laydown around the turbine bases during the construction phase would be required.

2.3.14 The temporary construction compound would require a hardstanding area of approximately 4,000 m^2 (50 m x 80 m), which allows area for staff parking. This area would be re-vegetated after construction has been completed (Figure 2.9).

2.3.15 Ancillary excavation works and material storage around other parts of the proposed development, such as those for cable trenching, would have no likely significant effects on environmental receptors due to the very minor scale of the excavation or duration of the works and are not considered further in this ES.

2.3.16 The area of temporary and permanent hardstanding associated with the proposed development is presented in Table 2.2.

Table 2.2: Summary of Temporary and Permanent Hardstanding		
Wind Farm Element	**Temporary**	**Permanent**
Turbines, Crane Pads and laydown areas	5,040m^2	11,760m^2
33/132kV Substation, Control Building and Battery Energy Storage	N/A	2,773.5m^2
On-site access tracks (New)	N/A	20,726 m^2
On-site access tracks (Upgrade)	N/A	2,241 m^2
Construction Compounds	4,000m^2	N/A
Enabling Works Compound	N/A	900m^2
Total Hardstanding	9,040m^2	38,400.5m^2

Wind Turbines

2.3.17 The wind turbine industry is constantly evolving, designs continue to improve both technically and economically. The most suitable turbine model for a particular location can change with time and therefore a final choice of machine for the proposed development has not yet been made. The most suitable machine would be chosen before construction, with an overall height limit of up to 138.5 m to blade tip as assessed in this ES.

2.3.18 For acoustic assessment purposes, the most suitable candidate turbine available in the market place (4.2 MW[5] nominal capacity and with an overall height to blade tip of up to 138.5 m) has been assumed. Most of the dominant wind turbine manufacturers are now producing turbines that are classed as suitable for the wind regimes typical of Scotland and many are also producing turbines that match the 138.5 m tip height being suggested for the proposed development. Exact tower and blade dimensions vary marginally between manufacturers, but suitable turbines are produced by Nordex, GE and Vestas amongst others. A diagram of a typical 138.5 m tip height turbine is provided in (Figure 2.2).

2.3.19 The colour and finish of the wind turbine, blades, nacelles and towers would be agreed with the Highland Council (THC).

2.3.20 A significant amount of research has been undertaken in relation to turbine colour and finish. Siting and Designing Wind Farm in the Landscape (Version 3a) SNH, August 2017 states that as a rule for most rural areas of Scotland:

- A single colour of turbine is generally preferable;
- The use of graded colours at the turbine base should be avoided as public perception studies have demonstrated that aesthetic unity is viewed more favourable. Graduated schemes, or turbines with colour variation, should be used with caution;
- Light coloured turbines seen against a land backdrop may have greater prominence than light or dark turbines seen against the sky;
- The use of coloured turbines (such as greens, browns or ochres) in an attempt to disguise wind turbines against a landscape backcloth is usually unsuccessful although variation from the standard light grey colour, using a darker grey, may be successful when the wind farm is backclothed by the landscape from important viewpoints or receptors. The chosen turbine colour should respond to the character of the site and its setting;

[5] It is expected that should consent be granted the nominal capacity of the turbines would be up to 4.2 MW resulting in an indicative total installed capacity of 33.6 MW

- Paint reflection should be minimised. Texture is an important factor in reducing reflectivity, and matt or light absorbent finishes are preferable; and
- For multiple wind farm groups or wind farm extensions, cumulative colour effects would be a key consideration. A strategic approach to turbine colour is desirable and the colour of turbines should generally be consistent.

2.3.21 In cognisance of the preceding guidance, a simple pale colour with a semi-matt finish is suggested for the turbines.

2.3.22 Turbines normally rotate clockwise when viewed from the front, although this can vary between models. The computerised control system within each turbine continuously monitors the wind direction and instructs the turbine to turn (yaw) to face into the wind to maximise the amount of energy that is captured. Turbines begin generating automatically at a wind speed of around 3 to 4 metres per second (m/s) and have a shutdown wind speed of about 25 m/s.

2.3.23 It is proposed to install infrared lighting on the turbines in a pattern that is acceptable to the Ministry of Defence (MoD) for aviation visibility purposes. Infrared lighting allows military aircraft with night vision capabilities to detect and avoid the proposed development. Infrared lighting cannot be detected with the naked eye, thereby reducing visual effects.

2.3.24 Each turbine would have a transformer and switchgear. The transformers would be internally contained within the nacelle or tower base. The transformer's function is to raise the generation voltage from approximately 690 volts to the higher transmission level of 33 kV that is required to transport the electricity around the proposed development.

Turbine Foundations and Hardstanding

2.3.25 The wind turbines would be erected on steel reinforced concrete foundations. It is anticipated that the foundations would be of gravity base design however there could be a requirement to use piled foundations where ground conditions dictate. Final base designs would be determined after a full geotechnical evaluation of each turbine location. Figure 2.3 provides an illustration of the construction of a typical wind turbine foundation.

2.3.26 During the erection of the turbines, crane hardstanding areas would be required at each turbine base. Typically, these consist of one main permanent area of 1,350 m² (Figure 2.4) adjacent to the turbine position where the main turbine erection crane would be located. The other areas, totalling 630 m², would be temporary and used to assist turbine erection. The hardstanding would be constructed using the same method as the excavated access tracks. This involves the topsoil being replaced with hardcore to around the original ground level.

2.3.27 After construction operations are complete, the temporary crane hardstanding areas (shown on Figure 2.1) would be reinstated. There would be a requirement to use cranes on occasion during the operational phase of the proposed development and so the main crane hardstanding (1,350 m², as referred to in paragraph 2.3.7) would be retained to ease maintenance activities. This approach complies with best practice guidance[6] which recommends crane hardstandings are left uncovered for the lifetime of the proposed wind farm.

[6] SNH, Scottish Renewables, SEPA, HES, Marine Scotland Science, AEEcOW and the Forestry Commission Scotland Version 4 (2019) "Good Practice during Wind Farm Construction

Substation and Control Building with Battery Energy Storage

2.3.28 The proposed development would be connected to the grid at Thurso South substation at 33 kV (Figure 2.13). In order to transform the 33 kV voltage supplied by the proposed development's array cables, a 33 kV substation would be constructed along with a wind farm control building and ancillary electrical equipment. All of these elements would be contained in a single substation compound area as detailed in (Figures 2.7 and 2.8).

2.3.29 The control building would accommodate metering equipment, switchgear, the central computer system and electrical control panels. A spare parts store room, toilet and wash basin along with a kitchenette would also be located in the control building. The buildings would be staffed by maintenance personnel on a regular basis. This building would measure approximately 32.4 m x 13.9 m x 6.5 m high.

2.3.30 The compound area containing the above described elements would measure 64.5 m x 43 m and would provide staff parking. The compound would be illuminated by downwards pointing passive infra-red (PIR) activated lighting.

2.3.31 There is a preference to source water supply for the building locally where possible. This could be through ground water supply or alternatively it could be sourced from a rain water harvesting system. This would collect rain water from the roof of the control building via a modified drain pipe system and feed into a storage tank either within the roof space of the building or an external buried tank. An overflow from the tank would drain to the outside of the building into a rainwater soakaway.

2.3.32 The storage tank would supply raw / untreated water to the toilet and water via a UV filter to the hand basin. If an extended period of low rainfall occurs, water would be transported to the site in small tanks, as required.

2.3.33 Following an assessment of foul treatment options through a review of Pollution Prevention Guidelines, it was determined that both the toilet, wash hand basin and sink should drain to a small package treatment plant or septic tank located adjacent to the control building, which would follow the Controlled Activities Regulations (CAR) and be constructed and located in accordance with the relevant Building Standards and agreed with the THC.

2.3.34 A permanent external waste and recycling storage area would be required within the Control Building compound. The area would consist of a concrete plinth typically 5.5 m x 4 m surrounded with a palisade fence and double gate.

2.3.35 In order to match on-site energy generation to energy demand, as well as facilitate options such as a reduction in any possible grid constraint requirements, the proposed development also provides for the provision of an energy storage device. Permanent containers, mounted on small concrete pad foundations would house an energy storage device, inverters and other ancillary equipment. The proposed design is a compact and low-key containerised scheme within the compound. For each container there would be a transformer located on the hardstanding.

On-site Electrical Cabling

2.3.36 Assuming the use of the currently available models, each wind turbine would generate electricity at 690 V and would have an ancillary transformer located within the nacelle or the base of the tower to step up the voltage to the on-site distribution voltage of 33 kV. Each turbine would be connected to the substation by underground cable (Figure 2.11). Within the site the cables would be likely to follow the onsite tracks.

2.3.37 The substation and compound locations are shown in Figure 2.1. The substation is described in greater detail below.

Connection to Electricity Grid

2.3.38 A plan showing an indicative corridor of the proposed development's connection to the national grid network is provided in Figure 2.13. The grid connection route to the Thurso South Substation would be by a combination of underground cable and overhead line and would generally follow the most logical route to the substation; however, the final form and route would be subject to a separate application by the relevant network operator (Scottish and Southern Hydro Electric Transmission thereafter referred to as SHET) under the Electricity Act 1989 after further detailed surveys and assessments.

2.3.39 A desk-based assessment of the potential grid connection corridor is presented in Chapter 10: Grid Connection of this ES.

Access Tracks

2.3.40 Typical access track details are shown in Figure 2.5.

2.3.41 The on-site access track layout has been designed to minimise environmental disturbance and land take by wherever possible following a route through shallower areas of peat, areas of slope below 14% and avoiding or minimising areas of identified environmental constraints, as set out in Technical Appendices 2.3: PLHRA and 2.5: Phase 1 & 2 Peat Depth and Coring Report. New tracks are proposed to access the various turbine locations totalling approximately 4.14 km in length. Also, approximately 1.12 km of existing tracks would be widened and utilised to reduce the need for new track construction.

2.3.42 Where the track is required to cross an area of peat and topsoil greater than 1 m thick over an appreciable distance, a 'floating road' construction would be used where practicable. A layer of geotextile reinforcement would be placed directly onto the route of the track. The track would then be built up on the geotextile by laying and compacting stone up to a thickness of approximately 500 mm – 1500 mm, the exact depth being dependent on ground conditions (see Figure 2.5).

2.3.43 The use of 'floating roads' in areas of deep peat eliminates the need for excavation and minimises effects on ecology and disruption to existing water paths and allows for some filtration. Approximately 8% of the on-site tracks may be constructed as floating track.

2.3.44 In areas where the peat and topsoil are consistently less than 1 m thick, the vegetation and soil would typically be stripped to a suitable subsoil layer and the track (approximately 300 mm – 500 mm thick) would be constructed on the subsoil. The upper topsoil layer, together with turf, would be stored separately from the rest of the subsoil in piles adjacent to, or near to the tracks, where appropriate for later reinstatement.

2.3.45 Once the soil has been removed, as described above, to a suitable founding layer, the road and running surface would be constructed by tipping and compacting aggregate to the required shape and thickness. Cross-sections of the final road shape following reinstatement of the roadside slopes by replacing the layers of excavated material in the correct order are presented in Figure 2.5.

2.3.46 The track layout has been carefully designed to use existing tracks and avoid water crossings where possible. The latter is further discussed in the section below.

Watercourse Crossings

2.3.47 One of the main watercourses within the site (as show on a 1:50,000 Ordnance Survey map) will be crossed for the proposed development. This is currently an existing watercourse crossing and may be subject to upgrading works following a structural assessment. Four additional existing culvert crossings on minor watercourses (shown on the 1:25,000 Ordnance Survey mapping) will be utilised and will likely also be subject to upgrading works. The only new watercourse crossings proposed are on two minor channels and drains. These are noted in Technical Appendix 2.5: Hydrological Sensitivities for reference.

2.3.48 It is expected that several smaller unmapped drains throughout the site will require crossings and these would be crossed using simple culverts. An example of the typical watercourse crossing design, which could be applied to some of these smaller unmapped watercourses, is shown in Figure 2.6.

2.3.49 The design would be agreed with SEPA prior to construction and would be dealt with by registration under The Water Environment (Controlled Activities) (Scotland) Regulations 2011(as amended) (CAR) and Water Environment (Miscellaneous) (Scotland) Regulations 2017. The CAR requirements for the watercourse crossings are presented in Technical Appendix 2.5: Hydrological Sensitivities.

2.3.50 Guidance on the size, scale, design and construction of the crossings would be taken from the Construction Industry Research and Information Association (CIRIA) Culvert design and operation guide (C689). The crossings would be designed to ensure that they do not disconnect the watercourses at times of low flow and that they have appropriate flood capacity.

2.3.51 The crossings would be designed to ensure that fish and mammal movement is not restricted (specific mitigation for the safe passage of fish and mammals through culverts is considered within Chapter 5: Non-Avian Ecology).

2.3.52 The hydraulic requirements of all watercourse crossings would be considered and using the following guidance the watercourse crossings would be appropriately sized:

- Flood Estimation Handbook (Statistical Analysis) and Flood Studies Report (FSR) where appropriate used to determine the design flow;
- CIRIA Culvert design and operation guide (C689); and
- Scottish Executive (2002) River Crossings and Migratory Fish: Design Guidance (where appropriate).

2.3.53 Additional factors considered in the design and orientation of watercourse crossings includes:

- Use of clear span crossings in order to avoid disruption to the stream bed where stream bed width is >2 m;
- embedment of closed culverts to allow a natural bed substrate to form;
- crossing direction to generally be perpendicular with access road direction, therefore minimising the length of stream affected;
- consideration of the passage of out-of-bank flood flows;
- provision of mammal (e.g. otter/water vole) passage through the crossing structure in all flow conditions; and
- consideration of any factors or recommendations arising out of a pre-construction habitat survey of the watercourse channel at the crossing location.

Temporary Construction Compound and Temporary Enabling Works Compound

2.3.54 One temporary construction compound measuring 80 m x 50 m (Figure 2.9) would be constructed to provide welfare, offices and laydown facilities across the site. Figure 2.1 indicates a location for the temporary construction compound. In addition to the temporary construction compound one small temporary enabling works compound would be established to control vehicle movements. This compound would measure 30 m x 30 m (Figure 2.10). These compounds would be re-instated following completion of construction.

2.4 Construction Activities

Construction Programme

2.4.1 It is anticipated that the construction of the proposed development would take approximately 12 months.

Hours of Work

2.4.2 It is envisaged that the construction hours of work would be Monday to Saturday 07.00 to 19.00. There would be no working on a Sunday unless previously approved by the planning authority.

2.4.3 Out with these hours, development at the site would be limited to turbine delivery and erection, commissioning, maintenance and pouring of concrete foundations (provided that the Applicant notifies the planning authority of any such works within 24 hours if prior notification is not possible).

2.4.4 In addition, access for security reasons, emergency responses or to undertake any necessary environmental controls would be permitted out with these hours.

Construction Traffic and Plant

2.4.5 In addition to staff transport movements, construction traffic would consist of heavy goods vehicles (HGVs) and abnormal load deliveries.

2.4.6 Chapter 8: Traffic and Transport sets out the expected number of vehicle movements to and from the site each month, taking into account forecast vehicle numbers from construction activities with the highest volume of traffic occurring during month 5 of the 12-month construction period. A detailed Traffic Management Plan (TMP) would be written in consultation with THC prior to construction commencing should consent for the proposed development be granted. This is discussed further in Chapter 8: Traffic and Transport.

2.4.7 Turbine components would be supervised during their transportation using appropriate steerable hydraulic and modular trailer equipment where this is required. Axle loads would be appropriate to the roads and access tracks to be used. The transportation of turbine components would be conducted in agreement with the relevant road authorities and local police. The Applicant would notify the police of the movement of abnormal length (e.g. turbine blade delivery) and abnormal weight (e.g. crane) vehicles and obtain authorisation from the Scottish Government prior to any abnormal vehicle movements.

2.4.8 Police escorts would be used where necessary and the appropriate permits obtained for the transportation of abnormal loads to ensure that other traffic is aware of the presence of large, slow moving vehicles. Where long vehicles would have to use the wrong side of the carriageway or need to swing into the path of oncoming vehicles, a lead warning vehicle would be used, and escort vehicles would drive ahead and stop oncoming traffic. Vehicles would also be marked as long/abnormal loads. For return journeys, the extendible low loaders used for wind turbine delivery would be retracted.

Standard Mitigation and Working Methods during Construction

Construction Environmental Management Plan (CEMP)

2.4.9 The assessment in this ES has been carried out on the basis that standard mitigation measures would be implemented during the construction work, including compliance with both project wide and site-specific environmental management procedures, which would be included in a Construction Environmental Management Plan (CEMP). An Outline CEMP is provided in Technical Appendix 2.1. A detailed CEMP would be agreed with THC and relevant statutory consultees prior to construction commencing. The CEMP would, as a minimum, include details of:

- construction methodologies;
- pollution prevention measures;
- public liaison provision;
- peat slide, erosion and compaction management;
- ecological management;
- archaeological mitigation measures;
- control of contamination/pollution prevention;
- drainage management and SuDS;
- water quality monitoring;
- management of construction traffic;
- control of noise and vibration; and
- control of dust and other emissions to air.

2.4.10 Technical Appendix 2.1 provides a list of generic mitigation measures that would be included in the CEMP and implemented during the construction and decommissioning of the proposed development. It would be a contractual requirement that the appointed contractor complies with the CEMP.

Watercourse Crossings

2.4.11 Technical Appendix 2.5: Hydrological Sensitivities contains details of the watercourse crossings required as part of the proposed development and the proposed crossing type together with the relevant licensing requirements.

2.4.12 Typical watercourse crossings are presented on Figure 2.6 and the final crossing type would be identified as part of the detailed design of the proposed development prior to construction and in line with current best practice guidance[7].

Private Water Supplies (PWS)

2.4.13 A review of Private Water Supplies has been undertaken for the site and 2 km buffer around the site boundary (Technical Appendix 2.5: Hydrological Sensitivities)[8]. The assessment

[7] SEPA (November 2010) Engineering in the water environment: good practice guide, River Crossings, 2nd Edition

[8] Please note that SEPA does not require a hydrological impact assessment therefore this is a statement rather than an impact assessment.

identified 1 PWS within the buffer. The landowner subsequently confirmed the PWS is no longer used and the property is connected to the public mains water supply; it has therefore been scoped out of the assessment. In addition, water quality control measures would be implemented on site through the CEMP (Technical Appendix 2.1).

Peat Management

2.4.14 Technical Appendix 2.2: Draft Peat Management Plan provides a 'stage 1' peat management plan, which outlines the proposed working methods where the excavation of peat would be required and provides further details on potential volumes of peat excavated and the likely requirements for reinstatement. This provides details of the predicted volumes of peat that would be excavated for the proposed development, the characteristics of the peat that would be excavated, and how the excavated peat would be reused and managed. This document would be updated during the detailed design stage and agreed with SEPA prior to construction and would be included in the final version of the CEMP.

2.4.15 Technical Appendix 2.3: PLHRA provides further technical information on the likely risk and hazards associated with peat instability, and the proposed standard mitigation and working methods that would be implemented during construction to seek to avoid adverse effects associated with peat instability. The PLHRA has reviewed the survey data gathered from across the development site and has concluded that peat landslide risks are either low or negligible.

Access Management

2.4.16 Technical Appendix 2.7: Outdoor Access Management Plan sets out the proposals for managing pubic access to the site during the construction phase of the proposed development and for access during the operation of the proposed development.

2.5 Operation Management and Maintenance

2.5.1 Wind turbines and wind farms are designed to operate largely unattended. Each turbine at the proposed development would be fitted with an automatic system designed to supervise and control a number of parameters to ensure proper performance (e.g. start-up, shut-down, rotor direction, blade angles etc.) and to monitor condition (e.g. generator temperature). The control system would automatically shut turbines down should the need arise. Sometimes the turbines would re-start automatically (if the shut-down had been for high winds, or if the grid voltage had fluctuated out of range), but other shut-downs (e.g. generator over temperature) would require investigation and manual restart.

2.5.2 The proposed development itself would have a sophisticated overall Supervisory Control and Data Acquisition system (SCADA) that would continually interrogate each of the turbines and the high voltage (HV) connection. If a fault were to develop which required an operator to intervene then the SCADA system would make contact with duty staff via a mobile messaging system. The supervisory control system can be interrogated remotely. The SCADA system would have a feature to allow a remote operator to shut down one or all of the wind turbines.

2.5.3 An operator would be employed to monitor the turbines, largely through remote routine interrogation of the SCADA system. The operator would also look after the day-to-day logistical supervision of the proposed wind farm and would be on-site intermittently.

2.5.4 Routine maintenance of the turbines would be undertaken approximately twice yearly. This would not involve any large vehicles or machinery.

2.5.5 If a fault should occur, the operator would diagnose the cause. If the repair warranted the proposed development being disconnected from the grid, then the operator would make contact with SHET. However, this is a highly unlikely occurrence as most fault repairs can be rectified without reference to the network utility. If the fault was in the electrical system, then the faulty part or the entire proposed wind farm would be automatically disconnected.

2.5.6 A sign would be placed at the site of the proposed wind farm giving details of emergency contacts. This information would also be made available to the local police station and SHET.

2.6 Residues and Emissions

2.6.1 The EIA Regulations require that the ES provides an estimate, by type and quantity, of expected residues and emissions (such as water, air and soil and subsoil pollution, noise, vibration, light, heat, radiation and quantities and types of waste produced) resulting from the construction and operation of the proposed development.

2.6.2 Table 2.3 provides a summary of the anticipated residues and emissions.

Table 2.3: Residues and Emissions

Topic	**Potential Residue/Emission**
Water	Construction: Surface water runoff and discharges from construction working areas are likely during construction, although overall the quantity of surface runoff would not change overall as a result of the construction work. In addition, occasional and low quantity discharges could arise from pumping, or over-pumping in order to dewater foundation excavations. Pollution sources could arise as a result of soil erosion or from oil/fuel or chemical storage and use. All discharges would be managed in accordance with the Water Environment (Controlled Activities) (Scotland) Regulations 2011, as amended by The Water Environment (Miscellaneous) (Scotland) Regulations 2017. The proposals for water control and management of water quality and quantity from the proposed development are presented in Technical Appendix 2.1: Outline CEMP. Operation: No water emissions or pollution sources have been identified for the operational phase.
Air	Construction: The construction phase would require the transport of people and materials by road, with associated emissions to the atmosphere. There are no air quality management areas within the vicinity of the proposed development. Overall the quantity of air emissions is expected to be low relative to the general background air emissions from road traffic. No significant air emissions are anticipated. Operation: Due to the nature of the proposed development no significant point source or diffuse air emissions would be produced during its operation. The proposed development would contribute to providing renewable electricity, in turn displacing emissions associated with fossil fuel-based electricity generation elsewhere. The construction of the proposed infrastructure, and subsequent operation and decommissioning of the proposed development would include activities that either directly or indirectly result in CO_2 emissions. Technical Appendix 2.6: Carbon Balance Assessment calculates the greenhouse gas emissions and carbon payback times for wind farm developments in Scottish peatlands and concludes that the proposed development would 'pay back' the carbon emissions associated with its construction, operation and decommissioning in 0.9 years, based on best estimate values.
Soil and Subsoil	Construction: Soil and subsoil excavation, handling and storage would be required during construction. All soil and subsoil would be stored temporarily for use in

Table 2.3: Residues and Emissions	
Topic	**Potential Residue/Emission**
	reinstatement, such that there would be no residue (surplus) remaining following the construction work. Further details on peat management are provided in Technical Appendix 2.2. Operation: No requirement for soil or subsoil excavation or handling during the operation phase has been identified. No pollution sources have been identified for the operational phase.
Noise and Vibration	Construction: Noise sources during the construction phase would include increased traffic flows and noise from construction plant. Further details are provided in ES Volume 2: Chapter 9: Noise. Operation: The wind turbines would generate noise during operation, and the noise levels would vary according to the wind speed. The location of residential receptors in relation to the proposed development was a consideration in the design development process and the predicted noise levels are within acceptable limits. Full details of the noise impact assessment are present in Chapter 9: Noise.
Light	Construction: Technical Appendix 2.1: Outline CEMP notes that temporary lighting would be required at the temporary construction compounds for security purposes and to ensure that a safe working environment is provided to construction staff. In addition, temporary lighting could be required to ensure safe working conditions at infrastructure locations during construction. All temporary lighting installations would be downward facing, and all lights would be switched off during daylight hours and out with working hours. Operation: It is proposed to install infrared lighting on the turbines in a pattern that would be acceptable to the Ministry of Defence (MoD) for aviation visibility purposes. The lighting proposed would not be visible to the naked eye. The substation buildings are likely to be equipped with passive infra-red controlled security lighting. These would illuminate the sub-station compound area when activated. Any effect would be temporary and not expected to be significant during normal operation of the proposed development.
Heat and Radiation	No significant sources of heat and radiation have been identified during either the construction or operation phase of the proposed development.
Waste	Construction: Technical Appendix 2.1: Outline CEMP provides details on pollution prevention control and site waste management that would be implemented during construction. A Site Waste Management Plan would be designed to follow the principles of: Avoidance; Minimisation; Separable; Recyclable. Operation: The power generation aspect of the proposed development would not produce any waste emissions or pollutants. The general operation and maintenance of the proposed development has the potential to produce a small amount of waste. This is likely to be restricted to waste associated with the control building from employees and visiting contractors and the storage of oils and lubricants.

2.7 Decommissioning

2.7.1 The expected operational life of the turbines would be 35 years from the date of final commissioning. Towards the end of this period a decision would be made as to whether to refurbish, remove or replace the turbines. If refurbishment or replacement were to be chosen, then relevant applications would be made. If a decision was taken to decommission the proposed development this would require the removal of all the turbine components, transformers, the substation and associated buildings. Cables would be cut away below ground level and sealed. Some of the access tracks could be left on site to ensure the continued benefit of improved site access for the landowner or they could be reinstated. It is not currently usual to remove concrete foundations from the site as this would cause more damage to the environment. The exposed concrete plinth would be removed to a depth of 1 m below the surface and the entire foundation would be graded over with soil and would be replanted if appropriate.

2.7.2 This approach follows SNH Report No. 591 Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms and advice given in former Planning Advice Note: PAN 45 (Revised 2002) (which advises in paragraph 33 that "*Concrete foundations may be best left in place and covered over*") and is retained in the Scottish Government's web-based renewable advice which replaced PAN 45. This approach also follows advice given in the SNH Commissioned Report No. 591, which states that "*noise, ground disturbance, and cost (excavation / breaking / processing / transporting) along with associated carbon emissions, may create a larger environmental impact than leaving such concrete in situ*."

2.7.3 In alkaline or neutral pH ground water conditions, no chemical degradation of the concrete foundation would take place. The concrete mass would remain intact and have no effect on the local soil or groundwater. In soft, acidic groundwater conditions (low dissolved calcium content and high dissolved carbon dioxide content), where the water table is in contact with the concrete mass e.g. peat or marshland, sulphate attack of the concrete would tend to take place. This could cause alkali to leach into the groundwater in contact with the concrete. If this effect occurs, it would be highly localised around the foundations.

2.7.4 However, as discussed in the foundation construction section above, to address this, the concrete mix for the turbine foundations would be designed to withstand sulphate attack and it is therefore likely that the rate of alkali leaching would be low and would not be expected to have a significant effect on the local soil or groundwater conditions.

2.7.5 A draft Decommissioning and Restoration Plan is provided in Technical Appendix 2.1: Outline CEMP. If the proposed development obtains planning permission it is expected that an agreement would be put in place to allow for the establishment of a decommissioning bond or fund, on the basis of the draft Decommissioning and Restoration Plan, to be set aside for when the proposed development is decommissioned after its operational life. Prior to decommissioning of the proposed development, a method statement would be prepared and approved by THC.

2.7.6 Unlike most other forms of electricity production, wind farms are able to be decommissioned with comparative ease. Plant can readily be dismantled and removed from the site. Site restoration is relatively straight forward and after restoration there would be no significant visible trace of prior existence and no legacy of pollution.

3 Design Evolution and Alternatives

3.1 Site Selection Considerations

3.1.1 The site covers an area of approximately 3.58 km^2 and is located approximately 4.5 km northwest of the Thurso (Figure 1.1). The site was chosen for wind farm development for a number of reasons:

- the turbine array can be sited outwith designated areas (such as those designated for nature conservation, landscape or cultural heritage reasons) (Figure 3.1);
- the site is wholly located in Group 3 of Table 1 of Scottish Planning Policy 2014 ('SPP')[1] and of THC's Spatial Framework Plan. Group 3 areas are defined by SPP and THC as "Areas with potential for wind farm development"; and
- there is existing infrastructure in the area which can be utilised by the proposed development such as Thurso South Substation. Due to the presence of this existing infrastructure the proposed development can utilise existing tracks thereby reducing the need for new track.

3.2 Current Land Use and Site Context

3.2.1 The site is gently undulating with the high points located at Hill of Forss. The site can be categorised as open moorland used for the purposes of grazing.

3.2.2 The A836 is located immediately north and runs in parallel to the site boundary (Figure 1.1).

3.2.3 The nearest residential properties are located to the south-east of the site, among a cluster of properties around the hamlet known as Janetstown and immediately north of the site running along the A836. Properties located within the site boundary are within the control of the Applicant.

3.2.4 There are a number of wind farms within 40 km of the proposed development (Figure 4.7). Operational and consented wind farms include Limekiln, Baillie, Forss, Strathy North and Strathy South, Achlachan 1 & 2, Halsary and Bad a Cheo.

3.3 Policy Considerations

3.3.1 The Scottish Planning Policy (SPP) is a key national level document considered. SPP requires planning authorities to define a spatial framework identifying those areas that are likely to be most appropriate for onshore wind farms. The spatial frameworks must be based on the following criteria:

- Group 1: Areas where wind farms will not be acceptable:
  - National Parks and National Scenic Areas.
- Group 2: Areas of significant protection:
  - Recognising the need for significant protection, in these areas wind farms may be appropriate in some circumstances. Further consideration will be required to demonstrate that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation; and

[1] The Scottish Government (2014) Scottish Planning Policy, The Scottish Government, Edinburgh, June 2014 - URL: http://www.gov.scot/Publications/2014/06/5823/6 , accessed 12/09/19

- Group 2 areas include World Heritage Sites; Natura 2000 and Ramsar sites; Sites of Special Scientific Interest; National Nature Reserves; Sites identified in the Inventory of Gardens and Designed Landscapes; Sites identified in the Inventory of Historic Battlefields; areas of wild land as shown on the 2014 SNH map of wild land areas; carbon rich soils, deep peat and priority peatland habitat; and an area not exceeding 2 km around cities, towns and villages identified on the local development plan.

- Group 3: Areas with potential for wind farm development:
  - Beyond groups 1 and 2, wind farms are likely to be acceptable, subject to detailed consideration against identified policy criteria.

3.3.2 The site does not lie within any 'Group 1' areas, or within any national and international designations for ecology, ornithology, cultural heritage or wild land (Group 2 areas). All of the wind farm infrastructure is located within Group 3 as presented on Figure 3.1. The site boundary does extend into a Group 2 area in the southeastern area of the site boundary.

3.3.3 This Group 2 area relates to separation for community amenity in terms of consideration of visual impact. This is defined as an area not exceeding 2 km around cities, towns and villages identified on the local development plan with an identified settlement envelope and edge. As aforementioned, no infrastructure proposed as part of the development is located within this Group 2 area. However, the Applicant has undertaken a Residential Visual Amenity Assessment to assess impacts on the visual amenity of individual properties within 2 km of the proposed developments turbines (ES Volume 4: Technical Appendix 4.8).

3.3.4 At a local level, the key policy is provided within the following documents:

- The statutory development plan for the site comprises the Highland-wide Local Development Plan (the HwLDP) (adopted April 2012)[2];
- Onshore Wind Energy Supplementary Guidance (adopted November 2016)[3]; and
- The Caithness and Sutherland Local Development Plan (adopted August 2018)[4].

3.3.5 This ES does not make any judgements regarding the acceptability of the proposed development. A separate Planning Statement is provided which presents an appraisal of the proposed development with reference to the energy and planning policy framework and relevant material planning considerations.

3.4 Key Issues and Constraints

3.4.1 In addition to the policy considerations identified, key issues and constraints for consideration in the design process were established through a combination of desk-based research, extensive field survey and consultation (through the EIA scoping process). The design process considered the following issues:

- landscape character and visual amenity within a 40 km study area;

2 Highland-wide Local Development Plan (2012), URL: https://www.highland.gov.uk/info/178/local_and_statutory_development_plans/199/highland-wide_local_development_plan, accessed 12/09/19

3 Onshore Wind Energy Supplementary Guidance (November, 2016), URL: (https://www.highland.gov.uk/downloads/file/18793/onshore_wind_energy_supplementary_guidance_november_2016, accessed 12/09/19

4 Caithness and Sutherland Local Development Plan (2018), URL: https://www.highland.gov.uk/info/178/local_and_statutory_development_plans/283/caithness_and_sutherland_local_development_plan accessed 12/09/19

- cultural heritage, including mapping all known assets within the site, and designated assets within a 10 km study area to assess the potential for visibility and setting effects;
- sensitive fauna, with the mapping of the presence of European protected species;
- sensitive habitats, particularly peat forming habitats (supported by habitat and peat probing surveys) and habitats dependent on groundwater;
- ornithology, including surveys for bird flight activity and breeding bird activity on the site;
- cumulative operational noise levels and exposure at nearby properties; and
- hydrology and hydrogeology, including identifying all sensitive surface water features.

3.5 Alternatives

Do-Nothing Alternative

3.5.1 The "do nothing" scenario is a hypothetical alternative conventionally considered in the ES as a basis for comparing the development proposal under consideration. This scenario is considered to represent the current baseline situation as described in the individual chapters of this ES.

3.5.2 In the absence of the proposed development, it is anticipated that the site would continue to be managed as a combination of grazing livestock. These land uses would continue on the site whether or not the proposed development proceeds.

3.5.3 It is recognised that the baseline would not remain static for the lifetime of the proposed development. In particular, and apart from any changes arising from economic and agricultural policies and economic market considerations, it is predicted that biodiversity and landscape would undergo some level of change as a result of climate change. Two publications from the Landscape Institute[5] and Scottish Natural Heritage[6] consider the potential climate change effects on the landscape character. Due to the complexities and uncertainties inherent in attempting to predict the nature and extent of such changes to landscape and biodiversity during the lifetime of the proposed development, it has been assumed that the current baseline would subsist. It is considered that this represents an appropriate approach for ES preparation purposes.

Design Evolution and Alternative Layouts

3.5.4 There have been four principal iterations, which have been developed at different stages in the project design process (Figure 3.2):

- Option A: Hill of Forss Layout;
- Option B: Scoping Layout;
- Option C: Design Freeze Layout; and
- Option D: Design Freeze Layout (Amendment).

5 Landscape Institute (2008) Landscape architecture and the challenge of climate change, Position Statement, London, October 2008 – URL: https://www.landscapeinstitute.org/wp-content/uploads/2016/03/LIClimateChangePositionStatement.pdf

6 Land Use Consultants (2012) An assessment of the impacts of climate change on Scottish landscapes and their contribution to quality of life: Phase 1 – Final Report. Scottish Natural Heritage Commissioned Report 488 – URL: http://www.snh.org.uk/pdfs/publications/commissioned_reports/488_1.pdf

Option A: Hill of Forss Layout (July 2013)

3.5.5 The Hill of Forss Layout resulted in 5 turbines at a maximum tip height of 110 m. An initial baseline landscape and visual appraisal and analysis in respect of design priorities provided a number of locational and design priorities, including:

- Preferential location of the proposed development outwith areas classified as Group 1 or Group 2 on landscape and visual grounds in the 2016 spatial framework for onshore wind energy.
- Location of the proposed development outwith areas subject to landscape designations or classifications, and which is set back from settlements and principal concentrations of receptors.
- Positioning of the proposed development in a landscape that is relatively settled and subject to existing wind farm developments and other large-scale structures, as opposed to one that has a higher degree of naturalness and consequently a higher sensitivity.
- Selection of a location within a landscape of sufficient scale and simplicity to provide for the accommodation of the turbines.
- Location of the proposed development away from distinctive landscape features, the scale and form of which could be compromised.
- Positioning of turbines inland, away from key views of key landmark features and views including the distinctive cliffs and bays of the northern coastline of Caithness, and the land mass of Orkney.
- Positioning of the proposed development to ensure sufficient separation from other nearby wind farm sites to ensure that the proposed development is seen as distinct and separate.
- Preferential use of existing tracks on site to minimise effects associated with this aspect of the proposed development.
- Minimisation of the amount of site infrastructure and ancillary elements, and their careful positioning and design, to ensure that such elements are screened from the majority of external receptor locations.
- Siting of turbines and design of tracks and other infrastructure to avoid direct effects on archaeological remains.
- Careful siting and design of ancillary elements such as the proposed substation and control room along with potential associated energy storage facility to minimise visibility from external receptor locations, especially the A836 corridor.
- Creation of a balanced, coherent array that minimises 'stacking' of turbines in views from key neighbouring receptor locations.
- The site is located within a low priority zone for military low flying exercises.

Option B: Scoping Layout (July 2016)

3.5.6 The Scoping Layout resulted in a major design iteration to both the proposed turbine layout and maximum tip height (Figure 3.2). These changes were introduced as a result of an enlargement of the proposed developable area of the site. The layout increased from 5 turbines to 10 turbines and the tip height increased from 110 m to 125 m.

3.5.7 The key landscape and visual priorities in developing this preferred development were as follows:

- Setting of turbines back from the most visibly prominent slopes of the Hill of Forss, and within the flatter part of the site where turbines would have a more consistent elevation.
- Increasing the distance between the proposed development's turbines and the A836 corridor.
- Maintenance of a maximum distance from individual dwellings and Janetstown properties to avoid overbearing or overwhelming visual effects.

Option C: Design Freeze Layout (March 2019)

3.5.8 Reductions in turbine numbers to 8 machines, with corresponding reductions in necessary infrastructure.

3.5.9 Due to change in the market conditions for onshore wind farms, a larger turbine typology was proposed with the tip height increasing from 125 m to 138.5 m. This change resulted in the need to submit another Proposal of Application Notice and further consultation on the proposed design was held in April 2019.

3.5.10 The reduced number of turbines provided benefits in respect of reduced infrastructure requirements, development footprint and a narrowing of the horizontal extent of the proposed development, with consequent benefits in respect of the visual amenity of the A836 and Janetstown properties.

3.5.11 The changes to the layout resulted in reduced operational noise levels at properties to the southwest of the proposed development. These properties lie between the proposed development and the existing Baillie wind farm such that reductions in operational noise levels from the proposed development lead to reductions in the cumulative operational noise levels at these locations. The changes to the layout also reduce the change in cumulative noise exposure due to the introduction of the proposed development by limiting the range of wind directions from which all properties that are downwind of turbines belong to the proposed development.

3.5.12 With further site investigatory data available by March 2019, the Principal Designer identified an opportunity to utilise and win stone within the site and thereby reducing the need for delivery of construction material to be used in establishment of the proposed development. As the borrow pits were in the south of the site, the most realistic method of construction was to propose to build an enabling compound and build from the south of the site towards T5 and complete the access tracks to the site opening where proposed AILs were to exit the road network and onto site.

Option D: Design Freeze Layout (Amendment) (October 2019)

3.5.13 From the period of the consultation held in April 2019 and October 2019 there was a requirement to make an amendment to the red line boundary which resulted in an overall reduction in the overall area of the proposed development. The layout remains at 8 turbines with a tip height of 138.5 m.

3.5.14 The amendment to the red line boundary also led to the removal of a borrow pit and secondary access to the south.

3.5.15 The hardstanding at T6 was relocated to avoid direct impacts on the watercourse directly east of this turbine.

3.5.16 This layout incorporates bat disturbance buffers from the buildings located at 'Hopefield' and 'Blackheath'. These buildings were identified as having bat roost potential, the layout maintains a minimum 200 m, plus candidate turbine rotor radius, buffer from the buildings, in line with relevant guidance.

3.5.17 In response to consultation feedback, public access and heritage enhancement measures have been incorporated including the installation of noticeboards/information boards and signage, restoration of existing historic sheepfold, use of dry-stone walling and seating, and car parking close to site entrance[7].

Preferred Option

3.5.18 The preferred option which has been taken forward for assessment in this ES is Option D which is presented in Chapter 2: Development Description chapter and presented on Figure 2.1.

3.6 Mitigation by Design

3.6.1 The careful placement of the proposed turbines within the site boundary and the reduction in the number of turbines from 10 to 8 has facilitated effective mitigation, with potentially significant effects avoided or minimised as far as reasonably practicable through the design process. A summary of the potential effects addressed through the design process and the issues remaining following the selection of the final design is provided in Table 3.1 below.

[7] It is proposed that these measures are conditioned and a final design approved by THC following further consultation with the local community and THC

Table 3.1: Mitigation by Design

Topic/Issue	Environmental Constraint/ Potential Effect	Mitigation by Design	Issues Remaining
Landscape and Visual Amenity	Potential significant effects on landscape and visual receptors, including: ▪ Landscape and seascape character; ▪ Landscape designations and classifications (including Special Landscape Areas, Wild Land Areas and National Scenic Areas); ▪ Visual receptors, including: - residents of settlements, - road users; - rail passengers - tourists; and - recreational receptors including cyclists, walkers and hill walkers. Due to the emergent pattern of development, such potential effects were anticipated to include a high proportion of cumulative effects, both in combination and additional effects.	The number of turbines was changed from 5 to 10 and reduced to 8 through the design process and the layout of the remaining turbines was altered to provide the following mitigation: ▪ Placement of turbines within landscape of sufficient scale and simplicity and away from distinctive landscape features the scale and form of which could be compromised; ▪ Positioning of turbines inland, away from key views of key landmark features and views including the distinctive cliffs and bays of the northern coastline of Caithness, and the land mass of Orkney; ▪ Positioning of turbines to ensure sufficient separation from other nearby wind farm sites; ▪ Set-back from the most visible prominent slopes of the Hill of Forss; ▪ Maintenance of a maximum distance from individual dwellings and Janetstown properties; ▪ Minimisation of the amount of site infrastructure and ancillary elements; ▪ Location of ancillary elements to minimise visibility from external receptor locations, especially the A836 corridor; and ▪ Minimising 'stacking' of turbines in views from key neighbouring receptor locations.	ES Volume 2: Chapter 4: Landscape and Visual Amenity provides an assessment of the residual effects of the proposed development on landscape and visual receptors.
Archaeology and Cultural Heritage	▪ Potential direct effects on cultural heritage assets within the site boundary. ▪ Potential effects on the settings of designated heritage assets in the wider landscape. ▪ Cumulative effects on the settings of designated heritage assets in the wider landscape.	▪ Siting of turbines and design of tracks and other infrastructure to avoid direct effects on archaeological remains.	ES Volume 2: Chapter 7: Archaeology and Cultural Heritage provides an assessment of the residual effects of the proposed development on archaeology and cultural heritage assets.

Table 3.1: Mitigation by Design			
Topic/Issue	**Environmental Constraint/ Potential Effect**	**Mitigation by Design**	**Issues Remaining**
Ecology (non-avian)	▪ Potential effects on sensitive habitats through habitat loss, fragmentation and degradation, including peat forming habitats; ▪ Potential effects on protected species e.g. mammals, fish, etc.; ▪ Cumulative effects as arising from the addition of the proposed development in combination with other relevant projects; and ▪ Potential effects on statutory sites within 5 km designated for ecological interests.	▪ With the exception of access track watercourse crossings, the design incorporates a minimum 50 m buffer distance around all major surface watercourses and 25 m buffer off minor watercourses, avoiding direct effects on watercourses; ▪ Direct effects on the minor modified watercourse by turbine 2 will be avoided via diversion of the watercourse and improvement of its hydromorphology; ▪ A buffer of 200 m plus rotor diameter from turbines and 30 m from other infrastructure was maintained for potential bat roost features; ▪ Areas of deep peat have been avoided; ▪ The proposed development incorporates good practice drainage design during construction and operation using a multi-tiered sustainable drainage system (SuDS) approach to control the rate, volume and quality of runoff from the proposed development; and ▪ Turbines and access tracks avoid or minimise effects on sensitive habitats, including peat forming habitats and potential Groundwater Dependent Terrestrial Ecosystems (GWDTEs), as far as possible based on both habitat mapping and peat probing surveys.	ES Volume 2: Chapter 5: Non-Avian Ecology assesses the residual effects on aquatic and terrestrial habitats and protected species. ES Volume 4: Technical Appendix 2.1: Outline CEMP presents the approach to protecting and managing surface water quality and quantity. ES Volume 4: Technical Appendix 2.2: Draft Peat Management Plan and Technical Appendix 2.3: Peat Landslide Hazard and Risk Assessment present the approaches to peat management and handling of peat. The GWDTE assessment is presented in ES Volume 4: Technical Appendix 5.1: National Vegetation Classification & Habitats Survey Report.
Ornithology	▪ Short-term reduction in breeding or wintering bird populations due to construction disturbance (affecting breeding or foraging behaviour and potentially resulting in a reduction in productivity or survival); ▪ Long-term reduction in breeding or wintering bird populations due to the loss/fragmentation of habitat critical for nesting or foraging; ▪ Long-term reduction in breeding or wintering bird populations due to collision mortality;	▪ As a result of the high volume of flight activity recorded below 20 m (mainly by waders and raptors/owls), turbine ground clearance was kept above 20 m (21.5 m, EIAR Volume 4: Technical Appendix 6.1: Ornithology) to minimise the collision risk to these species; and ▪ Areas of suitable goose foraging habitat to the south the proposed development were avoided following the removal of the southern access route and borrow pit.	EIAR Volume 2: Chapter 6: Ornithology assesses the residual effects on birds, including presenting the results of collision risk analysis. EIAR Volume 2: Chapter 6: Ornithology also describes the appropriate steps to be taken to avoid/mitigate impacts on geese, swans and waders. These include the provision of a Breeding Bird Protection Plan (BBPP), appointment

Table 3.1: Mitigation by Design			
Topic/Issue	**Environmental Constraint/ Potential Effect**	**Mitigation by Design**	**Issues Remaining**
	▪ Cumulative/In-combination effects with other projects or activities that are constructed during the same period, and/or with projects or activities which pose either a potential collision risk or loss of habitat by displacement; and ▪ Potential effects on statutory sites within 20 km designated for ornithological interests.		of an Ecological Clerk of Works (ECOW), and proposals to undertake habitat improvement (where possible) for breeding waders.
Traffic and Transport	Potential significant effects on traffic and transport receptors, including cumulative effects of committed development, in regard to: ▪ Severance; ▪ Driver Delay; ▪ Pedestrian Delay and Amenity; ▪ Accidents and Safety; and ▪ Dust and Dirt.	The implementation of a Construction Traffic Management Plan (CTMP) is recommended, though effects of total traffic on receptors are deemed as not significant in accordance with the Institute of Environmental Assessment. Guidelines for the Environmental Assessment of Road Traffic. 1993.	ES Volume 2: Chapter 8: Traffic and Transport provides an assessment of the residual effects of the proposed development on Traffic and Transport.
Noise	Potential for significant effects at nearby residential properties due to operational and construction noise with potential for cumulative impact.	The number of turbines and their position was altered to provide the following mitigation: ▪ Reduce operational noise levels at nearby properties to minimise the amount of noise management required and improve project efficiency; ▪ Reduce cumulative operational noise impacts, particularly with the existing Baillie wind farm, in terms of both noise level and exposure; ▪ Maintain separation distances to nearby properties informed by baseline noise monitoring results whereby background noise levels at some locations are less than others; and ▪ The use of an enabling works compound allows the main construction compound to be located further from nearby properties, reducing construction noise levels.	See residual impact section of ES Volume 2, Chapter 9: Noise.

Table 3.1: Mitigation by Design

Topic/Issue	Environmental Constraint/ Potential Effect	Mitigation by Design	Issues Remaining
Hydrology and Hydrogeology	▪ Potential effects on designated sites due to potential changes in surface and/or groundwater quality and quantity; ▪ Potential effects on the catchments due to changes in surface and/or groundwater quality and quantity; ▪ Potential localised increase in flood risk due to watercourse crossings; ▪ Potential effects on GWDTE through changes to site hydrogeology; ▪ Potential effects on Public or Private Water Supply (PWS) abstractions due to potential changes in surface and/or groundwater quality and quantity; and ▪ Potential for peat slide risk.	▪ With the exception of access track watercourse crossings, the design incorporates a minimum 50 m buffer distance around all major surface watercourses and 25 m buffer off minor watercourses, avoiding direct effects on watercourses; ▪ Potential effects on the surrounding water environment have been minimised by utilising existing infrastructure where possible; ▪ All watercourse crossings would be designed to accommodate a 1 in 200-year return period peak flow; ▪ The number of watercourse crossings has been minimised through the design process, with the location of crossings selected to avoid damage; ▪ Direct effects on the minor modified watercourse by turbine 2 will be avoided via diversion of the watercourse and improvement of its hydromorphology; ▪ The proposed development incorporates good practice drainage design during construction and operation using a multi-tiered sustainable drainage system (SuDS) approach to control the rate, volume and quality of runoff from the proposed development; ▪ The proposed development is outwith any Scottish Water drinking water catchments or water abstraction sources designated as Drinking Water Protected under the Water Framework Directive; ▪ There is a single PWS registered within 2 km of the proposed development, however the property no longer uses the registered well and is connected to the public mains and supplied by Scottish Water; ▪ Peat depth probing was completed across the site. The design process involved avoiding the	As described in ES Volume 4: Techincal Appendix 1.1: Consultation Register, the requirement for a Hydrology chapter has been scoped out. Notwithstanding a number of technical appendices have been prepared to inform hydrological and hydrogeological matters. Potential effects on designated sites are assessed in ES Volume 2: Chapter 5: Non-Avian Ecology. ES Volume 4: Technical Appendix 2.1: Outline CEMP presents the approach to protecting and managing surface water quality and quantity. ES Volume 4: Technical Appendix 2.2: Draft Peat Management Plan presents the approaches to peat management and handling of peat. ES Volume 4: Technical Appendix 2.3: Peat Landslide Hazard and Risk Assessment provides details of the peat instability assessment and the recommended mitigation measures. ES Volume 4: Technical Appendix 2.4: Phase 1 & 2 Peat Depth and Coring Report presents the results of the peat depth and coring surveys used to inform the infrastructure layout. ES Volume 4: Technical Appendix 2.5: Hydrological Sensitivities presents the approach to avoiding or minimising effects on hydrological receptors. The GWDTE assessment is presented in ES Volume 4: Technical Appendix 5.1: National Vegetation

Table 3.1: Mitigation by Design			
Topic/Issue	**Environmental Constraint/ Potential Effect**	**Mitigation by Design**	**Issues Remaining**
		areas of greatest peat depths when siting the infrastructure, insofar as possible, taking account of other environmental constraints (e.g. sensitive habitats, ornithology, landscape and visual receptors etc.). Consequently, areas of deep peat have been avoided; ▪ Turbines and access tracks avoid or minimise effects on sensitive habitats, including peat forming habitats and potential Groundwater Dependent Terrestrial Ecosystems (GWDTEs), as far as possible based on both habitat mapping and peat probing surveys; and ▪ A Peat Landslide Hazard and Risk Assessment has been carried out to assess the potential for peat instability. This assessment concludes that there is a 'low' to 'very low' risk of peat landslide across at the site. Good practice measures are detailed, and these would be included as part of the CEMP.	Classification & Habitats Survey Report. Mitigation to be applied where GWDTE cannot be avoided to allow the flow of water across/through/under the infrastructure as appropriate.
Shadow Flicker	▪ Potential effects of shadow flicker on residential receptors.	▪ The proposed development includes a full Shadow Flicker Assessment to assess the impact. The assessment concludes that with the installation of a shadow flicker management system that all assessed properties would not experience significant residual effects.	ES Volume 2: Technical Appendix 2.8: Shadow Flicker Assessment present the full assessment of Shadow Flicker upon identified properties.

4 Landscape and Visual Amenity

4.1 Introduction

4.1.1 This chapter considers the likely significant effects on the landscape and visual resource of the area arising from the proposed development. The chapter comprises:

- a description of the methodology utilised in completing the assessment;
- a description of the existing landscape and visual baseline context and cumulative context;
- a description of the impacts associated with the type of development proposed and their potential effects on landscape and visual receptors;
- a description of design priorities and any mitigation measures proposed to address likely significant landscape and visual effects; and
- an assessment of residual landscape and visual effects, including cumulative effects taking into account the influence of design responses and mitigation measures.

4.1.2 This chapter is supported by the following technical appendices (TAs) which are presented in ES Volume 4: Technical Appendices:

- TA 4.1: Glossary;
- TA 4.2: Landscape Character Type Descriptions;
- TA 4.3: Designated and Classified Landscapes;
- TA 4.4: Residual Effects on Landscape Character Types;
- TA 4.5: Residual Effects on Designated Landscapes;
- TA 4.6: Wild Land Impact Assessment (WLIA);
- TA 4.7: Viewpoint Assessment;
- TA 4.8: Residential Visual Amenity Assessment; and
- TA 4.9: Statistical Route Analysis.

4.1.3 The chapter is also accompanied by a series of baseline and Zone of Theoretical Visibility drawings (Ref. Figures 4.1 to 4.7r in Volume 3a) as well as the following visualisations which are compliant with SNH's visualisation standards[1], and which are presented within Volume 3b: Figures:

- Figures 4.8Ai to 4.8Aiv-: Viewpoint 1: A836 by Motocross Track;
- Figures 4.8Bi to 4.8Bvi: Viewpoint 2: NCR1/Thurso to Reay Road;
- Figures 4.8Ci to 4.8Cvi: Viewpoint 3: A836, Thurso;
- Figures 4.8Di to 4.8Dvi: Viewpoint 4: St Mary's Chapel, Crosskirk;
- Figures 4.8Ei to 4.8Evi: Viewpoint 5: Kintail Cottage;
- Figures 4.8Fi to 4.8Fvi: Viewpoint 6: A9 South of Thurso;
- Figures 4.8Gi to 4.8Giii: Viewpoint 7: Northlink Ferry (Scrabster to Stromness);
- Figures 4.8Hi to 4.8Hvi: Viewpoint 8: A836 Reay;
- Figures 4.8Ii to 4.8Ivi: Viewpoint 9: Beinn Ratha;
- Figures 4.8Ji to 4.8Jvi: Viewpoint 10: Georgemas Junction Station Figures;

[1] SNH (2017) Visual Representation of Wind Farms - Guidance

- Figures 4.8Ki to 4.8Kvi: Viewpoint 11: Ben Dorrery;
- Figures 4.8Li to 4.8Liv: Viewpoint 12: Dunnet Bay Visitor Centre;
- Figures 4.8Mi to 4.8Mvi: Viewpoint 13: Easter Head Light House car park;
- Figures 4.8Ni to 4.8Nvi: Viewpoint 14: A9 north of Substation;
- Figure 4.8Oi to 4.8Ovi: Viewpoint 15: Loch Watten visitor car park; and
- Figure 4.8Pi to 4.8Piv: Viewpoint 16: Strathy Point.

4.1.4 Visualisation for each viewpoint have also been prepared in accordance with THC's Standards[2], as follows:

- Figure 4.9A to 4.9Aiv: Viewpoint 1: A836 by Motocross Track;
- Figure 4.9.B to 4.9Biv: Viewpoint 2: NCR1/Thurso to Reay Road;
- Figure 4.9C to 4.9Civ: Viewpoint 3: A836, Thurso;
- Figure 4.9D to 4.9Div: Viewpoint 4: St Mary's Chapel, Crosskirk;
- Figure 4.9E to 4.9Eiv: Viewpoint 5: Kintail Cottage;
- Figure 4.9F to 4.9Fiv: Viewpoint 6: A9 South of Thurso;
- Figure 4.9G to 4.9Giv: Northlink Ferry (Scrabster to Stromness);
- Figure 4.9H to 4.9Hiv: Viewpoint 8: A836 Reay;
- Figure 4.9I to 4.9Iiv: Viewpoint 9: Beinn Ratha;
- Figure 4.9J to 4.9Jiv: Viewpoint 10: Georgemas Junction Station A9;
- Figure 4.9K to 4.9Kiv: Viewpoint 11: Public road at Dorrery Farm;
- Figure 4.9L to 4.9Liv: Viewpoint 12: Dunnet Bay Visitor Centre;
- Figure 4.9M to 4.9Miv: Viewpoint 13: Easter Head Light House car park;
- Figure 4.9N to 4.9Niii: Viewpoint 14: A9 north of Substation;
- Figure 4.9O to 4.9Oiv: Viewpoint 15: Loch Watten visitor car park;
- Figure 4.9P to 4.9Piv: Viewpoint 16: Strathy Point.

4.1.5 Figures and technical appendices are referenced in the text where relevant.

[2] THC (2016) Visualisation Standards for Wind Energy Developments

4.2 Assessment Methodology and Significance Criteria

Scope of Assessment

Study Area

4.2.1 The study area for the LVIA comprises a 40 km radius area extending from the outermost turbines of the proposed development. This study area is presented in Figures 4.1 - 4.7s (ES Volume 3a). The extent of the study area is consistent with current SNH guidance, as set out in SNH's guidance on the visual representation of wind farm developments[3].

Scope of Assessment

4.2.2 This chapter assesses the landscape and visual effects of the proposed development as described in Chapter 2: Development Description of the ES. This chapter considers effects on:

- Landscape fabric;
- Landscape character;
- Designated Landscapes and Classified landscapes[4]; and
- Visual amenity.

4.2.3 Effects on landscape fabric occur when there is physical change to components of the landscape such as the landform, land use or land cover. Effects on landscape character arise when there is change to the key characteristics of the landscape and its associated distinct and recognisable pattern of elements. Visual effects are a subset of landscape effects and comprise changes in views of the landscape and the overall effects on visual amenity.

4.2.4 Landscape and visual effects may have effects on cultural heritage facets of the landscape, specifically on the setting of Gardens and Designed Landscapes (GDLs) and on listed buildings and ancient monuments. The landscape and visual assessment (LVIA) considers potential effects on GDLs, whilst effects on other cultural heritage receptors are considered in ES Chapter 5: Archaeology and Cultural Heritage.

4.2.5 Landscape and visual considerations have influenced the design of the proposed development and these are explained in ES Volume 2: Chapter 2: Development Description.

4.2.6 The scope of the assessment has been informed by consultation responses, published guidance and planning policy.

4.2.7 The chapter assesses the potential for additional cumulative effects when considered in addition to other existing operational, consented or proposed wind farm developments. The chapter considers the following cumulative development scenarios:

- Existing and consented developments (constituting the cumulative baseline context); and
- Existing, consented and proposed developments (i.e. baseline cumulative context plus developments subject of a formal registered planning application or an appeal).

4.2.8 The assessment considers both the 'additional' and 'in-combination' cumulative effects.

[3] SNH (2017) Visual Representation of Wind Farm – Guidance Version 2.2

[4] .i.e. non designated landscapes such as Gardens and designed Landscape s and Wild Land Areas

Guidance

4.2.9 The landscape and visual assessment was based on guidelines provided in:

- Guidelines for Landscape and Visual Impact Assessment (GLVIA)[5];
- Landscape Character Assessment[6];
- Techniques for Judging Capacity and Sensitivity[7];
- Siting and Designing Wind Farms in the Landscape[8];
- Assessing Effects on Wild Land[9]; and
- Guidance: Cumulative Effects of Wind Farms[10].

Consultation

4.2.10 Table 4.1, below, summarises the consultation responses received that are of relevance to the preparation of the LVIA and provides information on where and/or how they have been addressed in this assessment.

4.2.11 Full details on the consultation responses can be reviewed in ES Technical Appendix TA1.1: Consultation Register.

Table 4.1: Consultation Responses

Consultee and Date	**Scoping / Other Consultation**	**Issue Raised**	**Response / Action Taken**
The Highland Council (THC) 30th June 2016	Pre-Application Advice	Key sensitivities and constraints that must be taken into account in the preparation of any planning application include: ▪ Landscape and visual impact from the perspective of visitors to the area both travelling along the north coast and visiting the county in general; ▪ landscape and visual impact from the perspective of local residents in the immediate countryside and Thurso. There are a large number of houses in the countryside around the site which could be significantly affected by the development. Within a 2km radius there are approximately 110 properties and within 1km there are approximately 60 properties; and ▪ Dunnet Head Special Landscape Area (SLA) – See	The LVIA addresses the effect of the proposed development on both the seascape/landscape resource and visual amenity of the study area, with due regard to how it is experienced by a range of receptors including residents of local settlements, tourists, road users, rail and ferry passengers, recreational routes. TA4.8: Residential Visual Amenity Assessment addresses the potential effect of the proposed development on the amenity of properties within 2 km of the proposed development. TA4.5: Residual Effects on Landscape Designations discusses the effect of the proposed development on the special qualities of designated landscapes within the agreed study area.

[5] Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidance for Landscape and Visual Impact Assessment – Third Edition.

[6] The Countryside Agency and Scottish Natural Heritage (2002) Landscape Character Assessment.

[7] Scottish Natural Heritage and the Countryside Agency (2002) Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity.

[8] Scottish Natural Heritage (2017) Siting and Designing Wind Farms in the Landscape – Version 3a.

[9] Scottish Natural Heritage (2017) consultation on draft guidance: Assessing impacts on Wild Land Areas – technical guidance consultation on draft guidance: Assessing impacts on Wild Land Areas – technical guidance.

[10] Scottish Natural Heritage (2012) Assessing the Cumulative Impact of Onshore Wind Energy Developments.

Table 4.1: Consultation Responses			
Consultee and Date	**Scoping / Other Consultation**	**Issue Raised**	**Response / Action Taken**
		the SLA citations for further information.	
THC Landscape Officer 30th June 2016	Pre-Application Advice	▪ Methodology for the Assessment: must make clear what thresholds are defined for significance of impact. ▪ Mitigation measures must be clearly identified, and their effectiveness evaluated. This applies to all aspects of the development, including tracks borrowpits, compounds, control buildings, lay-down areas etc. ▪ Visualisations will be required to meet the most recent version of Highland Council Standard, available from the HC Website. ▪ Experience of people as they move around the area ▪ Identification of any key valued views, recognising that these might be. ▪ Views from key locations. ▪ Views to any key features.	Paragraphs 4.2.63 to 6.2.65 set out the threshold for significant effect. Mitigation measures proposed during the construction and operational life of the proposed development are set out in Section 4.5 of this chapter. Standards adopted for production of the visualisations are provided in paragraph 4.2.42. Section 4.6 of the LVIA contains an assessment of key transportation routes as well as recreational routes. Viewpoints utilised in the LVIA were agreed in consultation with THC and SNH. TA4.7: Viewpoint Assessment contain a detailed assessment of the effects on the landscape character and amenity at selected viewpoints, and Section 4.6 provides an assessment of the wider effects on the visual amenity of the study area, including settlements, key transportation routes recreational routes that aren't necessarily represented at selected viewpoints.
SNH 30th June 2016	Pre-Application Advice	All-natural heritage and landscape assessments should follow our published guidance and we would expect the developers to follow the latest guidance, appropriate to the time of the preparation or submission of the ES.	Guidance utilised for the LVIA is set out in paragraph 4.2.9 of this chapter.
THC 8th August 2016	Scoping Response	The consultation response repeats a number of elements of the advice provided in the Pre-Application Advice of June 2016, with the exception of the following specific points: Within NE Caithness, the higher density of the road network means developments are relatively close to one or more public roads. Further west into Sutherland the pattern in relation to roads changes with the landform and emerging development pattern, with larger and taller commercial development being located well back from highways and settlements.	Please refer to responses given in respect of the Pre-Application Advice of June 2016. The matters of sensitivity raised in THCs scoping response of August 2016 are incorporated in the baseline characterisation in Section 4.3.

Table 4.1: Consultation Responses			
Consultee and Date	**Scoping / Other Consultation**	**Issue Raised**	**Response / Action Taken**
		These factors all play into the sensitivity of the location and its susceptibility to change and must be captured in the Baseline studies which will form the basis of the LVIA.	

Legislation and Policy Context

NATIONAL LEGISLATION AND POLICY

4.2.12 A desk study of the relevant national, regional and local planning guidance and landscape planning policy context was carried out and the findings summarised below. Broader policy deliberations are covered in the accompanying Planning Statement.

4.2.13 The Scottish Government's Planning Guidance on renewable developments is set out in the National Planning Framework (NPF3) and in the Scottish Planning Policy (SPP) published in 2014.

4.2.14 Much of the relevant material in the SPP in regard to onshore wind farm development relates to the development of spatial frameworks. Paragraph 161 of the SPP states that:

"*Planning authorities should set out in the development plan a spatial framework identifying those areas that are likely to be most appropriate for onshore wind farms as a guide for developers and communities, following the approach set out below in Table 1 (page 39 of the SPP). Development plans should indicate the minimum scale of onshore wind development that their spatial framework is intended to apply to. Development plans should also set out the criteria that will be considered in deciding all applications for wind farms of different scales - including extensions and re-powering - taking account of the considerations set out at paragraph 169 of the SPP*."

4.2.15 These criteria refer to a number of environmental factors. Those of relevance to the LVIA include:

- cumulative impacts;
- impacts on communities and individual dwellings;
- landscape and visual impacts, including effects on Wild Land;
- impacts on long distance walking and cycle routes and scenic routes identified in NPF3; and
- impacts on tourism and recreation.

4.2.16 The categories proposed for use in spatial frameworks comprise the following:

- Group 1 Areas: Where wind farms will not be acceptable such as in National Parks (NPs) or National Scenic Areas (NSAs).
- Group 2 Areas: Areas designated/classified for their international or national heritage value, outwith National Parks and National Scenic Areas including:
  - National and international designations including (principally those relating to cultural heritage and/or ecological value);
  - Sites included in the inventory of Gardens and Designed Landscapes (GDLs);

- Other nationally important classified landscapes such as Wild Land Areas (WLAs); and
- Community separation for consideration of visual impact (i.e. an area not exceeding 2 km around cities, towns and villages identified on the local plan.

- Group 3 Areas: Areas with potential for wind farm development, subject to detailed consideration against policy criteria.

4.2.17 In addition to matters pertaining to spatial frameworks, the SPP provides guidance on the preparation of development plans. Paragraph 196 of the SPP states that:

"International, national and locally designated areas and sites should be identified and afforded the appropriate level of protection in development plans. Reasons for local designation should be clearly explained and their function and continuing relevance considered when preparing plans. Buffer zones should not be established around areas designated for their natural heritage importance. Plans should set out the factors which will be taken into account in development management. The level of protection given to local designations should not be as high as that given to international or national designations."

4.2.18 The outline of the extent and reason for local designations (Special Landscape Areas) are described in The Highland Councils (THCs) Assessment of Highland Special Landscape Areas.

4.2.19 In respect to non-designated sensitive landscape classifications, paragraph 200 of the SPP states that:

"Wild land character is displayed in some of Scotland's remoter upland, mountain and coastal areas, which are very sensitive to any form of intrusive human activity and have little or no capacity to accept new development. Plans should identify and safeguard the character of areas of wild land as identified on the 2014 SNH map of wild land areas."

4.2.20 The proposed development is not located within a Wild Land Area (WLA). The nearest WLA to the proposed development is the East Halladale Flows (WLA39), which is around 11 km to the southwest of the proposed development. The Causeymire – Knockfin Flows (WLA 36) is located more distantly, at around 20 km to the south of the proposed development, and the Hoy WLA (WLA41) is located around 29 km to the northeast of the proposed development. An assessment of the potential effect of the proposed development on the East Halladale Flows and Causeymire - Knockfin Flows WLAs was undertaken. This was undertaken in accordance with SNH's guidance on assessing impacts on wild land.

4.2.21 Paragraph 202 of the SPP provides guidance regarding the siting and design of wind farms and states that:

"The siting and design of development should take account of local landscape character. Development management decisions should take account of potential effects on landscape and the natural and water environment, including cumulative effects. Developers should seek to minimise adverse impacts through careful planning and design, considering the services that the natural environment is providing and maximising the potential for enhancement."

4.2.22 Paragraph 203 states:

"Planning permission should be refused where the nature or scale of proposed development would have an unacceptable impact on the natural environment. Direct or indirect effects on statutorily protected sites will be an important consideration, but designation does not impose an automatic prohibition on development."

4.2.23 Paragraph 203 goes on to state that:

"Planning authorities should apply the precautionary principle where the impacts of a proposed development on nationally or internationally significant landscape or natural heritage resources are uncertain but there is sound evidence indicating that significant irreversible damage could occur. The precautionary principle should not be used to impede development without justification. If there is any likelihood that significant irreversible damage could occur, modifications to the proposal to eliminate the risk of such damage should be considered. If there is uncertainty, the potential for research, surveys or assessments to remove or reduce uncertainty should be considered."

REGIONAL AND LOCAL POLICY

4.2.24 The proposed development would be wholly located within the Highland Council (THC) administrative area, the relevant planning context for which is contained in:

- Highland Wide Local Development Plan (HwLDP), adopted in April 2012;
- Highland Wide Local Development Plan, Supplementary Guidance (SG): Onshore Wind Energy, November 2016; and
- Highland Wide Local Development Plan, Addendum Supplementary Guidance (ASG): Part 2B, December 2017.

4.2.25 The HwLDP was adopted by THC on 5th April 2012. The Plan sets out the overarching vision, spatial strategy and general planning policies for THC area. Landscape policy of relevance to the proposed development includes:

- Policy 28 Sustainable Design, including provisions regarding residential amenity, design, impacts on landscape resource and designations;
- Policy 57 Natural, Built and Cultural Heritage, including provision for nationally, regionally and locally important landscape and heritage resource, including Wild Land areas;
- Policy 61 Landscape, which covers the design of new development to ensure that they reflect the landscape characteristics and special qualities identified in the Landscape Character Assessment for the area in which they are proposed; and
- Policy 67 Renewable Energy Developments, which relates to the location, siting and design of developments so that they will not be significantly detrimental overall, either individually or cumulatively with other developments.

4.2.26 The SG provides a spatial framework to guide the location of all wind farms through the identification of spatial constraints. In line with SPP, the guidance has identified three 'groups' which set out the requirements for safeguarding with regards to wind energy development. These are:

- Group 1: Areas where wind farms will not be acceptable.
- Group 2: Areas of significant protection; and
- Group 3: Areas with potential for wind farm development.

4.2.27 The proposed development is located across a mixture of landscape identified as Group 2 and Group 3. However, justification of the Group 2 classification at the site concerns the presence of carbon rich soils rather than landscape matters.

4.2.28 Whilst recognising the need for significant protection in areas identified as 'Group 2', the guidance identifies that in certain circumstances, wind farms may be appropriate in these locations and a set of criteria is presented in Table 1 of the guidance. The site is not located within an area designated for its landscape or scenic quality. The site is not located within an area of Wild Land. The closest settlement is Thurso, which is situated around 4.5 km to the southeast of the proposed development

4.2.29 Proposals located within 'Group 3' are likely to be supported, subject to detailed consideration of the relevant policies of the HwLDP.

4.2.30 Section 4 of the guidance sets out how important features and assets identified in HwLDP are expected to be safeguarded in relation to onshore wind energy development. With regards to impacts on the landscape resource and visual amenity, this includes narrative on:

- the siting and design of wind turbines and wind farms; and
- landscape and visual effects.

4.2.31 Criteria are set out as key landscape and visual aspects that the Council will use as a framework and focus for assessing proposals, including discussions with applicants.

4.2.32 The guidance also presents landscape sensitivity appraisals for a number of areas within the Highland administrative area:

- Loch Ness;
- Black Isle, Surrounding Hills and Moray Firth Coast; and
- Caithness.

4.2.33 The proposed development is located in the Caithness area. This LVIA has therefore used the sensitivity appraisals for the Caithness area, insofar as applicable, to the proposed development. Information contained within the Landscape Sensitivity report commissioned by THC to inform the sensitivity appraisals has also informed the LVIA.

Potential Effects Scoped Out

4.2.34 Effects related to the decommissioning of the proposed development were not assessed within the LVIA as such effects are anticipated to be equivalent or possibly less than those expected to occur during its construction.

Method of Baseline Characterisation

Desk Study

4.2.35 Initially, a desk study was undertaken to establish the baseline context of the proposed development, this considered physical components of the landscape (i.e. landscape fabric) as well as the distinctive recognisable patterns of elements that form the landscape character of the area and of designated and classified landscapes. Visual elements and receptors/receptor locations were also identified including settlements, transportation corridors and recreational trails and summits, as well as specific landscape character types and designated areas.

4.2.36 Landscape character types (LCTs) considered in the baseline and subsequent assessment are derived from the following SNH Landscape Character Assessments (LCAs) listed below:

- SNHs 2019 on-line database;
- The Onshore Wind Energy Supplementary Guidance: Draft Landscape Sensitivity Appraisal (OWESG); and
- The assessment of the sensitivity and capacity of the Scottish seascape in relation to windfarms.

4.2.37 The description of landscape designations and classifications contained in the LVIA were derived from the following publications:

- SNH (2010) The Special Qualities of the National Scenic Areas;
- THC (2011) Assessment of Highland Special Landscape Areas (THC, 2011); and
- SNH Wild Land Area descriptions.
- Other datasets utilised in the preparation of the LVIA included:
- Ordnance Survey 1:50,000 and 1: 250,000 mapping;
- Ordnance Survey 50 - 5 m Digital Terrain Model;
- Scottish Landscape Character Assessment data - SNH data sets;
- Gardens and Designed Landscapes - Historic Environment Scotland datasets;
- National Scenic Areas - Scottish Government data sets;
- Special Landscape Areas - The Highland Councils data sets;
- Wild Land Areas - SNH data sets;
- Road network - Meridian 2 data; and
- Cumulative data - THC dataset.

Field Survey

4.2.38 Desktop findings were verified and augmented by targeted field reconnaissance during which all key sensitive receptor locations were visited. During the field reconnaissance draft wireline images, mapping, GIS/GPS data collection systems and augmented reality tools such as *Ventus AR* were utilised to verify theoretical visibility (including cumulative visibility).

4.2.39 Extended, detailed field reconnaissance within Wild Land Areas was undertaken by two Landscape Architects as part of the Wild Land Impact Assessments in ES Volume 2: Technical Appendix 4.6.

Illustrative Materials

4.2.40 The LVIA is illustrated by a range of tools including Zone of Theoretical Visibility (ZTV) plans, photographs, wirelines, and photomontages. All outputs have been prepared in accordance with current best practice comprising:

- SNH (2017) Visual Representation of Wind Farm - Guidance Version 2.2;
- Landscape Institute (2018) Technical Guidance Note - Photography and Photomontage in Landscape and Visual Impact Assessment - Public Consultation Draft; and
- THC (2016) Visualisation Standards for Wind Energy Developments.

4.2.41 ZTVs have been prepared to assist in the identification of areas from where there is potential visibility of the proposed development, illustrated on ES Volume 3a: Figure 4.6a. ZTVs are based on Ordnance Survey (OS) digital terrain data supplied as gridded height data at 50 m interval resolution. This data does not reflect the screening effect of vegetation or built structures and so the visibility shown on the ZTVs is more extensive than actual visibility on the ground. Where the ZTV shows no visibility, it is predicted that no turbines can be seen.

4.2.42 The blade tip ZTV (Figure 4.6a) illustrates the extent of the proposed developments viewshed based on the visibility of turbines from base to maximum blade tip, whilst the blade tip/hub height comparison drawing in Figure 4.6b contains comparison of blade tip visibility and hub height visibility. This makes it possible to identify locations from where the proposed development would be seen as blade tips only and would therefore be less prominent.

4.2.43 In order to establish the cumulative theoretical visibility, ZTVs were prepared for all operational, under construction, consented and application stage wind farm projects within 40 km of the proposed development. The cumulative ZTVs are included in ES Volume 3a: Figures 4.7a to 4.7s.

Assessment of Effects

4.2.44 The aim of the landscape and visual impact assessment is to identify, predict and evaluate potential significant effects arising from the proposed development. Wherever possible, identified effects are quantified, but the nature of landscape and visual assessment requires interpretation by professional judgement. In order to provide a level of consistency to the assessment, landscape sensitivity to change, the prediction of magnitude of impact and assessment of significance of the residual effects has been based on pre-defined criteria, the level of effects being determined by a comparison of the sensitivity of receptors and the magnitude of impact arising from the proposed development.

4.2.45 In order to assist in evaluating the potential landscape and visual effects arising from the proposed development, ZTVs were generated to identify the potential extent of visibility of the proposed development over the study area (ES Volume 3: Figure 4.6a and 4.6b). An assessment of the predicted visibility of the proposed development from each of the landscape character types, designated and sensitive non-designated landscapes in the study area has been carried out by analysing the ZTVs and verifying the findings during field reconnaissance. The visibility assessment has concentrated on the publicly accessible areas including outdoor recreational areas, cycle routes, roads, and the public footpath network.

4.2.46 Mitigation measures which have been incorporated into the final design and layout of the proposed development are described, together with a summary of the design optimisation process carried out in parallel with the LVIA. Further details of the constraints which were identified, and the design process are described in: Chapter 2: Development Description of the ES.

4.2.47 Representative viewpoints were chosen in consultation with THC, SNH and non-statutory consultees in respect of this application. These viewpoints are considered to be representative of the main sensitive receptors in the study area. The viewpoints have also been checked against the cumulative ZTVs for existing/consented and proposed developments within the study area in order to ensure that they provide representative coverage of potential cumulative visibility and related effects. Viewpoint locations are detailed in ES Volume 2: Technical Appendix 4.7 and are included in ES Volume 3a: Figures 4.7a to 4.7s.

4.2.48 Analysis of the potential effects on landscape and visual amenity arising from the proposed development at each of these viewpoints has been carried out. This analysis has involved the production of computer-generated wirelines and/or photomontages to predict the operational views of the proposed development from each of the agreed viewpoints. The existing and predicted views from each of these viewpoints have been analysed to identify the magnitude of impact and the residual effects on landscape character and visual amenity at each viewpoint location.

Criteria for Assessing the Sensitivity of Receptors

4.2.49 The sensitivity of the landscape to change is defined as high, medium or low based on professional interpretation of a combination of its susceptibility to change associated with the type of development proposed, and the value attributed to the landscape. The following parameters were therefore applied in determining the susceptibility of the landscapes within the study area:

- Landscape quality;
- Existing land-use;
- The pattern and scale of the landscape;
- Visual enclosure/openness of views and distribution of visual receptors;
- The scope for mitigation, which would be in character with the existing landscape; and
- The degree to which the particular element or characteristic contribution to the landscape character and can be replaced or substituted.

4.2.50 In determining value, the LVIA uses, as its primary indicator, formal landscape designations. Where other clearly defined indicators were identified, these have also been referred to.

4.2.51 Visual receptor sensitivity is also defined as high, medium or low based on an interpretation of a combination of parameters, and also relates to the susceptibility and value ascribed to visual receptors or receptor locations. The following criteria were utilised in determining viewpoint sensitivity:

- The land use or main activity at the viewpoint/receptor location;
- The frequency and duration of use of receptor location; and
- The landscape character and quality of the intervening landscape.

4.2.52 In relation to land use at the viewpoint, visual sensitivity is defined in Table 4.2, below.

Table 4.2: Sensitivity in Relation to Receptor Type and Activity

Sensitivity	Receptor Type and Sensitivity
High	▪ Tourists and those engaged in outdoor recreational activities for which the landscape and views form a key part of their experience, including hill walkers and visitors to formal vantage points, ▪ Passengers and Tourist travelling on key routes; ▪ Passengers on trains and ferries where visual amenity and scenic qualities form an integral part of receptors experience and expectations; ▪ Walkers on strategic recreational footpaths or on hills, cycle routes or rights of way; ▪ Visitors to landscapes/sites that have a strong physical, cultural or historic connection with the landscape or a particular view; and ▪ Residential receptors at individual dwellings and within settlements.
Medium	▪ Local road users/commuters whose are generally travelling alone and/or are focused on the road rather than the adjoining landscape.
Low	▪ People engaged in outdoor sports or recreation (other than appreciation of the landscape); and ▪ Receptors located in commercial and retail buildings, industrial complexes, and other locations where people's attention may be focused on their work or activity.

Criteria for Assessing the Magnitude of Change

4.2.53 The magnitude of impact arising from the proposed development may be described as Substantial, Moderate, Slight, Negligible or None based on the interpretation of a combination of largely quantifiable parameters, as follows:

- The distance of receptors from the proposed development;
- The duration of the predicted change and whether it is reversible;
- The size and scale of the change anticipated;
- The geographical extent of the study area, landscape character unit, designation or route that would be affected;

- The angle of view in relation to main receptor activity;
- The degree of contrast represented by the proposed development in the context of the baseline landscape or view;
- The background context to the proposed development; and
- The extent and nature of other built development visible, including vertical elements.

4.2.54 The assessment of effects at viewpoints in ES Volume 2: Technical Appendix 4.7 quantifies the horizontal angle occupied by the proposed development in each view.

4.2.55 Table 4.3, below, provides a brief definition for different magnitudes of impact.

Table 4.3: Magnitude of Impact	
Magnitude	**Definition**
Substantial	Total loss or considerable alteration/interruption of key elements, features or characteristics of the landscape character and/or composition of views resulting in a substantial change to baseline conditions.
Moderate	Notable partial loss or alteration to one or more key features or characteristics of the baseline, resulting in a prominent, but localised change within a broader unaltered context.
Slight	Discernible loss or alteration to one or more key elements, features or characteristics of the baseline conditions. Change arising from the loss/alteration would be discernible but underlying landscape character or view composition would be broadly consistent with baseline.
Negligible	Very limited or imperceptible loss or alteration to one or more key elements/characteristics of the baseline. Change may be barely discernible.
None	No aspect of the proposed development would be discernible. The proposed development would result in no appreciable change to the landscape resource or view.

Criteria for Assessing Cumulative Effects

4.2.56 Table 4.4, below, provides a brief definition for different magnitudes of cumulative impact.

Table 4.4: Magnitude of Cumulative Impacts	
Magnitude	**Definition**
Substantial	The proposed development would represent a considerable or possibly fundamental increase in the influence of wind energy development on the character of the landscape and/or the composition of views.
Moderate	The proposed development would represent a notable and possibly considerable increase in the influence of wind energy development on the character of the landscape and/or the composition of views. Moderate cumulative impacts may, however, equate to a localised change within an otherwise unaltered context.
Slight	The proposed development would represent a minor addition to the influence of wind energy development on the character of the landscape and/or the composition of views. The change would be discernible, but the original baseline conditions would be largely unaltered.
Negligible	The proposed development would represent a barely discernible addition to influence of wind energy development on the character of the landscape and/or the composition of views. The baseline condition of the landscape or view would, for all intents and purposes, be unaffected.
None	No other cumulative development would be apparent.

4.2.57 In assessing potential cumulative landscape and visual effects, consideration has been given to cumulative effects arising from combined and/ or consecutive (concurrent) visibility (where the observer is able to see two or more developments from one viewpoint location), and sequential effects (where a number of similar developments would be visible individually or simultaneously over a sequence of connected viewpoints, such as would be found along a road or footpath). This is in accordance with current SNH guidance.

4.2.58 Consideration has also been given to the additional effects attributable specifically to the proposed development, as well as its 'in combination' effect, where the combined effect of the proposed development and other cumulative schemes are taken into account.

4.2.59 In accordance with current SNH and Scottish Government policy, projects which are at scoping stage have not been included in the detailed assessment as they may undergo substantial change before a formal planning application is submitted and may not progress to an application at all. The final list of cumulative developments for consideration was derived from THCs online data base (ES Volume 3: Figure 4.7), and is summarised in Table 4.5, below. In order to ensure the LVIA is proportionate and to limit cumulative considerations to developments that are most likely to contribute to significant in-combination or additional effects, turbines less than 50 m to maximum blade tip height above ground level have been omitted from the assessment.

Criteria for Assessing Significance

4.2.60 Table 4.5 below, illustrates how residual effects are determined by comparison of the sensitivity of receptors with the magnitude of predicted change. For the purposes of this assessment significant landscape or visual effects are **Major** or **Major/Moderate**.

Table 4.5: Residual Effects

	Magnitude of Impact				
Landscape and Visual Sensitivity	Substantial	Moderate	Slight	Negligible	None
High	Major	Major/Moderate	Moderate	Moderate/ Minor	None
Medium	Major/Moderate	Moderate	Moderate/Minor	Minor	None
Low	Moderate	Moderate/Minor	Minor	Minor/None	None

4.2.61 In line with the recommendations in the GLVIA the matrix is not used as a prescriptive tool or arithmetically, and the methodology and analysis of potential effects at any particular location must allow for the exercise of professional judgement. Descriptions of residual effects, especially those considered significant, are described in narrative text.

4.2.62 Landscape and visual effects can be adverse (i.e. having a detrimental effect on the physical elements, character and visual amenity of the area) or beneficial (i.e. having a positive effect on the landscape and visual amenity of the area through strengthening or augmentation of baseline conditions and/or improvement of the existing landscape or views). For the purposes of this assessment residual effects are assumed to be adverse, unless stated otherwise.

Limitations and Assumptions

4.2.63 The LVIA has been prepared in accordance with current standards and guidance. Commercially obtained data utilised in the preparation of the LVIA has a number of inherent tolerances and limitations. Where this is relevant to the findings of the assessment it is stated.

Data

4.2.64 The data utilised in completion of the LVIA has a number of inherent limitations related to data tolerances and levels of accuracy. However, these have been taken into account in the assessment.

Measurement

4.2.65 Unless stated otherwise, all measurements pertaining to the distance of receptors from the proposed development are based upon the nearest turbine rather than the nearest visible turbine or any other ancillary element of the proposed development. Where measurements pertain to Landscape Character Types (LCTs), designations and classifications, the measurement given relates to the nearest section of the LCT or designated/classified area boundary to the proposed development turbines, which may not be subject to potential views of the proposed development. This is important because effects experienced within such areas may occur at a considerably greater distance, with corresponding consequences for the level of residual effect.

4.3 Baseline Conditions

Current Baseline

Topography and Hydrology

4.3.1 Figure 4.1 depicts the topographical levels and form of the landscape within the site and in the wider study area.

4.3.2 The proposed development would be located within an undulating lowland that varies in elevation between sea level and up to 144 m AOD, the highest points comprising low hills and ridges. The proposed development would be located on one such ridge which is orientated northeast to southwest. With the exception of a small number of bays such as Dunnet Bay and Sandside Bay, the coast is marked by steep cliff exposures that form an abrupt edge to the coast.

4.3.3 Further inland to the south-west and south, the landscape rises to form a series of sweeping moorlands at elevations of up to 180 m AOD, but with high summits and individual hills of up to 290 m OAD.

Land use

4.3.4 Figure 4.2 illustrates the general land uses within the study area based on published Corine data.

4.3.5 Land use in the study area is characterised by a distinct contract between the agricultural lowlands which also contain the principal areas of settlement, transportation corridors as well as power infrastructure, and the largely undeveloped uplands that play host to peatlands and moorland, interspersed with large scale coniferous forests

Landscape Designations

4.3.6 Figure 4.4. identifies landscape designations in the study area that indicate particular value based on specific qualities or characteristics and are assumed to have a high sensitivity, unless otherwise stated.

4.3.7 The application site is not subject to any landscape designation. However, there are a number of national and local designations present within the wider study area including the following:

- Hoy and West Mainland National Scenic Area (NSA), which is situated around 29 km to the north-northeast of the proposed development.
- Dunnet Head Special Landscape Area (SLA) which is located 11.5 km to the east-northeast of the proposed development.
- Farr Bay, Strathy and Portskerra SLA, which is situated approximately 18.2 km to the west of the proposed development.
- The Flow Country and Berriedale Coast SLA, which is situated approximately 21.1 km to the south of the proposed development.
- Duncansby Head SLA, which is situated approximately 32 km to the east of the proposed development.
- Bens Griam and Loch nan Clar SLA, which is 32.7 km to the southwest of the proposed development.

Landscape Classifications

4.3.8 Whilst not formally designated, there are a number of landscapes that have been identified as having particular value in the context of either the natural and/or cultural heritage and are therefore considered to have high sensitivity.

4.3.9 Scottish Natural Heritage identified Search Areas for Wild Land (SAWL) in 2002. These were considered to be where the most significant and valued areas of wild land would be found. This initial mapping was acknowledged as preliminary and incomplete. In 2013 SNH published a revised map for consultation which identifies a series of Core Areas of Wild Land (CAWLs). In June 2014 a new map of Wild Land Areas (WLA) was created which replaces the CAWL 2013 map. The new map identifies 42 wild land areas (19.5% of Scotland). In comparison with the CAWL 2013 map this combines two areas into one, divides one area into two, sets aside two areas and adds one new area. It also modifies the extent of a number of areas. This latest iteration of the wild land mapping changed its nomenclature to Wild Land Areas (hereafter referred to as WLAs).

4.3.10 Within the study area the WLAs predicted to provide views of the proposed development include:

- the East Halladale Flows WLA, which is situated over 11 km to the southwest of the proposed development;
- the Causeymire – Knockfin Flows WLA, situated over 20 km to the south of the proposed development; and
- the Hoy WLA which is situated around 29 km northeast of the proposed development.

4.3.11 Technical appendix TA4.6: Wild Land Impact Assessment provides a summary of the key wild land aspects for these WLAs as well as assessing susceptibility and sensitivity of the WLAs to the type of development proposed and the residual effect of the proposed development. The assessment addresses effects on the East Halladale Flows and the Causeymire- Knockfin Flows WLAs.

4.3.12 In addition to areas of Wild Land, the study area contains three potential receptor sites classified as Gardens and Designed Landscapes (GDLs). These are landscapes which have been devised and developed for artistic effect. The most common type of site on the Inventory is the estate landscape i.e. the policies associated with an important house or castle, developed by country landowners for both pleasure and productive purposes. Other types include botanic garden collections, urban parks, small plantsman's gardens and even some cemeteries.

4.3.13 Inventory sites usually have a combination of different features such as built structures, planting, open grounds, landforming, water management, archaeological remains and natural landscape features, all of which may contribute to the value of a site. Some of these elements may be important enough to be designated in their own right by Historic Scotland as listed buildings or scheduled monuments, or by Scottish Natural Heritage for their scientific or nature conservation value. Sites are included in the inventory of GDLs on the basis of their:

- value as an individual work of art;
- historic value;
- horticultural, arboricultural and silvicultural value;
- architectural value;
- scenic value;
- nature conservation value; and
- archaeological value.

4.3.14 There are only two GDLs within the study area with theoretical visibility of the proposed development:

- Castle of Mey (Barrogill Castle) GDL: Early 19th century parkland, woodland, formal gardens and walled gardens set around a category A listed castle situated approximately 8 km west of John O'Groats on the north coast of Scotland, over 22.5 km to the east-northeast of the proposed development; and
- Melsetter House GDL: An early 20th century Arts and Crafts style garden and landscape set around a category A listed house. This GDL is situated approximately 28.8 km northeast of the proposed development on the island of Hoy.

4.3.15 Both GDLs are located distantly from the proposed development and therefore unlikely to be subject to significant effects. Moreover, field reconnaissance suggests that a principal focus of the Castle of Mey is seaward views across Wester Haven bay, whilst views towards the proposed development from the ground floor of the Castle would be restricted by a combination of intervening topography and intervening garden walls around the gardens and vegetation adjoining the access road leading to the Castle. Similarly, Melsetter House is oriented towards the Pentland Firth, but is enclosed by a combination of a garden wall and substantial mature woodland that restricts views towards the proposed development. On this basis, neither GDL has been considered further in this assessment.

Landscape Character Types

4.3.16 The location and extent of Landscape character types within the study area are indicated in Figure 4.3a, and the extent of the proposed developments visibility from each LCT is indicated in Figure 4.3b.

4.3.17 Landscape character types (LCTs) which would provide theoretical visibility of the proposed development, based on SNH's character assessments, are listed in Technical Appendix TA4.2 along with a description of their key characteristics and sensitivity to the type of development proposed.

Cumulative Context

4.3.18 Table 4.6, below, lists the existing/operational, consented and proposed (i.e. at application) wind farms located within the study area which have been included in the cumulative assessment. Existing and consented wind farms are taken to form the cumulative baseline as well as forming part of the broader basis for the cumulative assessment that also considers proposed turbines. The cumulative assessment also takes cognisance of non-wind farm development that forms an important aspect of the baseline within the study area such as the Dounreay Power Station and grid infrastructure and the large-scale prominent buildings of JCG Engineering.

Table 4.6: Cumulative Wind Farms

Wind Farm	**Approx. Distance and Direction from the proposed development**	**No. of Turbines**	**Size of Turbines - Maximum height to blade tip (m)**
Existing/Operational Wind Farms			
Achairn	29 km SE	3	100
Achlachan	18 km SSE	5	115
Bad a Cheo	20 km SSE	13	112
Baillie	3 km WSW	21	115
Bettyhill	32 km WSW	2	119
Bilbster	26 km SE	3	93
Buolfruich	33 km SE	15	75
Burn of Whilk	34 km SE	9	116
Camster	26 km SE	25	100
Causeymire	19 km SSE	21	101
Forss 1	4 km W	2	76
Forss 2	4 km W	4	78
Lochend	20 km E	4	99.5
Strathy North	25.5 km WSW	33	110
Stroupster	27 km E	13	110
Taigh Na Muir Dunnet	20 km ENE	1	79.6
Wathegar	27 km SE	5	100
Wathegar 2	28 km SE	9	110
Weydale Farm	8 km ESE	1	66
Consented Wind Farms			
Achlachan 2	18 km SSE	3	110
Berriedale and Dunbeath	37 km SSE	3	74

Table 4.6: Cumulative Wind Farms			
Wind Farm	**Approx. Distance and Direction from the proposed development**	**No. of Turbines**	**Size of Turbines - Maximum height to blade tip (m)**
Cogle Moss	24 km ESE	12	100
Dounreay Tri	15 km W	2	201
Halsary Wind Farm	20 km SE	15	120
Limekiln	9.2 km SW	24	139
Lybster Road Forss	3 km W	1	79
Osclay Quarry	34 km SSE	1	80
Rumster Community	30.5 km SSE	3	75
Strathy South	29 km WSW	39	135
Hill of Lybster	3 km W	1	99.5
Proposed Wind Farms			
Camster II	27 km SE	11	126.5
Drum Hollistan 2	13 km WSW	7	125
Golticlay Wind Farm	30 km SSE	19	130
Limekiln Extension	8.5 km SW	7	149.9
Slickly Wind Farm	25 km E	11	150
Strathy Wood	25 km WSW	16	145
Tacher A Wind Turbine	23 km SSE	1	150
Tacher B Wind Turbines	23.5 km SSE	1	150

4.3.19 Figure 4.7: Cumulative Context, shows the location of each of the cumulative schemes.

4.3.20 The main concentrations of development are located in the Sweeping Moorland and Flows and Farmed Lowland Plain landscapes (LCTs 134 and 143, respectively). Within the Sweeping Moorland Flows landscape development is situated close to the edge of the LCT and with the exception of Achlachan, Causeymire, Halsary and Bad a Cheo turbines, set within 6 km of the coast. Within the Farmed Lowland Plains, wind energy development is focused west of Wick and forms a concentration of turbines in this location, as well as on the northern coast between Sandside Bay and Thurso (e.g. Baille Forss, Hill of Lybster and Lybster Road Forss schemes). Whilst Forss, Hill of Lybster and Lybster Road Forss turbines are positioned on or immediately adjacent to the coastal edge Baille is positioned around 2.8 km inland and is situated on a low undulating ridge at between 70 and 110 m AOD. The proposed development would also be positioned on a low ridge of between 110 and 144 m AOD and located around 2 km inland, south of the A838, in keeping with the majority of nearby cumulative wind farm sites.

4.3.21 It is apparent from the details of turbine size and geometry that there has been a gradual trend toward larger turbines, with machines of over 110 m to maximum blade tip not unusual, even within the Farmed Lowland Plain. It is also clear from the currently proposed development such as Camster II, Golticlay and Strathy Wood that developers are favouring even larger turbine geometries in keeping with contemporary turbine design and supply.

4.3.22 There appears little by way of regular spacings between developments, but a separation of between 3 and 5 km is not uncommon, for example:

- Forss/Lybster cluster and Baille Wind Farm (around 3 km separation);
- Lochend and Stroupster wind farms (around 5 km separation);
- Cogle Wind Farm and the Bilbster/Camster cluster of development (around 4 km separation);
- Camster and Burn of Whilk wind farms (approximately 4 km separation).

4.3.23 It is apparent from the details of turbine size and geometry that there has been a gradual trend toward larger turbines, with machines of over 110 m to maximum blade tip not unusual, even within the Farmed Lowland Plain. It is also clear from the currently proposed development such as Camster II, Golticlay and Strathy Wood that developers are favouring even larger turbines in order to achieve subsidy free development. The changing size of turbines will inevitably lead to some disparity between newer and older developments, some of which are located in close proximity to each other (e.g. the Achlachan, Causeymire, Bad a Cheo, Limekiln and Halsary cluster of developments).

Settlement

4.3.24 Settlement in the study are is concentrated, for the most part, within the Farmed Lowland Plain that forms the coastal landscape at the northeastern and eastern extents of Caithness. However, elsewhere, there are numerous crofting properties and farmsteads scattered across the landscape. Those settlements subject to theoretical visibility of the proposed development include:

- Thurso: At its closest to the proposed development, is located approximately 3.3 km to the east of the proposed development, at the mouth of the River Thurso and the confluence of the A9, A836 and B874;
- Reay: A village situated approximately 9.2 km to the west-southwest of the proposed development on the A836;
- Castletown: A village situated 11.7 km to the east of the proposed development, on the southern end of Dunnet Bay, on the junction of the A836 and the B876;
- Dunnet: A village situated approximately 15.2 km east-northeast of the proposed development, on the junction of the A836 and the B855;
- Portskerra: A village situated approximately 18.4 km west-south-west of the proposed development, on a minor road off the A836; and
- Wick: Situated approximately 33.5 km to the southwest of the proposed development, at the mouth of the Wick River and the junction of the A99 and the A882.

4.3.25 For the purposes of this assessment receptors within these settlements are assumed to have a high sensitivity, unless stated otherwise.

4.3.26 The area also contains a number of scattered dwellings and farmsteads. Matters pertaining to the residential visual amenity of these properties are dealt with in TA4.8.

Transport Routes

4.3.27 The majority of transportation routes are located along the coast or within the eastern part of the study area. Those that would experience potential visibility of the proposed development are indicated in Figure 4.5 and include:

- The A9: This is a major route connecting Thurso to Inverness and the central belt of Scotland beyond. The route extends southwards from Scrabster on the coast, through Thurso to Latheron and the junction of The A99 just outside the study area to the south. At its closest, this route is situated approximately 3.3 km east of the proposed development.
- The A99: This route connects John O'Groats with the A9 to the south of the study area, roughly following the coast from the point that the A9 heads inland. The route passes through the settlement of Wick. At its closest, this route passes 28 km to the southwest of the proposed development.
- The A836: This route runs roughly east-west through the study area starting from John O'Groats in the east and leaving the study area next to Bettyhill in the west. It follows the northern coast of Scotland and forms part of the North and West Highlands National Tourist Route. At its closest is situated approximately 1 km to the north of the proposed developments turbines. This route forms part of the promoted North Coast 500 Route.
- The A882: This is a relatively short route which connects the A99 from Wick with the A9 to the northwest. At its closest this route is located approximately 12 km to the southeast of the proposed development.
- The B855: This is a short route which extends northwards from the A836 at Dunnet to Dunnet Head, the most northerly point of mainland of Great Britain. At its closest, this route is situated 15.3 km to the east-northeast of the proposed development.
- The B870: This route begins at a junction with the B874 at Glengolly to the south of Thurso, from which it heads south for 14 km before turning east to Watten. From Watten it heads northeast for a short length to finish at a junction with the B876. At its closest, this route is situated around 4.3 km to the southeast of the proposed development.
- The B874: This route starts at a junction with the A9 in the centre of Thurso, from which it heads roughly southwards to the settlement of Halkirk. From here it heads northeast for approximately 4 km before turning to head southeast to join the A99 next to Wick Airport.
- The B876: is a link road between the A99 at Reiss on the east coast and the A836 at Castletown on the north coast. At its closest it is approximately 12.8 km to the east of the proposed development.
- The B9047: This route in the main road on the islands of Hoy and South Walls and follows the north coast of South Walls before crossing over The Ayre causeway to follow the east coast of the Hoy. At its closest, this route is approximately 29 km to the northeast of the proposed development.
- The Far North railway: This route enters the study area in the southwest adjacent to the A897 and heads northwards to Forsinard before heading northeast to the Georgemas Junction, east of Halkirk. From here a spur heads northwards to connect to Thurso, whilst the main route turns southeast reaching the end of the line at Wick. At its closest, this route is located approximately 4.5 km east of the proposed development.

- Orkney Ferry - Stromness to Thurso – which, at its closest passes within 3.5 km of the proposed development where it moors at Scrabster.
- Stromness Ferry Alt Route - Stromness to Thurso – which, at its closest passes within 3.5 km of the proposed development where it moors at Scrabster.

4.3.28 For the purposes of this assessment tourists and passengers utilising road, rail or ferry routes are considered to have a high sensitivity, whilst general road users are considered to have a medium sensitivity as they are more likely to be travelling alone and therefore concentrating on road conditions rather than the landscape.

Recreational Routes/ Access

4.3.29 In addition to the road, rail and ferry routes described above, there is one long range recreational route that is anticipated to provide theoretical views of the proposed development, that of National Cycle Route 1 (NCR1). This cycleway links Dover and the Shetland Islands, mainly via the east coast of England and Scotland. It enters the study area in the west and follows the coast eastwards, to Thurso and thereafter finishing at John O'Groats. For much of the route in the west of the study area it follows the A836, before taking to a number of minor roads on the east of the study area. At its closest, this route is situated 3.2 km to the south of the proposed development.

4.3.30 Locally there are a number of short core paths which are identified within the Highland Core Paths Plan adopted 2011. Those within 10 km of the proposed development comprise:

- Core Path CA06.06 - Water Access by Loch Calder (Route reference 1 and 2 in Figure 4.5);
- Core Path CA09.01 - Westfield to Achnavast (Route 4 in Figure 4.5);
- Core Path CA09.02 - Achscrabster quarries (Route 5 in Figure 4.5);
- Core Path CA11.01 - Broubster Forest (Routes 6 and 7 in Figure 4.5);
- Core Path CA11.02 - Achvarasdal Woodland (Route 8 in Figure 4.5);
- Core Path CA11.03 - Limekiln Forest (Route 9 in Figure 4.5);
- Core Path CA11.06 - Reay Roadside Link (Route 10 in Figure 4.5);
- Core Path CA11.07 - Reay Golf Course via Mary's Cottage (Route 11 in Figure 4.5);
- Core Path CA11.08 - Reay Golf Course via Clubhouse (Route 12 in Figure 4.5);
- Core Path CA11.09 - Borlum Circuit (Route 13 in Figure 45.5);
- Core Path CA11.10 - Achvarasdal East Drive (Route 14 in Figure 45.5);
- Core Path CA13.01 - Thurso Riverside (The Mall) (Route 15 in Figure 4,5);
- Core Path CA13.02 - Victoria walk (Route 16 in Figure 4.5);
- Core Path CA13.03 - Braes of Scrabster (Bishop's Walk) (Route 17 in Figure 4.5);
- Core Path CA13.04 - Thurso East (Route 18 in Figure 4.5);
- Core Path CA13.05 - Lady Janet's walk (Route 19 in Figure 4.5);
- Core Path CA13.06 - Scrabster to Holbornhead Quarries (Route 20 in Figure 4.5);
- Core Path CA13.07 - Scrabster to Hill of Forss (Route 21 in Figure 4.5);
- Core Path CA13.08 - Pennyland to Alexander Bain House (Route 22 in Figure 4.5);
- Core Path CA13.09 - Ellan Bridge (Route 23 in Figure 4.5);
- Core Path CA13.10 - The North Highland College to Heathfield (Route 24 in Figure 4.5);
- Core Path CA13.11 - Millbank to Mount Vernon (Route 25 in Figure 4.5);
- Core Path CA13.02 - Thurso Promenade (Route 26 in Figure 4.5);

- Core Path CA13.13 - Thurso Bay (Route 27 in Figure 4.5);
- Core Path CA13.14 - Cnoc Freiceadain to Achibraeskiall Burn (Route 28 in Figure 4.5);
- Core Path CA13.15 - Brims Ness (Route 29 in Figure 4.5);
- Core Path CA13.16 – Forss to School Place (Route 30 in Figure 4.5);
- Core Path CA13.17 – Mount Vernon (Route 31 in Figure 4.5);
- Core Path CA13.18 - Holborn Head to Scrabster (Route 32 in Figure 4.5);
- Core Path CA13.19 - Burnside path (Route 33 in Figure 4.5);
- Core Path CA13.20 - Thurso to Thurso Business Park (Route 34 in Figure 4.5);
- Core Path CA13.10 - Thurso to Glengolly (Route 35 in Figure 4.5);
- Core path CA13.22 – Springpark (Route 36 in Figure 4.5);
- Core Path CA13.- 03 Scrabster A9 roadside link - Thurso to Scrabster (Route 37 in Figure 4.5);
- Core Path CA13.24 - Summer Craig to West Murkle (Route 38 in Figure 4.5);
- Core Path CA13.25 - St Mary's Chapel - Chapel Pool to Crosskirk Cottage (Route 39 in Figure 4.5);
- Core Path CA13.20 - Thurso Business Park (Route 40 in Figure 4.5);
- Core Path CA13.27 – Forss Wind Farm (Route 41 in Figure 4.5);
- Core Path CA13.28 - John Kennedy Drive Link - John Kennedy Drive (Route 42 in Figure 4.5); and
- Core Path CA13.29 - Scrabster House roadside link - Scrabster House (Route 43 in Figure 4.5).

4.3.31 Of these Core Paths, a large proportion are of less than 1 km in length, often enclosed by a combination of vegetation, built structures or topography, thereby restricting potential visibility of the proposed development, are associated with wind farm developments, or are coastal and consequently focused on seaward and the coastal edge. A series of routes was therefore selected for assessment that are representative of the amenity of walkers on routes over 1 km in length and which are more open and indicative of views across the countryside adjoining the proposed development. These include:

- Core Path CA09.01 - Westfield to Achnavast;
- Core Path CA11.01 - Broubster Forest;
- Core Path CA13.06 - Scrabster to Holbornhead Quarries;
- Core Path CA13.07 - Scrabster to Hill of Forss;
- Core Path CA13.10 - Thurso to Glengolly.

4.3.32 Walkers on strategic recreational routes are generally assumed to have a high sensitivity to the type of development proposed due to the nature of their use, the often-scenic quality of their route, and their importance as a regional or national leisure/tourist resource. Whilst Core Paths are generally of shorter length, they are assumed to represent important local recreational routes that receive regular and frequent use. Consequently, walkers on these routes are also considered to have a high sensitivity.

Future Baseline

4.3.33 The principal changes anticipated in the area relate to a number of key considerations:

- Continued interest in the development of wind energy development, including repowering and extension of existing/consented developments as well as new green field proposals; and
- The decommissioning of the Dounreay Power Station, safeguarding and re-use of the land.

4.3.34 There is some uncertainty regarding the timescales and nature of both sources of change. Proposals for renewable energy projects are considered highly probable, notwithstanding any constraints represented in THCs spatial framework. The long-term decommissioning and re-use of the Dounreay site is also a matter of considerable uncertainty due to the complexity and lengthy timescales involved in decommissioning nuclear power stations.

4.3.35 In order to make sensible assessment of the likely trajectory of the landscape and visual context the cumulative assessment addresses the known cumulative context.

4.4 Assessment of Likely Effects

4.4.1 Any onshore wind farm development in the UK has potential to cause significant effects on landscape and visual amenity of a given location, including locations outwith the development site itself.

4.4.2 The proposed development would comprise three phases:

- a construction phase;
- an operational phase; and
- a decommissioning phase.

4.4.3 From the perspective of the LVIA there are two aspects to a wind farm development that have potential to result in landscape and visual effects, these comprise of:

- activities and elements that would affect the fabric of the landscape; and
- elements that would affect the character and amenity of the surrounding landscape.

Potential Construction Effects

4.4.4 The construction phase would be approximately 12 months in duration. The methods that would be utilised during the construction stage are described in Chapter 2: Development Description.

4.4.5 The following elements and activities associated with the construction phase of the proposed development have the potential to result in effects on the landscape and visual amenity of the study area:

- Construction of a new site access tracks and bell mouth entrance;
- Construction of temporary site compounds incorporating site offices;
- Construction of site infrastructure, including tracks between turbine locations;
- Construction of laydown areas and crane pads;
- Construction of substation and compound, incorporating control room and battery energy storage facility;
- Excavation and construction of turbine foundations;
- Erection of turbines;
- Excavations of ditches for underground cables;
- HGV and abnormal load deliveries to site and movement of vehicles on site;

- Reinstatement work, including removal of temporary accommodation works; and
- Habitat creation/enhancement works.

4.4.6 The majority of effects occurring during this phase would concern disturbance of existing landcover at the site and potential for long term change or loss of characteristic vegetation with consequent effects on the character and amenity of the site and the adjoining area. However, a large proportion of the construction effects would be managed through adoption of good practice and careful construction management and monitoring regimes (such as those presented in outline Construction and Environmental Management Plan (CEMP) ES Volume 4: Technical Appendix 2.1). Given the relatively localised, short duration and partially reversible nature of such effects, they are considered unlikely to result in significant effects on landscape fabric.

Potential Operational Effects

4.4.7 The operational life of the proposed development would be 35 years. The operational elements with the potential to affect the landscape and visual amenity of the study area are:

- Wind turbine generators;
- On-site access tracks and hardstanding areas;
- Any retained off-site highway improvements established during the construction phase of the proposed development; and
- Substation/ site control building / battery energy storage facility.

Potential Decommissioning Effects

4.4.8 Decommissioning of the proposed development could have effects similar to that of the construction period with temporary disturbance of landscape fabric and effects on landscape character and visual amenity, both within the site and in the wider study area. Detailed decommissioning proposals would be devised in conjunction with THC, SNH and other statutory consultees prior to the commencement of this phase, the emphasis being upon minimising landscape and visual effects.

Potential Cumulative Effects

4.4.9 The primary sources of cumulative effects in landscape and visual terms would occur during the operational life of the proposed development and arise from the intervisibility (either in combined, concurrent or sequential views) with other wind farms as well as baseline features comprising large structures such as the Dounreay Power Station, grid infrastructure and industrial buildings.

4.5 Mitigation

Guidance

4.5.1 The siting and design of the proposed development has been influenced by a number of national and regional sources of guidance, including:

- SNH’s current guidance on the siting and design of wind farms;
- Scottish Planning Policy; and
- THC’s 2016 Adopted Onshore Wind Energy Supplementary Guidance (SG).

SNH Guidance

4.5.2 Paragraph 1.15 of the SNH guidance (guidance) states that "Wind farms should be sited and designed so that adverse effects on landscape and visual amenity are minimised and so that landscapes which are highly valued are given due protection."

4.5.3 Paragraph 2.15 states that "Choice of turbine size is an integral part of the design process. Identification of the key landscape characteristics, their sensitivity and capacity to accommodate change will inform this. Generally speaking, large wind turbines will appear out of scale and visually dominant in lowland, settled, or smaller-scale landscapes, which are often characterised by the relatively 'human scale' of buildings and features. They are best suited to more extensive, upland areas, and set back from more sensitive upland fringes. This can reduce effects on settled and smaller-scale valleys and lowland landscapes."

4.5.4 However, large scale lowland landscapes which may also be typified by their simplicity could be argued to provide a suitable basis for large scale turbines, where there are few size indicators.

4.5.5 Paragraph 2.20 goes on to propose that "ancillary elements for a wind farm development should be designed so they relate to the key characteristics of a landscape. It is important that these elements do not confuse the simplicity of the wind farm design, or act as a scale indicator for the turbines themselves. Undergrounding power lines within the wind farm, using transformers contained within tower bases (where possible), and careful siting of substations, transmission lines, access tracks, control buildings and anemometer masts will all help to achieve a coherent wind farm design. Simplicity of appearance and use of local, high quality materials will further enhance this."

4.5.6 Paragraph 2.25 addresses the layout of turbines and suggests that "turbines can be arranged in many different layouts. The layout should relate to the specific characteristics of the landscape - this means that the most suitable layout for every development will be different."

4.5.7 The proposed development would be positioned on a broad shallow ridge running between Scrabster Hill, Hill of Forss and Cairnmore Hill in a north-east to south-west orientation, with turbines arranged approximately in two parallel alternating rows that reflect the form of the ridge.

4.5.8 Paragraph 3.23 discusses design responses to terrain, stating that *"landform is a key landscape characteristic, whether it is rugged, flat, undulating or rolling, upland or lowland. In flat landscapes, any undulations tend to become accentuated so that even low hills appear substantial."*

4.5.9 The landform at site is gently undulating and comprises a low, gently graded ridge.

4.5.10 Paragraph 3.24 goes on to state that "it is generally preferable for wind turbines to be grouped on the most level part of a site, so the development appears more cohesive, rather than as a poorly related group of turbines."

4.5.11 The proposed development has been designed to form a coherent and balanced group set at relatively even elevations.

4.5.12 The guidance identifies skylines to be of critical importance and posits that the design should avoid detracting from, or overwhelming the character of distinctive skylines, as well as avoiding variable heights or overlapping turbines.

4.5.13 A further design objective discussed in the guidance is the appropriate scale for the wind farm that is in keeping with that of the landscape. SNH suggests that the proposed development should form an element of:

- Minor vertical scale in relation to the other key features of the landscape;
- Minor horizontal scale in relation to the key features of the landscape (where the wind farm is surrounded by a much larger proportion of open space than occupied by the development); and
- Minor size compared to other key features and foci within the landscape; or separated from these by a sufficiently large area of open space (either horizontally or vertically) so that direct scale comparison does not occur.

4.5.14 The guidance also discusses the relationship between wind farms. A key factor determining the cumulative impact of wind farms is the distinct identity of each development. This relates to their degree of separation and similarity of design between wind farms. This applies whether they are part of a single development, a wind farm extension, or a separate wind farm in a wider group. A wind farm, if located close to another of similar design, may appear as an extension. However, if it appears at least slightly separate and of different design, it may conflict with the other development.

Scottish Planning Policy

THC's 2016 Adopted Onshore Wind Energy Supplementary Guidance (SG)

4.5.15 According to THC's SG and spatial framework (ES Volume 3: Figure 3.2) the proposed development would predominantly be located largely in a Group 3 area which is defined by SPP as locations where wind farms. Considering there are no predicted issues in terms of peat and carbon rich soils, the application site, in effect, can be regarded as Group 3. This approach was taken by the Reporter in the Cnoc an Eas decision.

4.5.16 Section 4 of THC's Adopted Onshore Wind Energy Supplementary Guidance (2016) contains a series of criteria relating to potential landscape and visual effects of developments. It should be noted that these criteria are not policy tests but are intended as a framework and focus against which the THC can assess proposals. The Planning Statement to be submitted alongside the ES contains an evaluation of the scheme against these criteria and is based, to a large degree, on the findings in Section 4.6 and 4.7 of this LVIA.

Siting and Design Priorities

4.5.17 The design of any on-shore wind farm is a matter of balance between commercial, technical and environmental constraints and opportunities. ES Chapter 3: Design Evolution and Alternatives provides a summary of the key design drivers and decisions made during the course of the design of the proposed development.

4.5.18 Landscape and visual considerations, such as the existing landscape and visual baseline context as well as the published guidance and recommendations made by SNH and THC (as summarised in Table 4.1, above) were key to the design development. In landscape and visual terms, the siting and design priorities applied included:

- Location of the proposed development outwith areas classified as Group 1, and outwith areas defined as Group 2 on landscape and visual grounds in the 2016 spatial framework for onshore wind energy.

- Location of proposed development outwith areas subject to landscape designations or classifications, and which is set back from settlements and other concentrations of receptors.
- Positioning of the proposed development in a landscape that is relatively settled and subject to existing wind farm developments and other large-scale structures, as opposed to one that has a higher degree of naturalness and consequently a higher sensitivity.
- Selection of a location within a landscape of sufficient scale and simplicity to provide for the accommodation of the turbines.
- Location of the proposed development away from distinctive landscape features the scale and form of which could be compromised.
- Positioning of turbines inland, away from key views of key landmark features and views including the distinctive cliffs and bays of the northern coastline of Caithness, and the land mass of Orkney.
- Positioning of the proposed development to ensure sufficient separation from other nearby wind farm sites to ensure that the proposed development is seen as distinct.
- Preferential use of existing tracks on site to minimise effects associated with this aspect of the proposed development.
- Minimisation of the amount of site infrastructure and ancillary elements, and their careful positioning and design, to ensure that such elements are screened from the majority of external receptor locations.
- Careful siting and design of ancillary elements such as the proposed substation and control room along with potential associated energy storage facility to minimise visibility from external receptor locations.

Mitigation during Construction

General Construction Mitigation

4.5.19 The location and management of construction elements has been carefully considered to minimise environmental effects including potential landscape and visual effects during the construction stage. Additionally, the following general precautionary measures would be adopted in order to minimise landscape and visual effects.

4.5.20 All working areas would be restricted as far as practicable to the specified areas and demarcated to prevent incursion of site plant into non-construction locations:

- Material storage/temporary stockpiles would be retained for the shortest duration practicable and would be sited to avoid visual intrusion to neighbouring receptor locations, with particular regard to avoidance of sky-lining such features in views from the A836 carriageway;
- Peat materials would be placed directly wherever practicable to avoid double handling, reduce vehicle movements, and to reduce potential drying and oxidisation of the peat. Where this is not possible the peat shall be stored in accordance with the ES Volume 4: Technical Appendix 2.2: Draft Peat Management Plan;
- Temporary site compounds would be reinstated prior to the commencement of the operational phase of the site to avoid the necessity of retaining restoration materials on site over the operational period and to avoid sustained effects on landscape fabric character and visual amenity;

- The surface of lay-down areas would be reinstated to replicate the appearance of adjoining moorland; and
- Excavations for turbines foundations, laydown areas and underground cables, would be reinstated prior to commencement of the operational phase of the proposed development and all track sides would be reinstated with translocated turves to ensure they would blend in with the adjoining (undisturbed) ground in the site.

Temporary Construction Compounds

4.5.21 A total of up to 2 temporary construction compounds are proposed: One close to the main site entrance off the A836 (the Enabling compound); and one to east of turbine 4.

4.5.22 The use of the temporary compounds is intended to limit the necessary overall size of compound and reduce length and frequency of on-site vehicle movements. It is also intended that all temporary compounds would be returned to a condition consistent with that of the adjoining moorland during final construction works at the site.

Concrete for Turbine Bases

4.5.23 It is the intention that concrete required for the construction of turbine foundations will be imported to site.

Mineral Extraction Areas

4.5.24 It is proposed that aggregate for new tracks would be imported to site to avoid the necessity for borrow pits.

Crane Pads and Laydown Areas

4.5.25 These elements of the proposed development would be kept to a minimum size and would be surfaced to match the track construction. Laydown areas not potentially required for future maintenance could be removed at the end of the construction phase of the proposed development and the ground reinstated to match adjoining undisturbed ground. Alternatively, the surface of the laydown areas could be reinstated to match adjoining moorland whilst a form sub base is retained for future use if required. The final option in this regard would be confirmed prior to construction operations commencing at the site.

Substation and Control Building with Battery Energy Storage Facility

4.5.26 The control building and substation, along with potential associated battery energy storage facility, would be set back from the northernmost side of the Hill of Forss to provide screening of this element of the proposed development from the A836. Its position would also, with careful detailed design, be substantially screened from adjoining receptors.

4.5.27 A battery energy storage facility would be located on the base of the substation. This aspect of the proposed development would comprise a number of modular steel containers along with associated electrical components and smaller GRP housings, enclosed by palisade fencing or similar within a maximum 64.5 m by 43 m area. Figure 2.12 provides an indicative layout for the battery energy storage compound.

Mitigation during Operation

4.5.28 Mitigation measures relating to the operational phase of the proposed development have been incorporated into the design of the scheme, as described previously, above, and in Chapter 2: Development Description of the ES.

Mitigation during Decommissioning

4.5.29 The decommissioning phase of the proposed development would be of a shorter duration to that of the construction phase, with the dismantling of all above ground structures and reinstatement of disturbed ground, subject to a hydrological assessment. Below ground structures would be left in place to avoid further disturbance. There would therefore be a temporary impact from the activities on site to remove structures, but this would be of relatively short duration. Accordingly, the decommissioning phase is considered to be likely to have a minimal effect on the landscape and visual amenity of the locality when compare to that of the operational development. Mitigation measures associated with decommissioning would be agreed during the preparation of the final decommissioning plan, that would require the approval of THC.

4.6 Assessment of Residual Effects

4.6.1 Taking account of proposed mitigation measures described in Section 4.5, the residual effects predicted during the construction and operational phases of the development are described below.

Residual Construction Effects

4.6.2 Construction operations would result in temporary disturbance of around 0.9 ha of the site, primarily related to the establishment of temporary compounds laydown areas and crane pads, site infrastructure and turbine foundations. Construction associated with establishment of new tracks and upgrading of existing tracks, as well as turbine bases and the substation compound would affect around a further 3.84 ha. Construction operations would be temporary and of relatively short duration and restricted to the interior of the site and would be partially reversed during reinstatement of temporary compounds and track sides.

Landscape Effects

EFFECTS ON LANDSCAPE FABRIC

4.6.3 Construction operations would result in the temporary loss of less than 0.9 ha of moorland grassland, establishment of just over 2 ha of tracks and associated localised minor changes in topography. As such these impacts would be confined to the application site and to be of relatively short duration and are therefore predicted to be slight, constituting a moderate/minor residual effect.

EFFECTS ON LANDSCAPE CHARACTER

4.6.4 The effect of construction operations at the site would be localised to construction locations and would be of relatively short duration and much of the disturbance associated with construction operations would be ameliorated or removed during subsequent reinstatement of characteristic vegetation at the site. Consequently, the effect of construction operations are not considered to give rise to significant residual effects on landscape character either within the site or in the adjacent landscape.

EFFECTS ON LANDSCAPE DESIGNATIONS

4.6.5 As with predicted effects on landscape character types, effects on designated landscapes within the study area are also not anticipated to be significant during construction. The proposed development would occur outwith designated areas and would therefore have no direct physical effect on designated landscapes. Whilst indirect effects are likely, primarily as a result of the operation of cranes and erection of turbines, such effects would be localised and would be of a relatively short duration and rapidly replaced by operational effects. Consequently, such effects are not considered to represent significant residual effects on designated landscapes in the study area.

VISUAL EFFECTS

4.6.6 Construction operations would be confined to locations within the site but would be visible from a number of neighbouring receptor locations screened from the majority of key external receptor locations, including settlements, transportation routes and the majority of recreational routes as defined in Section 4.4, the exception to this being the operation of site cranes and erection of turbines. However, even these aspects of the construction operations would be of relatively short duration. In this context, residual construction effects on visual amenity are considered unlikely to be significant.

Residual Operational Effects

4.6.7 The operational development would occupy approximately 3.84 ha of the site. The greatest land take being associated with site infrastructure, and turbine bases.

Landscape Effects

EFFECTS ON LANDSCAPE FABRIC

4.6.8 Following completion of the construction operations and reinstatement of temporary compounds and track sides effects on landscape fabric during the operational life of the site would reduce and remain non-significant.

EFFECTS ON LANDSCAPE CHARACTER

4.6.9 TA 4.4: Residual Effects on Landscape Character Types contains a detailed assessment of residual effects and cumulative effects on landscape character and is summarised below.

SNH: 143: FARMED LOWLAND PLAIN AND THC C9: FARMED LOWLAND PLAIN – NORTH CAITHNESS

4.6.10 **Major** (significant) effects on the character of the site itself due to the transformation of the site from open moorland to a wind farm. Outwith the site, the proposed development would also result in **Major** – **Major/Moderate** (significant) effects on the landscape character in sections of this LCT within:

- the A836 corridor between Thurso and Reay;
- the A9 corridor on the approach to Thurso;
- the coast at Scrabster and Crosskirk;
- Janetstown; and
- parts of the Thurso to Reay local road and NCR1

4.6.11 Such locations are generally within 7 km of the proposed development. In general, the proposed development would add to the existing context of prominent power lines, existing and consented turbines and large-scale built structures that are present within this LCT and which interrupt the gently undulating form and openness of this landscape.

4.6.12 This would be the case in respect of both the baseline cumulative context (i.e. existing and consented wind farms and other power and industrial elements) as well as when proposed wind farms within the study area are taken into account.

4.6.13 The 'in-combination' effects in respect of existing and consented wind farms would also be significant at these locations. The consented Limekiln turbines, once constructed, are likely to result in the extension of significant cumulative effects into the neighbouring Sweeping Moorland and Flows landscape and will lessen the clarity of the transition between this LCT and the neighbouring Sweeping Moorland LCT. The inclusion of the proposed Limekiln Extension would compound this.

SNH: 141/ HIGH CLIFFS AND SHELTERED BAYS AND THC: CT8: HIGH CLIFFS AND SHELTERED BAYS – RUBHA BHRA TO DUNBEATH

4.6.14 Residual operational effects on this LCT would range from None to Moderate at locations such as Strathy Point, Dunnet Head and Fresgoe/Sandside Bay. The proposed development, whilst adding to the complexity of the development that is a characteristic of the landscape context that forms the backdrop to views inland from this LCT, would not be anomalous and would not significantly detract from the distinctive characteristics of this LCT.

4.6.15 This would remain the case if the proposed wind farms in the study area are taken onto account.

4.6.16 In combination effects on this LCT derived from both the proposed development and existing/consented wind turbines, grid infrastructure and the Dounreay Power Station would range from none to **Major/Moderate** (significant), the greatest in-combination cumulative impact occurring at Fresgoe where a large proportion of the skyline above the cliffs and Sandside Bay is already occupied by large quantities of built structures and grid infrastructure associated with Dounreay Power Station. The recently consented Limekiln array is likely to extend these significant in combination effects to Sandside Bay and Strathy Point from where they would be seen above the distinctive cliffs of the Melvich area. This effect would be further intensified in the event of the proposed Limekiln Extension and Drum Hollistan 2 arrays being consented and built.

SNH: 134: SWEEPING MOORLAND AND FLOWS AND THC: CT3, CT4, CT5 AND CT6 SWEEPING MOORLAND AND FLOWS

4.6.17 The proposed development would result in Moderate to Moderate/Minor effects on this LCT, the greatest effects occurring in the following units:

- Northeast Caithness (CT3) - Moderate effects and Moderate cumulative effects;
- Central Caithness (CT4) – Moderate to Moderate/Minor effects and Moderate to Moderate/Minor cumulative effects;
- Dunnet Interior (CT5) - Moderate effects and Moderate cumulative effects; and
- Black Hill Mosses (CT6) – Moderate/Minor effects and cumulative effects.

4.6.18 The proposed development, whilst adding to the cumulative context that forms a characteristic of both parts of the LCT, but also often occupies the backdrop to views from this LCT, would not significantly detract from the distinctive characteristics of this LCT. This remains the case if the proposed wind farms in the study area are taken into account.

SNH: 140: SANDY BEACHES AND DUNES AND THC: CT7 SANDY BEACHES AND DUNES – SANDSIDE BAY, MELVICH BAY, DUNNET BAY

4.6.19 There would be no impact at Melvich Bay, but the impact attributable to the proposed development in conjunction with baseline cumulative context (e.g. existing and consented wind farms in the study area as well as Dounreay power station and associated grid infrastructure) would be slight at Sandside Bay, increasing to Moderate at Dunnet Bay. The greater impact predicted at Dunnet Bay relates to the prominent skyline position of the proposed development and extension of existing impacts associated with Baillie wind farm around further around the bay. Consequently, the effect on this LCT would range from None to Moderate, but with localised **Major/Moderate** (significant effects) at locations in the proximity of the visitor centre in Dunnet Bay.

4.6.20 Generally, the cumulative effect on this LCT would range from none to moderate, but localised **Major/Moderate** (significant cumulative effects) would be experienced at locations in the proximity of the visitor centre in Dunnet Bay when the proposed development is considered in conjunction with the current cumulative baseline. This would remain the case if proposed wind farms within the study area are taken into account.

4.6.21 In combination effects would not be significant, however as the majority of development being positioned inland, away from the principal focus of this LCT.

SNH:307: Cliffs – Orkney

4.6.22 Residual operational effects on this LCT would be Moderate/Minor and localised. The proposed development would have no effect on physical aspects of this landscape or its scale and openness. It would also have no effect on the landmark features of the Hoy cliffs and no significant effect on the scenery and seaward views towards Caithness. This would remain the case when proposed wind farms in the study area are also taken into account.

Seascape Unit 8 North Caithness and Penland Firth

4.6.23 TA4.4 concludes that the proposed development would result in Moderate to **Major/Moderate** (significant) effects on this seascape unit. These effects would be confined to offshore locations along the Orkney Ferry route where the proposed development would overtop the distinctive cliffs between Holburn Head and Brims Ness and affect their form and scale. The proposed development would, however, not significantly affect the sense of remoteness or degree of perceived exposure. This would remain the same in the event of the proposed wind farms in the study area being incorporated.

4.6.24 In combination effects derived from both the proposed development and existing/consented wind turbines, grid infrastructure and the Dounreay Power Station would range from none to **Major/Moderate** (significant), the greatest cumulative impact occurring at on the Orkney Ferry, Fresgoe/Sandside Bay where a large proportion of the skyline above the cliffs and Sandside Bay is already occupied by large quantities of built structures and grid infrastructure associated with Dounreay Power Station. The recently consented Limekiln array will, once constructed, extend these significant in combination effects to Sandside Bay and Strathy Point from where they would be seen above the distinctive cliffs of the Melvich area. The inclusion of the proposed Limekiln Extension and Drum Hollistan 2 turbines would further intensify this effect.

Effects on Landscape Designations

4.6.25 TA4.5 contains a detailed assessment of the proposed developments effect on the special qualities of:

- Dunnet Head SLA;
- Farr Bay, Strathy and Portskerra SLA; and
- Flow Country and Berriedale Coast SLA.

4.6.26 The assessment concludes that there is no likelihood of significant effects on the special qualities of these designated landscapes, either based on the existing cumulative baseline, or a scenario where proposed wind farms in the study area are also taken into account.

Visual Effects

EFFECTS ON THE AMENITY OF SETTLEMENTS AND RESIDENTIAL PROPERTIES

THURSO

4.6.27 This settlement is located on the coast on a north-eastern slope overlooking Thurso Bay and is centred in the line of the River Thurso. It is a relatively diverse settlement comprising a combination of an irregular street at its easternmost end, adjoining the bay, a grid iron street pattern in its oldest residential sections, and a series of post-war housing areas to the west at Pennylands, Ormlie, High Ormlie and Mount Pleasant which are characterised by suburban cul-de-sacs and estate roads. The satellite settlements of Burnside, to the north of the main settlement of Thurso is a relatively recent extension to the settlement and comprises a predominance of single storey dwellings oriented towards estate roads.

4.6.28 Whilst the ZTV in Figure 4.6a indicates extensive visibility from this settlement, field reconnaissance suggests that a combination of the underlying topography and the urban form of the settlement would restrict views of the proposed development, the clearest views of the proposed development being provided from the western fringes or Ormlie and Pennyland, and Burnside and the B836 from where all eight of the proposed developments turbines would be seen on the skyline and would form prominent new features in views inland. Figures 4.8Ciii and 4.9Ci to 4.9Civ illustrate the predicted view from Viewpoint 3 which is indicative of the visibility and prominence of the proposed development from such locations. The proposed development would introduce large scale vertical engineered features and movement to a part of the view that is rural in aspect and characterised by open moorland skyline that does not contain such elements, and which is essentially still. Consequently, the impact on the amenity of these locations would be Moderate, representing a notable visual influence and a **Major/Moderate** effect. However, within the interior of the settlement more widely, the majority of receptors would experience highly restricted or no views of the proposed development. Consequently, the proposed development is not considered to represent a pervasive or significant effect on the amenity of this settlement. The settlement would also not be subject to cumulative effects due to its generally restricted views inland to where existing and consented wind farms and large-scale developments tend to be located.

REAY

4.6.29 This is a broadly linear, elongated settlement centred on the A836 carriageway, south of Sandside Bay, and which is organised in two sections, one of either side of the Sandside and Reay burns. The western section is the older of the two and comprises a predominance of storey detached dwellings oriented towards the A836, whilst the eastern section of the settlement is more recent and contains a greater number of two storey properties.

4.6.30 Views of the proposed development from the eastern section of the settlement would be substantially restricted by intervening topography. However, oblique views would be provided to properties at the eastern end of the western section of Reay and from the A836 carriageway that is oriented towards the proposed development. Viewed from such locations, the proposed development would be seen distantly (at distances of over 10 km) and in the context of the more prominent Baillie and Forss turbines. Given the restricted nature of views from this settlement, the distance at which the proposed development would be seen and its developed context, the magnitude of impact upon the amenity of this settlement would be slight and the residual effect would be Moderate and not significant. This would remain the case in the event of the proposed developments in the study area being consented and constructed.

4.6.31 However, in-combination effects would be significant due to the proximity and prominence of Limekiln Wind Farm, as they would form a prominent new feature of the landscape to the south of this settlement, resulting in a possible perception of encirclement. However, the proposed development would not contribute to this.

CASTLETOWN

4.6.32 Castletown is a small low-lying village on the north coast of Caithness, immediately south of Dunnet Bay. The village has an orderly clustered arrangement centred upon Main Street. Dwellings within the village are a mixture of one and two storey properties, a large proportion of which are oriented in a north-east-south-west direction. Whilst the settlement has a wooded northern and eastern aspect connecting views into Dunnet Bay are provided. Views out from its western and southern aspect are open, providing connecting views inland. According to the ZTV in Figure 4.6a the proposed development would be screened from the majority of this settlement by the intervening raised landform of the Hill of Clindrag, and that only limited theoretical visibility would occur at the northern extents of the village on Harbour Road. However, field reconnaissance indicates that views from this location would be screened by intervening vegetation and buildings. Consequently, the proposed development would have no discernible effect on the amenity of this settlement.

DUNNET

4.6.33 A village situated approximately 15 km east/north-east of the proposed development which overlooks Dunnet Bay. It is a low-density settlement comprising a main cluster of one and two storey properties centred on the junction of the A836 and the B855, and more scattered properties extending along minor local roads along the base of the Dunnet peninsula. The prospect to the south and west of the village is essentially open providing long range views across the bay and into the rural hinterland beyond. However, localised restrictions on views from within the settlement occur as a result of intervening vegetation and buildings in the village.

4.6.34 Where visible, the proposed development would be seen at distances of around 15 km to the west/south-west where it would be seen distantly and in the context of the Baillie and Forss turbines, but would appear closer and more prominent, and would extend development closer to the bay. Figures 4.8Liii and 4.9Li to 4.9Liv provide an indication of the likely operational view of the proposed development from the more open sections of the settlement. In this particular circumstance, the impact would be Moderate and the residual effect on receptors at this settlement would be **Major/Moderate** and significant. However, elsewhere in the settlement, where views out are constrained by intervening vegetation and buildings, the magnitude of impact would reduce to slight, and the residual effect would be Moderate and not significant. These findings would remain the case if proposed developments in the study are also taken into account.

4.6.35 In-combination cumulative effects experienced at this settlement would also range from **Major/Moderate** to Moderate and would be related to the partial extension of wind energy developments across a key skyline to the west and south-west in views from the settlement.

PORTSKERRA

4.6.36 Portskerra is a hamlet overlooking Melvich Bay, approximately 18 km west of the proposed development. It is located on an east facing slope and is arranged in two linear groups of dwellings along the Portskerra Road and Shore, which are oriented in a north-south direction. Dwellings in the settlement are a combination of one and two storey properties, the majority of which are oriented towards the main roads into the settlement (in an east-west direction), but properties set back from these roads often have a more north-south orientation. The settlement is relatively open in character providing long-range views across Melvich Bay towards the Caithness Coastline beyond, and to the north into the Pentland Firth. The proposed development would be seen distantly to the east and in the context of the Forss turbines and the Dounreay Power Station.

4.6.37 Given the distance at which it would be seen, the limited proportion of the view from this settlement that it would occupy, and the existing developed context in its vicinity, the proposed development would represent a Slight impact, equating to a Moderate effect. This would remain the case in the event of the proposed developments such as the Limekiln Extension and Drum Hollistan 2 being consented and constructed.

4.6.38 In combination effects associated with the proposed wind farms would be Moderate and not significant. This would remain the case in the event of the proposed developments within the study area being consented and constructed.

SCATTERED DWELLINGS

4.6.39 TA4.8: Residential Visual Amenity Assessment (RVAA) contains a detailed assessment of effects on the visual enmity of properties within 2 km of the proposed development. The focus of the RVAA was not whether significant visual effects would occur, but whether such effects would constitute potentially 'overbearing' or 'overwhelming' effects that might be considered to render a property an unattractive place in which to live and not in the public interest which may be considered material in planning terms and in the determination of the planning application.

4.6.40 It is apparent from the RVAA that, whilst a number of properties would be subject to significant visual effects, none were considered sufficient to be deemed 'overbearing' or 'overwhelming.'

EFFECTS ON THE AMENITY OF TRANSPORTATION ROUTES

4.6.41 TA4.9 contains a statistical analysis based on the theoretical visibility of the proposed development and other cumulative developments in the ZTVs in Figures 4.7a to 4.7s. This analysis represents a worst case as it is based on bare terrain and doesn't, therefore, take account of the screening effect of highly localised topographical features, vegetation or built structures. In order to verify the actual visibility of the proposed development from key transportation routes they were visited during field reconnaissance, and the findings summarised below. Where the duration of views is quantified it assumes that receptors would be travelling at appropriate speed limits for the routes concerned.

A9

4.6.42 Of the nearly 50 km of this route that falls within the study area, the proposed development would be visible from around 33 km of the route and would affect northbound road users only.

4.6.43 Driving north from Latheron the proposed development would be screened by intervening topography, but the existing Buolfruich turbines are visible in oblique views to the west. Progressing northwards, approaching Loch Rangag, the proposed development would be seen on the skyline around 30 km to the north and would be seen in the context of the Baillie turbines and Causeymire Wind Farm and pylons, which would be closer and more prominent. Once the consented Bad a Choe, Achlachan and Halsary turbines have been constructed, these schemes would form a prominent cluster of development in views from this section. Further north, this route bisects this cluster and enters an area that has increased forest cover, thereby increasing the sense of enclosure and restricting long-range views towards the proposed development, as demonstrated at Viewpoint 14 (Ref. Figures 4.8Niii and 4.9Ni to 4.9Niii). Between Spittal and Sibster intermittent views of the proposed development would occur, the proposed development would be seen at distances of over 12 km and partially obscured by intervening topography. Whilst Baillie and Weydale turbines are theoretically visible from this location, field reconnaissance suggest that they would not be immediately apparent. However, the middle-ground of views from this section of the route does contain pylons and grid infrastructure. Viewpoint 10 is indicative of the views from this section of the route (Ref. Figures 4.8Jiii and 4.9Ji to 4.9Jiv). Beyond this section of the route the landscape becomes more open and views are expansive. In this context, the proposed development would gradually increase in prominence and intervisibility with Baillie and Forss and would be seen in the context of the large-scale grid infrastructure that crosses the intervening landscape. Viewpoint 6 is indicative of views approaching Thurso on this section of the route (Ref. Figures 4.8Fiii and 4.9Fi to 4.9Fiv).

4.6.44 Based on the preceding analysis the magnitude of impact on this route would range from:

- None for southbound road users and north-bound road users at Latheron;
- Negligible between Loch Rangag and Spittal for northbound road users;
- Slight between Spittal and Sibster for northbound road users; and
- Moderate on the approach to Thurso, as experienced by northbound road users.

4.6.45 Consequently, taking account of the baseline cumulative context, **Major/Moderate** significant effects, including sequential effects, would be confined to northbound receptors on sections of the route approaching Thurso. This remains the case if the proposed developments within the study area are also taken into account.

A836

4.6.46 This route occurs in two sections, one between A'Chraobh and Thurso and one between John O'Groats and Thurso.

4.6.47 Of the 57 km of between A'Chraobh and Thurso, the proposed development would theoretically be visible from a maximum of 24 km of the route, but with the exception of a short section between the site and Thurso, would generally only affect eastbound receptors. Views of the proposed development between A'Chraobh and Melvich would be highly constrained and intermittent largely due to the undulating nature of the intervening topography. Where views of the proposed development do occur, they would be fleeting, and the proposed development would be seen at distances of over 19.8 km and in the context of the Baillie and Forss turbines. Between Melvich and Reay there would be a notable viewshadow from where the proposed development would not be visible. As the route progresses eastwards from here, the landscape flattens out, marking the transition from the Sweeping Moorland and Flows landscape into the Farmed Lowland Plain, and providing long-range open views along the Caithness coast. The proposed development would be seen at a distance of around 13 km and would occupy a prominent skyline position inland, to the east. The proposed development would be seen between the existing Baillie and Forss turbines which also form prominent features in the horizon. Thereafter, with the exception of constrained visibility at Reay, views of the proposed development would remain relatively constant, the prominence of the proposed development, Baillie and Forss turbines increasing commensurately with their proximity. However, as receptors reach Forss, Baillie would no longer be visible from eastbound vehicles, and the Forss turbines would be seen to the north, away from the proposed development, which would be seen to the south-east. As the route reaches the site location the proposed development would be seen obliquely to the south. Viewpoint 1 is indicative of the view from this stretch of the route Figures 4.8Aiii and 4.9Ai to 4.9Aiv illustrate the predicted view from this location. Between Thurso and the site, the proposed development would form a prominent new focal point in views from westbound vehicles, the Baillie and Forss turbines receding into the distance. Viewpoint 3 is indicative of such views (Ref. Figures 4.8Ciii and 4.9Ci to 4.9Civ).

4.6.48 On the basis of the preceding analysis the magnitude of impact on the A836 between A'Chraobh and Thurso would range from:

- Negligible between A'Chraobh and Reay; and
- Increasing to Moderate approaching Forss and Substantial by the site itself.

4.6.49 This equates to a **Major/Moderate** and **Major** significant effects and in-combination effect in the context of the cumulative baseline approaching Forss and between Forss and Thurso and extending westwards towards Limekiln Wind Farm as far as Portskerra and Melvich Bay due to the prominence of this development at those locations. This effect would be intensified by the inclusion of the proposed Limekiln Extension and Drum Hollistan 2 turbines.

4.6.50 Between John O' Groats and Thurso, views of the proposed development would be provided from around 18.7 km of this 31 km route and would affect westbound receptor only.

4.6.51 Between John O' Groats and Gills the proposed development would be entirely screened by intervening topography, but the existing Lochend turbines would be viewed briefly from Huna. Between Gills and Whitebridge views of the proposed development would be intermittent due to the incidence of roadside structural vegetation and scattered dwellings. Where views do occur, they would be glimpsed, and the proposed development would be seen distantly (i.e. at a distance of over 20 km). In contrast, the existing Lochend and Stroupster turbines would form prominent features on the skyline to the south of the route. West of Whitebridge the landscape becomes more open, providing long-range expansive views towards Dunnet Bay and across the Farmed Lowland Plain. Here, the proposed development would be seen distantly and occupy what would be a small proportion of an expansive view and would be seen in the context of the Baille turbines and would therefore not be anomalous. Viewed from sections of the route around the southern side of Dunnet Bay, the proposed development would be seen form a prominent feature above the western side of the Bay. Further west, views from this route as it enters Castletown would be restricted by a combination of topography, built forms and vegetation. Between Castletown and Thurso, the visibility and prominence of the proposed development would increase, the proposed development forming a prominent new feature in the approach to Thurso. Baillie Wind Farm would also be visible from this stretch of the route but would be partially screened by intervening topography.

4.6.52 On the basis of the preceding analysis the magnitude of impact on the A836 between John O' Groats and Thurso would range from:

- Negligible between John O' Groats and Whitebridge;
- Slight between Whitebridge and Dunnet; and
- Moderate between Dunnet Bay and Thurso.

4.6.53 This equates to a **Major/Moderate** significant effect and in-combination effect in the context of the cumulative baseline between Dunnet Bay and Thurso. This would remain the case if the proposed wind farms in the study area were also taken into account.

B855

4.6.54 Views of the proposed development would be confined to south-bound road users at Burifa Hill, locations close to Dunnet Head, and approaching Dunnet village. Seen from both locations the proposed development would be seen at a distance of around 15 km, would be partially screened by intervening topography and set within a long-range panoramic view, and would be seen in the context of the existing Baille Wind Farm. On this basis, the proposed development would represent a slight impact and a Moderate effect on the amenity of this route, which is not considered significant. Similarly, in-combination effects on this route would be non-significant, due to the distance that wind energy development is from it.

B870

4.6.55 Of the 37 km of this route within the study area, views of the proposed development would be provided from a total of around 20 km. Views of the proposed development from locations between Kirk and Scotscalder would be intermittent and generally oblique, intervening topography and vegetation restricting views from this part of the route. This section would, however, be subject to sequential views of the existing/consented Cogle Mains, Bilbster, Camster, Causeymire, Achlachan and Halsary developments which would be seen to the south of the route. Where visible the proposed development would be seen briefly and at a distance of over 12 km, would occupy a small proportion of the view and would be seen in conjunction with the existing Baillie and Forss turbines to the north, in the opposite direction to the main cumulative context along this section of the route. As the route progresses northwards views would continue to be intermittent, and the proposed development would be seen briefly at distances of between 6 km and 10 km. Further north, approaching Thurso, views across the coast are revealed, and the influence of existing wind farms, grid infrastructure, built structures and settlement increases. The proposed development would add an additional focal point in the landscape in the background of views.

4.6.56 The magnitude of impact on the A870 would range from:

- Negligible between Kirk and Scotscalder;
- Slight between Scotscalder and Achscrabster; and
- Moderate between Achscrabster and Thurso.

4.6.57 This equates to a **Major/Moderate** significant effects and in-combination effect in the context of the cumulative baseline between Achscrabster and Thurso. This would remain the case if the proposed wind farms in the study area are also taken into account.

B874

4.6.58 Of the approximately 37 km of this route within the study area, the proposed development would be visible from around 16 km of the B874, northbound receptors being the only receptors affected.

4.6.59 Between Wick an Halkirk visibility would be intermittent, any views of the proposed development being brief and distant. As the route progresses northwards views would continue to be intermittent, and the proposed development would be seen briefly at distances of between 8 km and 12 km. Further north, nearing the junction with the B870, views across the coast are revealed, and the influence of existing wind farms, grid infrastructure, built structures and settlement increases. The proposed development would add an additional focal point in the landscape in the background of views.

4.6.60 The magnitude of impact on the B874 would range from:

- Negligible between Wick and Halkirk;
- Slight north of Halkirk; and
- Moderate nearing the B870.

4.6.61 On this basis no significant effects are anticipated on the amenity of this route.

B876

4.6.62 Views from this route would be intermittent and partially constrained by topography, vegetation and roadside dwellings and farmsteads. Additionally, only north-bound receptors would be affected by the proposed development. Seen from locations between Reiss and Killimster the proposed development would be seen distantly (over 27 km) to the north and would be substantially screened by intervening topography, mainly blade tips being evident. Further north some restricted visibility would also be provided between Kirk and Hastigrow. Thereafter, the only other visibility from this route would be immediately south of Castletown. From this location the proposed development would be seen at a distance of over 14 km and would appear as a series of blade tips only. Given the limited visibility from this route and the distance at which it would be seen, the proposed development would represent a Negligible impact on the amenity of this route and a Moderate/Minor residual effect, which would not be significant.

HELMSDALE TO WICK RAILWAY

4.6.63 Unlike road users, passengers in train carriages generally experience only oblique views, but can obtain views both in the direction of travel and behind it (i.e. front and rear facing seats).

4.6.64 Views from this railway would be substantially restricted between Kinbrace and Scotscalder due to the screening effect of intervening topography, embankments, and vegetation, and the proposed development would be seen briefly from the northern side of the rail carriage. However, the turbines would be seen fleetingly and at a distance of around 11 km and would occupy a relatively small proportion of the view from this position. Between Halkirk and Wick, views would be intermittent and acutely oblique (i.e. virtually in the direction of travel) and therefore less prominent in passengers' views.

4.6.65 Consequently, the magnitude of impact on the amenity of passengers would be Negligible and the residual effect would be Moderate/Minor and not significant.

FAR NORTH (HALKIRK – THURSO) RAILWAY

4.6.66 The proposed development would be theoretically visible from the majority of this 11 km long route.

4.6.67 Viewed from sections of the line between Georgemas Junction Station and Sordale the proposed development would be seen obliquely to the north-west at a distance of around 10 km and would be seen in the context of existing pylons and overhead lines that run broadly parallel to the railway. Beyond this, the line turns north-west, towards the proposed development, thereby screening it from passengers. Approaching Glengolly views to the proposed development are screened by intervening topography.

4.6.68 Given the limited proportion of this route subject to potential views, their brief duration and the distance at which the proposed development would be seen, the magnitude of impact on this route would be Negligible, equating to a Moderate/Minor effect, which would not be significant.

ORKNEY FERRY - STROMNESS TO THURSO

4.6.69 Stromness Ferry port is located outwith the study area and viewshed for the proposed development. However, views of the proposed development would be provided from parts of Scrabster harbour, including the ferry port. Viewed from this location the proposed development would be visible on the skyline above the harbour and would form a prominent feature above the cliffs that enclose Scrabster to the west.

4.6.70 Of this 47 km route between Scrabster and Stromness, the proposed development would be visible from around 38 km of it. However, this assumes that receptors are able to access external spaces on the ferry. Viewed from the northernmost section of the route, adjacent to Hoys northern coast, the proposed development would be seen at distances of over 31 km, would occupy a small proportion of what is an enormous panoramic view, and would be set within the context of other wind farm developments and the Dounreay Power Station on the northern coast of Caithness. As the ferry reaches the midpoint of the Pentland Firth the proposed development would continue to occupy a prominent skyline position above the distinctive cliffs between Holburn Head and Brims Ness but would be most prominent as the ferry approaches the Caithness coast and makes its final approach to the Scrabster Harbour. Viewpoint 7 is indicative of such a location (Ref. Figures 4.8Giii and 4.9Gi to 4.9Giv illustrate).

4.6.71 The magnitude of impact upon this route would therefore be:

- None at Stromness;
- Negligible as the ferry passes the northern coast of Hoy;
- Slight within the centre of the Pentland Firth; and
- Moderate on the approach to the Caithness coastline; and
- Substantial at locations within Scrabster Harbour.

4.6.72 Consequently, **Major** and **Major/Moderate** significant effects would be experienced at Scrabster Harbour and on the final approach to Caithness coast, respectively.

4.6.73 In cumulative terms, the proposed development would significantly increase the cumulative effects attributable to the existing/consented cumulative baseline.

STROMNESS FERRY ALT ROUTE - STROMNESS TO THURSO

4.6.74 The effect on the alternative ferry route between Stromness and Scrabster would be virtually identical to that of the main ferry route.

EFFECTS ON THE AMENITY OF RECREATIONAL ROUTES, SUMMITS AND PROMONTORIES

NCR1

4.6.75 The proposed development would be visible from a large proportion of this route.

4.6.76 Travelling eastwards from Bettyhill to Reay views of the proposed development between would be highly constrained and intermittent due to the undulating nature of the intervening topography. Where views of the proposed development do occur, they would be of short duration, and the proposed development would be seen at distances of over 19.8 km, and in the context of the Baille and Forss turbines and sequentially with the consented Limekiln array. Between Melvich and Reay there would be a notable viewshadow from where the proposed development would not be visible. Beyond Reay the cycleway tuns southeast and extends along a minor local road that that skirts the southern side Stemster Hill (the location of Baille Wind Farm) before travelling further east through Knockglass and Westfield and on to Thurso. The proposed development would be seen at distances of over 3 km to the north of the route and would be seen obliquely.

4.6.77 Cyclist travelling on this route between John 'O' Groats and Thurso would experience intermittent views of the proposed development. The proposed development would generally be seen distantly, to the west southwest (i.e. in the direction of travel) and in the context of the existing Baille and Forss schemes and sequentially with Stroupster, Lochend and Taigh na Muir Dunnet, but would represent a relatively minor new focal point on the skyline in views from this route. However, as the route approaches Castletown and Dunnet Bay and thereafter Thurso, the proposed development would become increasingly prominent in views to the west.

4.6.78 On the basis of the preceding analysis the magnitude of impact on NCR1 would range from Negligible between Bettyhill and Reay, increasing to Moderate between Reay and Thurso, equating to Moderate/Minor Effects between Bettyhill and Reay and **Major/Moderate** (significant) effects on the amenity of eastbound cyclists between Reay and Thurso. Moderate impacts would also be experienced by westbound cyclists on the approach to Dunnet Bay and Thurso and would constitute a **Major/Moderate** (significant) effect on the amenity of cyclists.

CORE PATH CA09.01 - WESTFIELD TO ACHNAVAST

4.6.79 This route is located between Westerfield and Achnavast and would be subject to clear views of the proposed development. The proposed development would be seen at distances of around 3 km to the north northwest of the route and would be seen obliquely, whilst the existing Baillie Wind Farm is visible to the west of this route. Whilst the proposed development would be partially screened by intervening topography west of Janetstown, it would represent a notable new feature and increase in the influence of wind energy development, a Moderate impact and **Major/Moderate** (significant) effect on the amenity of walkers on this route.

CORE PATH CA11.01 - BROUBSTER FOREST

4.6.80 This Core Path is located within a substantially forested landscape with limited views out and is situated over 7 km southwest of the proposed development. Consequently, the anticipated impact in this route would be Negligible and the residual effect would be Minor and not significant.

CORE PATH CA13.06 - SCRABSTER TO HOLBORNHEAD QUARRIES

4.6.81 This route would be subject to clear views of the proposed development which would be seen at distances of around 2 km to the southwest and represent a substantial addition to the cumulative context comprising Baillie, Forss, Hill of Lybster and Lybster Forss Road and a **Major** (significant) effect on the amenity of walkers on this route.

CORE PATH CA13.07 - SCRABSTER TO HILL OF FORSS

4.6.82 Given the openness and proximity of this route relative to the proposed development, the amenity of walkers on the majority of this route is predicted to be subject to **Major** (significant) effects.

CORE PATH CA13.10 - THURSO TO GLENGOLLY

4.6.83 This route extends southwards from the outskirts of Thurso and follows part of the NCR1 route. The proposed development would be seen from the majority of this path and would appear as a prominent new wind farm around 3.5 km to the west northwest and would be seen in conjunction with the Baille and Forss, Hill of Lybster and Lybster Forss Road arrays. In this context, the proposed development would represent a Moderate impact and a **Major/Moderate** (significant) effect on the amenity of this route.

HILLS, SUMMITS AND PROMONTORIES

4.6.84 Whilst the study area contains a number of small hills, there is only classified hill, which is Morven, which is a Graham and situated nearly 40 km from the proposed development and is therefore considered unlikely to be subject to significant effects on its amenity.

4.6.85 A small number of non-classified summits were included in the representative viewpoints in TA4.7. These include Beinn Ratha, (Viewpoint 9), and Ben Dorrery (Viewpoint 11). Nether of which were assessed as being subject to potential significant effects. The high points at Strathy Point (Viewpoint 16) and Dunnet Head (Viewpoint 13) were also assessed as key vantage points and visitor attractions and ere not predicted to experience significant effects.

Residual Decommissioning Effects

4.6.86 In accordance with paragraph 4.2.34 of this chapter, no assessment of decommissioning effects has been undertaken in respect of landscape and visual receptors.

4.7 Summary

4.7.1 The preceding LVIA was undertaken by an experienced and competent Landscape Architect and in accordance with an agreed scope and methodology. It considers the current landscape and visual baseline context of the proposed development, which is inextricably linked to the baseline of cumulative developments and surface mining in the vicinity and identifies key sensitive receptors to be addressed in the assessment.

4.7.2 Section 4.4 of the LVIA identifies key impact generators associated with the construction and operation of the proposed development and prioritises them for mitigation in order to ameliorate potential for significant effects on the landscape and visual resource of a 40 km radius study area.

4.7.3 The design of the proposed development was informed by a number of technical, commercial and environmental drivers. Section 4.5 of the LVIA sets out the key guidance and priorities adopted in order to mitigate potential landscape and visual effects.

4.7.4 Section 4.6 of the LVIA describes anticipated residual construction effects, whilst Section 4.7 contains a summary of assessment findings in the following TAs:

- TA 4.4: Assessment of Residual Effects on Landscape Character Types;
- TA 4.5: Assessment of Residual Effects on Designated Landscapes;
- TA 4.6: Wild Land Impact Assessment (WLIA);
- TA 4.7: Viewpoint Assessment;

- TA 4.8: Residential Visual Amenity; and
- TA 4.9: Statistical Rote Analysis.

4.7.5 Table 4.7, below, summarises the significant landscape and visual effects identified by the LVIA for construction and operational phases of the proposed development. It is apparent from this analysis that significant effects would be geographically limited in extent and would not significantly affect nationally important landscapes.

4.7.6 The decommissioning phase of the proposed development would be of a shorter duration to that of the construction phase, with the dismantling of all above ground structures and reinstatement of disturbed ground, subject to a hydrological assessment. Below ground structures would be left in place to avoid further disturbance. There would therefore be a temporary impact from the activities on site to remove structures, but this would be of relatively short duration. Accordingly, the decommissioning phase is considered to be likely to have a minimal effect on the landscape and visual amenity of the locality. Mitigation measures associated with decommissioning would be agreed during the preparation of the final decommissioning plan, that would require approval of statutory consultees and THC.

Table 4.7: Summary of Potential Significant Effects of the Proposed Development

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Construction			
Landscape Fabric	Mitigation as set out in Section 4.5 of this chapter	Embedded mitigation and construction management and reinstatement	Not significant
Landscape Character	Mitigation as set out in Section 4.5 of this chapter	Embedded mitigation and construction management and reinstatement	Not significant
Landscape Designations	Mitigation as set out in Section 4.5 of this chapter	Embedded mitigation and construction management and reinstatement	Not significant
Visual Amenity	Mitigation as set out in Section 4.5 of this chapter	Embedded mitigation and construction management and reinstatement	Not significant
Operation			
Landscape Fabric	Mitigation as set out in Section 4.5 of this chapter	Embedded mitigation reinstatement and post construction management	Not significant
Landscape Character	Mitigation as set out in Section 4.5 of this chapter	Embedded mitigation	Significant effects and cumulative effects are predicted within parts of: LCT 140 LCT 143: Farmed Lowland Plain (THC C9: Farmed Lowland Plain – North Caithness) as well as Seascape Unit 8: North Caithness and Pentland Firth.

Table 4.7: Summary of Potential Significant Effects of the Proposed Development			
Likely Significant Effect	**Mitigation Proposed**	**Means of Implementation**	**Outcome/Residual Effect**
			Significant in-combination effects are predicted at LCTs 141, 143 and Seascape Unit 8
Landscape Designations	Mitigation as set out in Section 4.5 of this chapter	Embedded mitigation	Not significant
Visual Amenity	Mitigation as set out in Section 4.5 of this chapter	Embedded mitigation	Significant effects are predicted on the amenity of: ▪ Parts of Thurso and Dunnet; ▪ A9 northbound receptors approaching Thurso; ▪ A836 between Forss and Thurso and as far as Portskerra and Melvich Bay, and between Dunnet Bay and Thurso; ▪ B870 between Achscrabster and Thurso; ▪ Sections of the Orkney Ferry - Stromness to Thurso ferry route and the Stromness to Thurso route; ▪ Parts of NCR1; and ▪ Core Paths CA09.01, CA13.06, CA13.07 and CA13.10.
Decommissioning			
Landscape Fabric	Mitigation as set out in Section 4.5 of this chapter	Embedded mitigation and construction management and reinstatement	Not significant
Landscape Character	Mitigation as set out in Section 4.5 of this chapter	Embedded mitigation and construction management and reinstatement	Not significant
Landscape Designations	Mitigation as set out in Section 4.5 of this chapter	Embedded mitigation and construction management and reinstatement	Not significant
Visual Amenity	Mitigation as set out in Section 4.5 of this chapter	Embedded mitigation and construction management and reinstatement	Not significant

4.8 Glossary and Abbreviations

4.8.1 TA4.1 contains a glossary of terms relevant to the LVIA, whilst abbreviations used in the LVIA are summarised in the table below.

Abbreviation	**Expanded Term**
LVIA	Landscape and Visual Impact Assessment
ZTV	Zone of Theoretical Visibility
GLVIA	Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidance for Landscape and Visual Impact Assessment – Third Edition.
THC	The Highland Council
SNH	Scottish Natural Heritage
LCT	Landscape Character Type
LCA	Landscape Character Assessment
GDL	Garden and Designed Landscape
NPF	National Planning Framework
SPP	Scottish Planning Policy
HwLDP	Highland Wide Local Development Plan
SG	Supplementary Guidance
SLA	Special Landscape Area
WLA	Wild Land Area
km	Kilometres
m	metres
N	North
NE	Northeast
E	East
SE	Southeast
S	South
SW	Southwest
W	West
NW	Northwest
ha	Hectare

5 Non-Avian Ecology

5.1 Introduction

5.1.1 This chapter considers the likely significant effects on non-avian ecology associated with the construction, operation and decommissioning of the proposed development. The specific objectives of the chapter are to:

- describe the ecology baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

5.1.2 The assessment has been carried out by MacArthur Green and in accordance with Scottish Natural Heritage (SNH) and Scottish Environment Protection Agency (SEPA) guidelines. All staff contributing to this chapter have undergraduate and/or postgraduate degrees in relevant subjects, have extensive professional ecological impact assessment and ecology survey experience, hold professional membership of the Chartered Institute of Ecology and Environmental Management (CIEEM), and abide by the CIEEM Code of Conduct.

5.1.3 This chapter is supported by the following figures and technical appendices:

- Figure 3.2: Layout Design Evolution;
- Figure 5.1: Ecological Designated Sites within 5 km;
- Figure 5.2: NVC Study Area and Survey Results;
- Figure 5.3: Potential Groundwater Dependent Terrestrial Ecosystems (GWDTEs) Study Area and Survey Results;
- Figure 5.4: Hydrological Sensitivity of Potential Groundwater Dependent Terrestrial Ecosystems (GWDTEs);
- Figure 5.5: Protected Species Survey Results;
- Figure 5.6: 2019 Bat Roost Survey Results;
- Figure 2.4.1: Phase 1 and 2 Site Location and Sample Locations;
- Figure 2.4.2: Phase 1 and 2 Peat Depth Sample Locations;
- Figure 2.4.3: Phase 1 and 2 Interpolated Peat Depths;
- Technical Appendix 5.1: National Vegetation Classification & Habitats Survey Report;
- Technical Appendix 5.2: Protected Species Survey Report;
- Technical Appendix 5.3: Bat Survey Report;
- Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm; and
- Technical Appendix 2.4: Phase 1 and Phase 2 Peat Depth & Coring Survey Report.

5.1.4 Figures and technical appendices are referenced in the text where relevant.

5.2 Assessment Methodology and Significance Criteria

Scope of Assessment

5.2.1 This assessment concentrates on the effects of construction, operation and decommissioning of the proposed development upon those ecological features identified during the review of desk-based information and field surveys (the extents of the study areas are set out in the Method of Baseline Characterisation section below). Effects upon the following features are assessed:

- Designated sites: including direct effects (i.e. derived from land-take or disturbance to habitats and/or protected species) and indirect effects (i.e. changes caused by effects to supporting systems such as groundwater or over land flow).
- Terrestrial habitats: including direct effects (i.e. derived from land-take) and indirect effects (i.e. changes caused by effects to supporting systems such as groundwater or over land flow).
- Aquatic habitats: effects are limited to the ecological impacts of changes in water conditions through potential pollution effects.
- Protected species: including direct effects (i.e. loss of life as a result of the proposed development; loss of key habitat; displacement from key habitat; barrier effects preventing movement to/from key habitats; and general disturbance) and indirect effects (i.e. loss/changes of/to food resources; population fragmentation; degradation of key habitat e.g. as a result of pollution).
- Groundwater Dependent Terrestrial Ecosystems (GWDTE): SEPA has classified a number of NVC communities as potentially dependent on groundwater[1]. Many of the NVC communities on the list are very common habitat types across Scotland and generally of low nature conservation value. Furthermore, some of the NVC communities may be considered GWDTE only in certain hydrogeological settings. Because designation as a potential GWDTE is related to groundwater dependency and not nature conservation value, GWDTE status has not been used as criteria to determine a habitat's nature conservation value. There is however a statutory requirement to consider GWDTEs and the data gathered during the NVC surveys has been used to inform this assessment. The GWDTE assessment is presented within Annex C of Technical Appendix 5.1: National Vegetation Classification and Habitats Survey Report.

5.2.2 The chapter assesses cumulative effects as arising from the addition of the proposed development in combination with other relevant projects. Operational, under construction and consented developments are considered as part of the baseline.

5.2.3 The assessment is based on the proposed development as described in Chapter 2: Development Description.

5.2.4 The scope of the assessment has been informed by consultation responses summarised in Table 5.1 and the legislation, policy and guidance set out in the subsections below.

Legislation

5.2.5 This assessment is carried out in accordance with the principles contained within the following European legislation:

[1] SEPA. (2017). 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. Version 3. Issue date: 11/09/2017.

- European Union Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora;
- European Union Council Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy ("Water Framework Directive"); and
- Environmental Impact Assessment Directive 2014/52/EU.

5.2.6 The following national legislation is considered as part of the assessment:

- The Wildlife and Countryside Act 1981 (as amended);
- The Protection of Badgers Act 1992 (as amended);
- The Water Environment and Water Services (Scotland) Act 2003 (as amended) (WEWS);
- The Nature Conservation (Scotland) Act 2004 (as amended);
- The Wildlife and Natural Environment (Scotland) Act 2011;
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (''The Habitats Regulations'');
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended); and
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2011.

Policy & Guidance

5.2.7 This assessment is carried out in accordance with the principles contained within the following documents:

- CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (3rd Edition) (Version 1.1 Updated September 2019);
- Collins, J. (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). Bat Conservation Trust;
- European Commission (2010). Natura 2000 Guidance Document '*Wind Energy Developments and Natura 2000'*. European Commission, Brussels;
- European Commission (2011). Wind Energy Developments and Natura 2000;
- Hundt, L. (2012). Bat Surveys: Good Practice Guidelines (2nd edition). Bat Conservation Trust;
- Joint Nature Conservation Committee (2013). Guidelines for selection of biological Sites of Special Scientific Interest (SSSI);
- Natural England (2014). Natural England Technical Information Note TIN 051. *Bats and Onshore Wind turbines – Interim Guidance* (3rd Edition);
- Rodrigues L., Bach L., Dubourg-Savage M.J., Karapandza B., Kovac D., Kervyn T., Dekker J., Kepel A., Bach P., Collins J., Harbusch C., Park K., Micevski B., Minderman J. (2014). Guidelines for consideration of bats in windfarm projects. Revision 2014. EUROBATS Publication Series No. 6;
- Scottish Biodiversity Strategy: It's in Your Hands (2004)/2020 Challenge for Scotland's Biodiversity (2013);
- Scottish Government (2017). Planning Circular 1/2017: Guidance on The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011;

- Scottish Executive (2000). Nature conservation: implementation in Scotland of EC Directives on the conservation of natural habitats and of wild flora and fauna and the conservation of wild birds (‘The Habitats and Birds Directives’). Revised guidance updating Scottish Office Circular no. 6/1995;
- Scottish Executive (2004). The Scottish Biodiversity Strategy: It's in Your Hands;
- Scottish Executive (2006). The Scottish Forestry Strategy (SFS);
- Scottish Government (2001). European Protected Species, Development Sites and the Planning Systems: Interim guidance for local authorities on licensing arrangements;
- Scottish Government (2010). Management of Carbon-Rich Soils;
- Scottish Government (2013). 2020 Challenge for Scotland's Biodiversity;
- Scottish Government (2016). Draft Peatland and Energy Policy Statement;
- Scottish Government (2017). Planning Advice Note 1/2013 - Environmental Impact Assessment, Revision 1.0;
- Scottish Government (2018). Climate Change Plan: Third Report on Policies and Proposals 2018-2032;
- Scottish Government, SNH and SEPA (2017). Peatland Survey - Guidance on Developments on Peatland;
- Scottish Renewables, SNH, SEPA, Forestry Commission (Scotland), Historic Environment Scotland, Marine Scotland Science, AEECOW (2019). Good Practice During Windfarm Construction (4th Edition);
- SEPA (2017). Land Use Planning System Guidance Note 4 - Planning guidance on on-shore windfarm developments;
- SEPA (2017). Land Use Planning System Guidance Note 31 - Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems;
- SERAD (Scottish Executive Rural Affairs Department) (2000). Habitats and Birds Directives, Nature Conservation: Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and of Wild Flora and Fauna and the Conservation of Wild Birds (‘The Habitats and Birds Directives’). Revised Guidance Updating Scottish Office Circular No 6/1995;
- Scottish Natural Heritage (2012). Assessing the Cumulative Impact of Onshore Wind Energy Developments;
- Scottish Natural Heritage (2013). Planning for Development: What to consider and include in Habitat Management Plans;
- Scottish Natural Heritage (2015). Scotland’s National Peatland Plan;
- Scottish Natural Heritage (2018). Environmental Impact Assessment Handbook – Version 5: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland;
- Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter & Bat Conservation Trust (2019). Bats and Onshore Wind Turbines: Survey Assessment and Mitigation;
- The Caithness Biodiversity Action Plan (2003); and
- UK Post-2010 Biodiversity Framework (2012).

Consultation

5.2.8 Full details on the consultation responses can be reviewed in Technical Appendix 1.1: Consultation Register.

5.2.9 In undertaking the assessment, full consideration has been given to consultation undertaken with relevant organisations. Table 5.1 below outlines the consultation responses where more detailed consideration was required, or additional consultation has been undertaken and provides information on where and/or how they have been addressed in the assessment.

Table 5.1: Consultation Responses

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
The Highland Council (THC) 8th August 2016	Scoping	The Environmental Statement (ES) should provide a baseline survey (species and location) of the animal (including European Protected Species) interests on site.	Protected Species Surveys were undertaken in 2014, 2018 and 2019. The results are outlined in Technical Appendices 5.2: Protected Species Survey Report and 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm.
Scottish Natural Heritage (SNH) 28th July 2016	Scoping	Non-avian ecology surveys should be completed no more than 18 months prior to submission of the ES.	Contemporary Protected Species Surveys were undertaken in 2018 and 2019. The results are outlined in Technical Appendix 5.2: Protected Species Survey Report.
Scottish Environment Protection Agency (SEPA) 19th July 2016	Scoping	Map and assess impacts on GWDTE.	The potential impacts on potential GWDTE have been assessed in Annex C of Technical Appendix 5.1: National Vegetation Classification & Habitats Survey Report and illustrated in Figures 5.3 and 5.4 (Volume 3a).
SNH 25th February 2019	Post-scoping	A letter was issued to SNH by MacArthur Green to provide details of the assessment of the site for bats to date, proposed 2019 roost surveys and justification as to why updated activity surveys were not considered necessary for the proposed development. SNH responded on 21st March 2019 to say they welcomed new roost surveys at the site in 2019. Updated bat activity surveys would be recommended, however, given the previous assessment of the site in 2014 (low risk for bats) and that no significant changes have occurred to the habitat since this time, SNH agree that the 2014 data is likely to be still	Updated roost surveys were undertaken in 2019, with the results outlined in Technical Appendix 5.3: Bat Survey Report. It has been noted that the ES should contain the justification for the use of the 2014 bat data. This information is available in paragraphs 5.3.54 to 5.3.58 of this ES.

Table 5.1: Consultation Responses			
Consultee and Date	**Scoping / Other Consultation**	**Issue Raised**	**Response / Action Taken**
		relevant for the site and can be used for an EIA assessment. SNH recommends that justifications for use of the 2014 data is included within the ES for completeness.	
SNH 11th April 2019	Post-scoping	A letter was issued to SNH by MacArthur Green to provide details of the updated bat roost surveys, conducted on the 6th March 2019. 'Blackheath' and 'Hopefield' buildings were identified as having moderate potential for bats. Blackheath marginally fell within the 200 m buffer, plus rotor radius of the layout at the time of consultation. The letter provided justification on unlikely negative impact from the turbine or wider development on the building, if a roost feature was present. SNH responded on 30th April 2019 to state that it agrees with the proposed approach, given the level of detail and justification provided in the supporting information. SNH would encourage this information to be included within the ES for the proposed development. SNH also commented that, from the photographs of the Blackheath property and the location information, the building is unsuitable for breeding but use by a small number of bats (as a non-breeding roost) cannot be ruled out. SNH noted that what has been proposed in terms of mitigation in the event that bats are found (e.g. buffers etc) is proportionate.	The results of the updated bat roost surveys are provided in Technical Appendix 5.3: Bat Survey Report. It has been noted that the ES should contain the justification and proposals for the Blackheath property. This information is included within paragraph 5.3.74 of this ES. Since this consultation the proposed development layout has been revised further and now avoids overlap with recommended bat roost disturbance buffers.
SEPA 03rd April 2019 - 20th September 2019	Post-scoping Email Correspondence	SEPA were consulted by MacArthur Green post-scoping and pre-application via ongoing email correspondence from 03rd April 2019 to 20th September 2019 in relation to the layout and design of the proposed development with regards to SEPAs remit on potential impacts to GWDTE, peatland, and hydrological sensitivities. Correspondence included the provision of baseline NVC data,	Following the consultations with SEPA, the following actions and responses were undertaken, and commitments made, to inform and agree on the proposed development layout: Existing infrastructure is utilised as far as practicable; Undertake an assessment of areas of potential GWDTE (see Annex C of Technical Appendix 5.1: National

Table 5.1: Consultation Responses			
Consultee and Date	**Scoping / Other Consultation**	**Issue Raised**	**Response / Action Taken**
		peat depth data, and locations of hydrological sensitivities (such as watercourses) overlain by proposed infrastructure layouts. During this ongoing correspondence and consultation, concerns raised by SEPA on the siting of some infrastructure elements were considered and the proposed layout amended. The proposed development layout as presented in this application has been agreed with SEPA, pursuant to pre-construction planning conditions to be proposed by SEPA being met, and the implementation of associated commitments made within this ES.	Vegetation Classification & Habitats Survey Report); Except where a minimum number of watercourse crossings are required, a 50 m buffer has been applied off major watercourses and a 25 m buffer of minor watercourses (N.B. no major watercourses require new crossings); The modified linear water feature at T2 will be sensitively rerouted before further works in the area would take place in order to avoid direct impacts on the feature and improve the hydromorphology (details and plans to be agreed upon further detailed survey post-consent and pre-construction - see Technical Appendix 2.5: Hydrological Sensitivities); and The modified linear water feature northwest of T6 will be sensitively rerouted further from this area to improve the hydromorphology of the feature and allow the micrositing of T6 to maintain a minimum 25 m buffer from the watercourse immediately to the east of T6 (details and plans to be agreed upon further detailed survey post-consent and pre-construction - see Technical Appendix 2.5: Hydrological Sensitivities). SEPA also acknowledge that the majority of the site is underlain by shallow peat. However, given design alterations since the Phase 2 peat depth probing was undertaken, there are some areas with comparatively fewer sample probes. Such areas should be subject to further depth probing to inform any micrositing requirements and peat management, however SEPA acknowledge this can be undertaken at the post-consent and pre-construction stage.

Potential Effects Scoped-out

5.2.10 No construction or operational effects were scoped-out prior to commencement of desk-based and field surveys, and determination of the presence and distribution of ecological features in relation to the planned infrastructure and activities associated with the proposed development. On the basis of the results of the desk-based and survey work undertaken, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, the following species and habitats/habitat features have been 'scoped-out' of the assessment.

5.2.11 Generally, common or widely distributed habitats or species which <u>do not</u> fall within the following categories were scoped-out of the assessment:

- Annex I habitats of the Habitats Directive, and species on Annex II of the Habitats Directive;
- UK Biodiversity Action Plan (UKBAP) or Scottish Biodiversity List (SBL) Priority Habitats[2]; and
- Habitats or species protected by other legislation such as The Wildlife and Countryside Act 1981 (as amended), the Nature Conservation (Scotland) Act 2004 (as amended), or The Protection of Badgers Act 1992 (as amended).

Method of Baseline Characterisation

Extent of the Study Area

5.2.12 This ecological assessment focuses on the site and appropriate buffer areas (collectively the 'study areas') which have been applied. The area within which the desk-based research and field surveys were undertaken varies depending on the ecological feature and its search/survey requirements. Details of the extent of each study area are outlined below and are also detailed in associated Technical Appendices 5.1 to 5.4 and Figures 5.1 to 5.6 (ES Volume 3a).

5.2.13 The specific field study areas are as follows:

- National Vegetation Classification (NVC) & Habitats: surveys within the majority of the site area and buffers appropriate to account for the presence of potential GWDTE (100 m and 250 m buffers as a minimum[3,4]). The NVC study area covered a total of 501.76 hectares (ha). Further information is provided within Technical Appendix 5.1: National Vegetation Classification and Habitats Survey Report and on Figure 5.2.
- Protected species (otter *(Lutra lutra),* water vole *(Arvicola amphibius*), badger (*Meles meles*), red squirrel (*Sciurus vulgaris*) and pine marten (*Martes martes*): surveys undertaken as part of the Extended Phase 1 survey in 2014 were conducted within the site boundary, as it was proposed at the time the surveys were undertaken (i.e. Option A Hill of Forss site boundary in Figure 3.2, which is within the finalised site boundary) (see Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm for more information). Surveys undertaken in

[2] Scottish Government (2013). Scottish Biodiversity List. URL: http://www.gov.scot/Topics/Environment/Wildlife-Habitats/16118/Biodiversitylist/SBL [April 2019].

[3] SEPA. (2017a). 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. Version 3.

[4] SEPA. (2017b). Land Use Planning System SEPA Guidance Note 4: Planning guidance on on-shore windfarm developments. Version 3.

2018 and 2019 were conducted around the most up to date proposed infrastructure locations at that time with survey buffers appropriate for each species, and also included a fisheries habitat survey (see Technical Appendix 5.2: Protected Species Survey Report and Figure 5.5).

- Bats: surveys undertaken in 2014 were conducted within the site boundary as proposed at the time the surveys were undertaken (i.e. Option A Hill of Forss site boundary in Figure 3.2; see Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm). A preliminary bat roost assessment was conducted in 2019 (as agreed with SNH; see Table 5.1), around the most up to date proposed infrastructure locations at that time (see Technical Appendix 5.3: Bat Survey Report and Figure 5.6).
- Peat depth & peat coring survey: the peat surveys conducted in 2016, 2018 and 2019, were all conducted within the site boundary, with Phase 2 surveys focussed around the proposed infrastructure as proposed at the time the surveys were conducted (i.e. Option C Layout in Figure 3.2) (see Technical Appendix 2.4: Phase 1 and Phase 2 Peat Depth & Coring Survey and Figure 2.4.1).

Desk Study

5.2.14 A desk study was undertaken to collate available ecological information in relation to the proposed development and surrounding environment. The following data sources were considered as part of the determination of scope of baseline surveys and assessment:

- National Biodiversity Network (NBN) Atlas website for historical species records[5];
- SNH SiteLink for designated site information[6];
- Deer Distribution Survey 2016 results by the British Deer Society[7];
- Ancient Woodland sites within 5 km of the proposed development[8]; and
- Carbon and Peatland Map 2016[9].

Field Survey

5.2.15 Ecological fieldwork (including peat surveys) commenced in July 2014 and was completed in March 2019. The following field surveys were undertaken to establish the baseline ecological conditions and methods used standard best practice (see Technical Appendices 5.1 to 5.4 and Technical Appendix 2.4: Phase 1 and Phase 2 Peat Depth & Coring Survey Report (ES Volume 4) for further details).

5.2.16 All field surveys outlined below were undertaken by MacArthur Green, unless otherwise specified.

[5] https://scotland.nbnatlas.org [May 2019].

[6] Scottish Natural Heritage. (n.d.) SiteLink. URL: https://sitelink.nature.scot/home. [May 2019].

[7] The British Deer Society. Deer Distribution Survey Results 2016. URL: https://www.bds.org.uk/index.php/research/deer-distribution-survey. [May 2019].

[8] Scottish Government. 2015. Ancient Woodland Inventory (Scotland). URL: https://data.gov.uk/dataset/c2f57ed9-5601-4864-af5f-a6e73e977f54/ancient-woodland-inventory-scotland. [May 2019].

[9] Scottish Natural Heritage (2016). Carbon and Peatland 2016 map. URL: http://map.environment.gov.scot/Soil_maps/?layer=10. [May 2019].

EXTENDED PHASE 1 HABITAT SURVEY

5.2.17 Surveys were undertaken as follows:

- Extended phase 1 survey (including protected species): 3rd to 4th July 2014 (undertaken by Caledonian Conservation).

5.2.18 Further information related to these surveys and their methods can be found in Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm.

NATIONAL VEGETATION CLASSIFICATION & HABITATS SURVEYS

5.2.19 Surveys were undertaken as follows:

- 2014: 3rd to 4th July (undertaken by Caledonian Conservation);
- 2018: 27th to 29th August 2018; and
- 2019: 5th and 6th March 2019.

5.2.20 The surveys in 2018 were conducted to verify the habitats and communities recorded during the 2014 baseline survey. This included adding further resolution to the mapping, where necessary, making updates to vegetation communities and classification, if required, and collecting further information on the habitats present, via additional target notes and photographs. Surveys in 2019 were undertaken to survey additional areas not covered in the original surveys.

5.2.21 Further information is provided in Technical Appendix 5.1: National Vegetation Classification and Habitats Survey Report and Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm.

PEAT DEPTH & CORING SURVEYS

5.2.22 Surveys were undertaken as follows:

- 2016: 7th to 9th September (peat depth surveys – 'phase 1 probing');
- 2018: 28th to 31st August (peat depth – 'phase 2 probing' and coring surveys); and
- 2019: 4th to 7th March (peat depth surveys – 'additional phase 2 probing').

5.2.23 Further information related to the peat depth and coring surveys and their methods can be found in Technical Appendix 2.4: Phase 1 and Phase 2 Peat Depth Coring Survey.

PROTECTED SPECIES SURVEYS

5.2.24 Surveys were undertaken as follows:

- 2014: surveys undertaken as part of the Extended Phase 1 Habitat Survey (see paragraph 5.2.17 above) on 3rd and 4th July (undertaken by Caledonian Conservation);
- 2018: 28th and 29th August; and
- 2019: 6th March 2019.

5.2.25 Further information related to the protected species surveys and their methods can be found in Technical Appendix 5.2: Protected Species Survey Report and Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm.

BAT SURVEYS

5.2.26 The following surveys were undertaken in 2014 by Caledonian Conservation:

- Walkover survey: conducted in May 2014;
- Bat habitat assessment survey: conducted in May 2014;

- Building roost survey: conducted in May 2014;
- Bat activity line transects: 21st May, 14th July and 24th September; and
- Remote static bat survey: 18th to 23rd May, 10th to 15th July and 15th to 23rd September.

5.2.27 Further information related to the 2014 bat surveys and their methods can be found in Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm.

5.2.28 Surveys were also undertaken by MacArthur Green as follows:

- 2019: a preliminary bat roost assessment was carried out to update the baseline on 6th March 2019.

5.2.29 Further information related to the bat surveys undertaken in 2019 can be found in Technical Appendix 5.3: Bat Survey Report.

Criteria for the Assessment of Effects

5.2.30 This section defines the methods used to assess the significance of effects on Important Ecological Features (IEFs) through the process of an evaluation of Nature Conservation Value, Conservation Status and Magnitude of Effect.

5.2.31 There can often be varying degrees of uncertainty over the sensitivity of receptors or magnitude of impacts as a result of limited information. A precautionary approach is therefore adopted where the response of a population to an impact is uncertain.

5.2.32 The evaluation for wider-countryside interests (interests unrelated to a Special Area of Conservation (SAC)) involves the following process:

- identification of the potential ecological impacts of the proposed development, including both beneficial and adverse;
- consideration of the likelihood of occurrence of potential impacts where appropriate;
- defining the Nature Conservation Value of the important ecological features present;
- establishing the feature’s conservation status where appropriate;
- establishing the magnitude of the likely impact (both spatial and temporal);
- based on the above information, a professional judgement is made as to whether the identified effect is significant in the context of the EIA Regulations;
- if a potential effect is determined to be significant, measures to avoid, reduce, mitigate or compensate for the effect are suggested where required;
- opportunities for enhancement are considered; and
- residual effects after mitigation, compensation or enhancement are considered.

Determining Nature Conservation Value of Ecological Features

5.2.33 Nature Conservation Value is defined on the basis of the geographic context given in Table 5.2 (which follows standard CIEEM guidance[10]). Attributing a value to an ecological feature is generally straightforward in the case of designated sites, as the designations themselves are normally indicative of an importance level. For example, a SAC, designated under the Habitats Directive, is implicitly of European (International) importance. In the case of species, assigning value is less straightforward as contextual information about

[10] CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (3rd Edition) (Version 1.1 Updated September 2019).

distribution and abundance is fundamental, including trends based on historical records. This means that even though a species may be protected through legislation at a national or international level, the relative value of the population on site may be quite different (e.g. the site population may consist of a single transitory animal, which within the context of a thriving local/regional/national population of a species, is therefore of local or regional value rather than national or international).

5.2.34 Where possible, the valuation of habitat/populations within this assessment will make use of any relevant published evaluation criteria (e.g. The SBL[11], Joint Nature Conservancy Council (JNCC) on selection of biological SSSIs[12]). Furthermore, JNCC guidance[13] has been consulted, where relevant, so that cross-referencing of classifications within different systems can be standardised (e.g. correctly matching NVC types with Annex I habitats where relevant etc.).

5.2.35 Where relevant, information regarding a feature's conservation status is also considered to fully define its importance. This enables an appreciation of current population or habitat trends to be incorporated into the assessment.

Table 5.2: Approach to Valuing Ecological Features[14]

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

[11] Scottish Government (2013). Scottish Biodiversity List. URL: http://www.gov.scot/Topics/Environment/Wildlife-Habitats/16118/Biodiversitylist/SBL [April 2019].

[12] JNCC (2013). Guidelines for selection of biological SSSIs. URL: http://jncc.defra.gov.uk/page-2303 [April 2019].

[13] JNCC (2014). NVC & Other Classifications. URL: http://jncc.defra.gov.uk/page-4266 [April 2019].

[14] Adapted from Hill, D, Fasham, M, Tucker, G, Shewry, M and Shaw, P (2005). *Handbook of Biodiversity Methods – Survey, Evaluation and Monitoring*. Cambridge University Press, Cambridge.

5.2.36 IEFs to be assessed were taken to be those features of local, regional, national and international importance.

Criteria for Assessing the Magnitude of Change

5.2.37 Determining the magnitude of any likely effects requires an understanding of how the ecological features are likely to respond to the proposed development. This change can occur during construction or operation of the proposed development.

5.2.38 Effect magnitude refers to changes in the extent and integrity of an ecological receptor. A suitable definition of ecological 'integrity' is found within Scottish Executive circular 6/1995 updated in Scottish Executive 2000[15] which states that, "*The integrity of a site is the coherence of its ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified*". Although this definition is used specifically regarding European level designated sites (SACs and SPAs), it is applied to wider countryside habitats and species for the purposes of this assessment.

5.2.39 Effects can be adverse, neutral or beneficial. Effects are judged in terms of magnitude in space and time. There are five levels of spatial effects and five levels of temporal effects as described in Table 5.3 and Table 5.4 respectively.

Table 5.3: Definition of Spatial Effect Magnitude upon IEFs

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

Table 5.4: Definition of Temporal Effect Magnitude upon IEFs

Temporal Magnitude	Description
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken here as 30+ years), except where there is likely to be substantial improvement after this period in which case the category Long Term may be more appropriate.
Long term	Between 15 years up to (and including) 30 years.
Medium term	Between 5 years up to (but not including) 15 years.
Short term	Up to (but not including) 5 years.
Negligible	No effect.

[15] Scottish Executive (2000). Nature conservation: implementation in Scotland of EC Directives on the conservation of natural habitats and of wild flora and fauna and the conservation of wild birds ('The Habitats and Birds Directives'). Revised guidance updating Scottish Office Circular no. 6/1995.

Criteria for Assessing Cumulative Effects

5.2.40 SNH's cumulative assessment guidance[16] is used to inform the cumulative assessment in this chapter. Cumulative effects are not possible to evaluate through the study of one development in isolation but require the assessment of effects when considered in combination with other developments, projects or activities. However, in the interests of focusing on the potential for significant effects, this assessment considers the potential for cumulative effects with other EIA developments. The context in which these effects are considered is heavily dependent on the ecology of the feature assessed. For example, for water voles it may be appropriate to consider effects specific to individual catchments, should the distance between neighbouring catchments be sufficient to assume no movement of animals between them, whereas for blanket bog the region/Natural Heritage Zone may be the relevant spatial scale. Therefore, an assessment of cumulative impacts will be made for each scoped-in feature, appropriate to its ecology.

Criteria for Assessing Significance

5.2.41 The potential significance of the effect was determined through a standard method of assessment based on professional judgement, considering the nature conservation value of the IEF and the magnitude of change.

5.2.42 Table 5.5 details the significance criteria that have been used in assessing the effects of the proposed development. 'Major' and 'Moderate' impacts are considered to be Significant in accordance with EIA Regulations. 'Minor' and 'Negligible' impacts are considered to be Not Significant in accordance with EIA Regulations.

Table 5.5: Significance Criteria

Level of Significance of Effect	**Description**
Major	**Significant effect**, as the effect is likely to result in a long term significant adverse effect on the integrity of the feature.
Moderate	**Significant effect**, as the effect is likely to result in a medium term or partially significant adverse effect on the integrity of the feature.
Minor	The effect is likely to adversely affect the feature at an insignificant level by virtue of its limited duration and/or extent, but there will probably be no effect on its integrity. The level of effect would be **Minor and Not Significant.**
Negligible	No material effects. The effect is assessed to be **Not Significant**.

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

Limitations and Assumptions

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

[16] SNH (2012). Assessing the Cumulative Impact of Onshore Wind Energy Developments.

5.2.45 Ecological surveys are limited by factors which affect the presence of plants and animals such as the time of year and behaviour. The ecological surveys undertaken to support the proposed development have not therefore produced a complete list of plants and animals and the absence of evidence of any particular species should not be taken as conclusive proof that the species is not present or that it would not be present in the future. However, the results of these surveys are considered to be robust and sufficient to undertake this assessment.

5.2.46 Therefore, whilst some limitations have been identified, it is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant effects on important ecological features.

5.3 Baseline Conditions

Current Baseline

5.3.1 This section details the results of the desk-study and field surveys, providing the baseline conditions for the site, and includes:

- statutory nature conservation designated sites within 5 km of the site;
- desk-based study results;
- habitats and vegetation; and
- protected or notable species recorded during baseline surveys.

Designated Sites

5.3.2 Information gathered from the desk-based study and consultation exercise revealed that the proposed development is within 5 km of seven designated sites with qualifying interests related to ecology (ES Volume 3a: Figure 5.1, and Table 5.6 below).

Table 5.6: Designated Sites within 5 km of the Proposed Development

Designated Site Name	Distance from Proposed Development	Qualifying Feature Category	Qualifying Features (Ecological)	Status
Newlands of Geise Mire	1.46 km	SSSI	Valley fen	Favourable Maintained 08/08/2012
Holborn Head	1.85 km	SSSI	Maritime cliff	Favourable Maintained 05/09/2006
Westfield Bridge	1.96 km	SSSI	Fen meadow Lowland calcareous grassland	Favourable Maintained 07/08/2003 Unfavourable Declining 20/06/2013
Loch Lieurary	2.07 km	SSSI	Basin fen	Favourable Maintained 14/08/2008
Ushat Head	2.15 km	SSSI	Maritime cliff	Favourable Maintained 14/08/2006
River Thurso	3.42 km	SSSI	Floodplain fen	Unfavourable No Change 29/05/2008

Table 5.6: Designated Sites within 5 km of the Proposed Development				
Designated Site Name	**Distance from Proposed Development**	**Qualifying Feature Category**	**Qualifying Features (Ecological)**	**Status**
			Vascular plant assemblage	Favourable Maintained 02/07/2014
River Thurso	3.42 km	SAC	Atlantic salmon (*Salmo salar*)	Unfavourable Recovering 01/10/2011

Desk-Based Studies

Ancient Woodland

5.3.3 There are two small areas of woodland within 5 km of the site which are listed on the Ancient Woodland Inventory (AWI). These areas are located 860 m west of the site by Bridge of Forss and 4,582 m east of the site (ES Volume 3a: Figure 5.1).

NBN Atlas

5.3.4 A search on the NBN Atlas for species records within a 10 km buffer of the site for the last 10 years (i.e. 2009 and onwards) contained records for the following relevant protected or notable species:

- Atlantic salmon;
- Common pipistrelle (Pipistrellus pipistrellus);
- Daubenton's bat (*Myotis daubentonii*);
- Otter;
- Pine marten (*Martes martes*);
- Red deer (*Cervus elaphus*); and
- Roe deer (Capreolus capreolus).

Deer Distribution Survey

5.3.5 Every five years the British Deer Society undertakes a survey plotting the current distribution of all six species of wild deer in Great Britain and Northern Ireland and uses it to monitor and record changes from the previous survey to establish if the range has changed.

5.3.6 The results of the 2016 Deer Distribution Survey[17] indicate the following in the area where the site is located:

- Red deer were recorded in 2007 and/or 2011 but unconfirmed in 2016; and
- Roe deer were recorded in 2007 and/or 2011 and reconfirmed in 2016.

5.3.7 No other deer species have been recorded in the area of the site.

[17] The British Deer Society (2016). Deer Distribution Survey Results. URL: https://www.bds.org.uk/index.php/research/deer-distribution-survey. [May 2019].

CARBON & PEATLAND MAP 2016

5.3.8 The Carbon and Peatland Map 2016[18] was consulted to determine likely peatland classes present at the site. The map provides an indication of the likely presence of peat at a coarse scale and has been developed as "*a high-level planning tool to promote consistency and clarity in the preparation of spatial frameworks by planning authorities*"[18]. It identifies areas of "*nationally important carbon-rich soils, deep peat and priority peatland habitat*" as Class 1 and Class 2 peatlands. Class 1 peatlands are also "*likely to be of high conservation value*" and Class 2 peatlands "*of potentially high conservation value and restoration potential*".

5.3.9 According to the Carbon and Peatland Map 2016[18], there is no peat present within the site. As the Carbon and Peatland Map is a high-level tool, detailed habitat and peat depth surveys have also been carried out across the peat study area to inform the detailed site assessment on peatland and associated habitats, which is required to identify actual effects of the proposal; including siting, design and mitigation. The results of the habitat surveys are discussed below, and the results of the peat depth surveys are discussed in Technical Appendix 2.4: Phase 1 and Phase 2 Peat Depth & Coring Survey.

Field Surveys

5.3.10 Details regarding field survey methodologies and results are included within Technical Appendices 5.1 – 5.4. The following section summarises the baseline conditions as identified during these surveys.

Habitat Surveys

5.3.11 The following paragraphs outline the baseline data for the habitat surveys. Where the text refers to the 'NVC study area', it is referring to the full area within which the NVC surveys were undertaken (see Technical Appendix 5.1: National Vegetation Classification and Habitats Survey Report and Figure 5.2). Where the term 'site' is used, this refers to the area within the site boundary.

5.3.12 Surveys followed the NVC scheme[19] using standard methods[20]. The NVC study area covered 501.76 hectares (ha) and in places is within or outwith the site boundary as a consequence of the requirement to ensure sufficient buffer areas were surveyed to account for the presence of potential GWDTEs, in line with SEPA guidance[21]. The NVC study area also extends beyond the recommended buffers in some instances, as the surveys were completed in relation to previous design layouts that extended across a larger area than the proposed development. The site extends to an area of 358.49 ha, however 26.77 ha of this was not surveyed as it was distant from proposed infrastructure or outwith necessary survey buffers (see Figure 5.2; see also 'NSA' within Table 5.7 below). Baseline information is provided here on the entire NVC study area to allow characterisation of the proposed development in the context of the wider local setting.

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[18] Scottish Natural Heritage (2016). Carbon and Peatland 2016 map. URL: http://map.environment.gov.scot/Soil_maps/?layer=10. [May 2019].

[19] Rodwell, J.S. (Ed) *et al*. (1991 – 2000). *British Plant Communities* (5 volumes). Cambridge University Press, Cambridge.

[20] Rodwell, J.S. (2006). *NVC Users' Handbook*. ISBN 978 1 86107 574 1.

[21] SEPA (2017). Land Use Planning System SEPA Guidance Note 4: *Planning guidance on on-shore windfarm developments*. Version 3. Issue date: 11/09/2017 and SEPA (2017). 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*. Version 3. Issue date: 11/09/2017.

5.3.13 The 2018 surveys were undertaken to verify and update the habitats and communities recorded during the 2014 baseline surveys, or to provide further resolution to the mapping, where any of this was required (as outlined in paragraph 5.2.20). The 2019 surveys were undertaken to survey additional areas not covered during the original surveys. As this walkover survey only resulted in minor updates to the 2014 vegetation classification of the site, those survey results remain valid. All data have been collated and are presented together within this Chapter.

PHASE 1 HABITATS

5.3.14 The NVC data was cross-referenced to the Phase 1 Habitat Survey Classification[22] to allow a broader characterisation of habitats. The extent of Phase 1 habitat types within the NVC study area and site was calculated using the correlation of specific NVC communities to their respective site-specific Phase 1 types (see Table 5.7 below), and their extents were determined within GIS; including within mosaic areas.

5.3.15 The results of the habitat surveys and this analysis are summarised below in Table 5.7; which includes the data collated from the 2014, 2018 and 2019 habitat surveys. Figure 5.2 displays the Phase 1 and NVC survey results for the NVC study area (N.B. The Phase 1 shading in Figure 5.2 has been used to broadly characterise stands of vegetation based on the dominant NVC community within a particular area).

Table 5.7: Phase 1 Habitat Types within the NVC Study Area and Site

Phase 1 Habitat Code	Phase 1 Habitat Description	Corresponding NVC & Other Habitat Types Recorded	NVC Study Area (ha)	Site Area (ha)	% of NVC Site Area
A2.1	Scrub: dense/continuous	W23	5.19	4.30	1.20
B1.1/B1.2	Acid grassland: unimproved & semi-improved	U4, U4b, U5, U5c	55.63	48.22	13.45
B2.1	Neutral grassland: unimproved	MG1	7.00	6.79	1.90
B2.2	Neutral grassland: semi-improved	MG5, MG10, MG10a	13.05	8.04	2.24
B3.1	Calcareous grassland: unimproved	CG10	0.09	0.00	0.00
B4	Improved grassland	MG6	96.42	57.12	15.93
B5	Marsh/marshy grassland	M23, M23b, M25b, SSM, Cn, Je	50.85	28.59	7.98
C3.1	Tall herb & fen – tall ruderal	OV25, OV27	0.32	0.32	0.09
D1.1	Dry dwarf shrub heath – acid	H9, H10	10.64	10.44	2.91
D2	Wet dwarf shrub heath	M15, M15a, M15b, M15c, M15d, Mvar	192.45	123.66	34.49
E1.7	Wet modified bog	M17, M17b, M19	18.65	0.88	0.25

[22] Joint Nature Conservation Committee, JNCC, (2010). *Handbook for Phase 1 habitat survey - a technique for environmental audit.* http://jncc.defra.gov.uk/PDF/pub10_handbookforphase1habitatsurvey.pdf

Table 5.7: Phase 1 Habitat Types within the NVC Study Area and Site					
Phase 1 Habitat Code	**Phase 1 Habitat Description**	**Corresponding NVC & Other Habitat Types Recorded**	**NVC Study Area (ha)**	**Site Area (ha)**	**% of NVC Site Area**
E2.1	Flush/spring: acid/neutral	M4, M6	3.13	0.48	0.13
E2.2	Flush/spring: basic	M10	0.06	0.06	0.02
F1	Swamp	S9, S10, S27, Svar	1.48	1.24	0.35
G1.4	Standing water – dystrophic	M1, M2, Mt, SW	0.55	0.005	0.001
J1.1	Arable	AR	38.84	37.05	10.33
J1.2	Amenity grassland	PG	0.19	0.19	0.05
J3.6	Buildings	BD	0.33	0.33	0.09
J4	Bare ground	BG	6.87	4.01	1.12
NSA	Non-Surveyed Area	NSA	N/A	26.77	7.47
TOTAL			**501.76**	**358.49**	**100**

NVC COMMUNITIES

5.3.16 The NVC communities and non-NVC habitat types recorded within the NVC study area are detailed in Table 5.8 below and include the proportions of a particular community or habitat type that are found within the NVC study area, including proportions within mosaic habitats. Descriptions of the habitats, NVC communities and associated flora of the NVC study area are provided in Technical Appendix 5.1: National Vegetation Classification and Habitats Survey Report, Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm and are displayed in Figure 5.2.

5.3.17 The NVC surveys recorded 25 recognised NVC communities within the NVC study area, with various associated sub-communities; however, only a small number of communities account for the majority of the NVC study area and site (Table 5.8). In addition, a number of non-NVC habitat types or features were also mapped, such as recently ploughed fields, non-NVC mires, *Juncus effusus* acid grassland community, buildings and bare ground. Semi-natural habitats within the NVC study area are mainly mire and grassland communities, with some scattered areas of scrub.

ANNEX I HABITATS

5.3.18 Certain NVC communities can also correlate to various Annex I habitat types listed under the Habitats Directive[23]. However, the fact that an NVC community can be attributed to an Annex I habitat type does not necessarily mean all instances of that NVC community constitute Annex I habitat. Its status can depend on various factors such as quality, extent, species assemblages, geographical setting, and substrates.

[23] As defined by the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora – the 'Habitats Directive'.

5.3.19 NVC survey data and field observations have been compared to JNCC Annex I habitat listings and descriptions[24]. Those habitats within the site which could be considered Annex I habitats are also summarised in Table 5.8.

5.3.20 The extents and often relatively low quality and degraded nature of these potential Annex I habitats within the site means none are considered of more than local nature conservation value (Table 5.2). Full details and discussion of Annex I habitat types present with the NVC study area are provided within Technical Appendix 5.1: National Vegetation Classification and Habitats Survey Report.

Scottish Biodiversity List Priority Habitats

5.3.21 The Scottish Biodiversity List (SBL)[25] is a list of animals, plants and habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland. The SBL identifies habitats which are the highest priority for biodiversity conservation in Scotland. Some of these priority habitats are quite broad and can correlate to many NVC types.

5.3.22 Relevant SBL priority habitat types and corresponding associated NVC types recorded within the site are also summarised in Table 5.8 and are outlined for the full NVC study area in Technical Appendix 5.1: National Vegetation Classification and Habitats Survey Report. These SBL priority habitats also correlate with UK Biodiversity Action Plan (BAP) Priority Habitats[26].

Groundwater Dependant Terrestrial Ecosystems

5.3.23 The NVC results were referenced against SEPA guidance[27], to identify those habitats which may be classified, depending on the hydrogeological setting, as being potentially groundwater dependent. Potential GWDTE NVC communities recorded within the NVC study area are summarised in Table 5.8 and are shown in Figure 5.3; all these communities (with the exception of CG10) are also present within the site.

5.3.24 The potential GWDTE sensitivity of each polygon containing a potential GWDTE community was classified on a four-tiered approach as follows:

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

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

[24] JNCC (2016). Annex I habitats and Annex II species occurring in the UK. URL: http://jncc.defra.gov.uk/page-1523 [April 2019].

[25] Scottish Government (2013). Scottish Biodiversity List. URL: http://www.gov.scot/Topics/Environment/Wildlife-Habitats/16118/Biodiversitylist/SBL [April 2019].

[26] JNCC (2016). UK BAP priority habitats. URL: http://jncc.defra.gov.uk/page-5718 [April 2019].

[27] SEPA. (2017). 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. Version 3.

5.3.26 GWDTE sensitivity has been assigned here according to SEPA listings[27]. However, depending on several factors such as geology, superficial geology, presence of peat and topography, many of the potential GWDTE communities recorded may in fact be only partially groundwater fed or not dependent on groundwater. Further information on groundwater dependency is provided within Technical Appendix 5.1: National Vegetation Classification and Habitat Survey Report.

Table 5.8: Summary of NVC Communities Recorded within the NVC Study Area & Site

NVC Community Code and Name		**Extent in Study Area (ha)**	**Extent in Site (ha)**	**% of Site**	**Potential Groundwater Dependency**	**Annex I Habitat Type**	**SBL Priority Habitat**
Mires and Flushes							
M1	*Sphagnum denticulatum* bog community	0.09	0.002	0.001	-	-	-
M2	*Sphagnum cuspidatum/fallax* bog pool community	0.13	0.003	0.001	-	-	-
M4	*Carex rostrata - Sphagnum fallax* mire	0.74	0.48	0.13	-	7140 Transition mires and quaking bogs	Upland flushes, fens and swamps
M6	*Carex echinata – Sphagnum fallax/denticulatum* mire	2.39	0.00	0.00	High	-	Upland flushes, fens and swamps
M10	*Carex dioica – Pinguicula vulgaris* mire	0.06	0.06	0.02	High	7230 Alkaline fens	Upland flushes, fens and swamps
M17, M17b	*Trichophorum germanicum – Eriophorum vaginatum* blanket mire	18.35	0.88	0.25	-	7130 Blanket bogs	Blanket bog
M19	*Calluna vulgaris – Eriophorum vaginatum* blanket mire	0.30	0.00	0.00	-	7130 Blanket bogs	Blanket bog
M23, M23b	*Juncus effusus/acutiflorus - Galium palustre* rush pasture	24.71	14.43	4.02	High	-	-
M25b	*Molinia caerulea – Potentilla erecta* mire	0.05	0.05	0.01	Moderate	-	-
Wet Heath							
M15, M15a, M15b, M15c, M15d	*Trichophorum germanicum – Erica tetralix* wet heath	181.37	120.11	33.60	Moderate	4010 Northern Atlantic wet heaths with *Erica tetralix*	Upland heathland
Dry Heath							

Table 5.8: Summary of NVC Communities Recorded within the NVC Study Area & Site							
NVC Community Code and Name		**Extent in Study Area (ha)**	**Extent in Site (ha)**	**% of Site**	**Potential Groundwater Dependency**	**Annex I Habitat Type**	**SBL Priority Habitat**
H9	*Calluna vulgaris – Deschampsia flexuosa* heath	8.94	8.90	2.48	-	4030 European dry heaths	Upland heathland
H10	*Calluna vulgaris - Erica cinerea* heath	1.70	1.54	0.43	-	4030 European dry heaths	Upland heathland
Calcifugous Grasslands							
U4, U4b	*Festuca ovina – Agrostis capillaris – Galium saxatile* grassland	36.01	28.68	8.00	-	-	-
U5, U5c	*Nardus stricta – Galium saxatile* grassland	19.62	19.54	5.45	-	-	-
Mesotrophic Grasslands							
MG1	*Arrhenatherum elatius* grassland	7.00	6.79	1.9	-	-	-
MG5	*Cynosurus cristatus – Centaurea nigra* grassland	3.68	1.21	0.34	-	-	-
MG6	*Lolium perenne – Cynosurus cristatus* grassland	96.42	57.12	15.93	-	-	-
MG10, MG10a	*Holcus lanatus - Juncus effusus* rush-pasture	9.37	6.83	1.91	Moderate	-	-
Calcicolous Grassland							
CG10	*Festuca ovina – Agrostis capillaris – Thymus polytrichus* grassland	0.09	0.00	0.00	High	-	Upland calcareous grassland
Woodland and Scrub							
W23	*Ulex europaeus – Rubus fruticosus* scrub	5.19	4.30	1.20	-	-	-
Swamps & Tall-Herb Fens							
S9	*Carex rostrata* swamp	0.19	0.05	0.01	-	-	Upland flushes, fens and swamps
S10	*Equisetum fluviatile* swamp	0.02	0.02	0.006	-	-	Upland flushes, fens and swamps
S27	*Carex rostrata - Potentilla palustris* tall-herb fen	1.21	1.11	0.31	Moderate	-	Upland flushes, fens and swamps
Open Habitat Communities							

Table 5.8: Summary of NVC Communities Recorded within the NVC Study Area & Site							
NVC Community Code and Name		**Extent in Study Area (ha)**	**Extent in Site (ha)**	**% of Site**	**Potential Groundwater Dependency**	**Annex I Habitat Type**	**SBL Priority Habitat**
OV25	*Urtica dioica – Cirsium arvense* community	0.02	0.02	0.005	-	-	-
OV27	*Chamerion angustifolium* community	0.30	0.30	0.08	-	-	-
Non-NVC Community or Feature Types							
SSM	Small sedge mire	24.98	13.81	3.85	Moderate	4010 Northern Atlantic wet heaths with *Erica tetralix*	Upland heathland
Mvar	*Eriophorum angustifolium - Schoenus nigricans* mire	11.08	3.55	0.99	Moderate	4010 Northern Atlantic wet heaths with *Erica tetralix*	Upland heathland
Svar	*Potentilla palustris* swamp	0.06	0.06	0.02	-	-	Upland flushes, fens and swamps
Cn	Wet *Carex nigra* mire	0.20	0.20	0.05	-	-	Upland flushes, fens and swamps
Je	*Juncus effusus* acid grassland community	0.91	0.11	0.03	Moderate	-	-
Mt	*Menyanthes trifoliata* bog pool community	0.29	0.00	0.00	-	-	Upland flushes, fens and swamps
SW	Standing water	0.04	0.00	0.00	-	-	-
AR	Recently ploughed fields/arable	38.84	37.05	10.33	-	-	-
PG	Private gardens/amenity grassland	0.19	0.19	0.05	-	-	-
BD	Buildings and associated outbuildings	0.33	0.33	0.09	-	-	-
BG	Bare ground, rock, tracks, disused quarry etc.	6.87	4.01	1.12	-	-	-
NSA	Non-Surveyed Area	N/A	26.77	7.47			
TOTAL		**501.76**	**358.49**	**100**	-	-	-

HABITAT DESCRIPTIONS

5.3.27 A brief description of the main Phase 1 habitats and associated NVC types recorded within the NVC study area and site is presented below (full descriptions are provided in Technical Appendix 5.1: NVC and Habitats Report, Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm, and shown in Figure 5.2). In the following paragraphs where reference is made to NVC community codes, the full community name and any respective sensitivity can be cross-referred to Table 5.8 above.

5.3.28 **Wet dwarf shrub heath** is made up of NVC communities and sub-communities M15, M15a, M15b, M15c and M15d and the non-NVC community 'Mvar' within the NVC study area. Wet heath covers around 192.45 ha (38.36%) of the study area and 123.66 ha (34.49%) of the site. M15 is the most common and extensive wet heath habitat within the NVC study area and site and it dominates the central plateau. The M15 present has a typical species assemblage which contains varying amounts of characteristic species such as heather *Calluna vulgaris*, cross-leaved heath *Erica tetralix*, common cottongrass *Eriophorum angustifolium*, deergrass *Trichophorum germanicum*, bog asphodel *Narthecium ossifragum*, heath rush *Juncus squarrosus* and sedges *Carex* spp. However, the M15 present is considered to be degraded and of poor quality due to overgrazing, trampling, drainage and burning; there are often patches of bare earth/peat and prostrate vegetation. The non-NVC Mvar mire community is a habitat dominated by large stands of common cottongrass with a blanket of *Sphagnum* species including *Sphagnum papillosum* and *S. subnitens*, fringed with tussocks of black bog-rush (*Schoenus nigricans*). This type of vegetation does not fit into any recognised NVC community description. The areas of Mvar within the NVC study area and site are heavily modified and are closest in nature to a wet heath community. The wet heath present is interspersed and mosaiced with several other similar upland mire, heathland and grassland NVC and non-NVC types.

5.3.29 **Improved grassland** used primarily for livestock grazing within the NVC study area is made up of NVC community MG6 and covers around 96.42 ha (19.22%) of the NVC study area and 57.12 ha (15.93%) of the site. Improved grasslands have been influenced by grazing and soil enrichment to the extent that most of the original plant species have been lost, resulting in a monotonous sward of low species diversity. This habitat is dominated by perennial rye-grass *Lolium perenne*. Other species found in these improved swards indicative of soil improvement included crested dogs-tail *Cynosurus cristatus*, Yorkshire fog *Holcus lanatus*, red fescue *Festuca rubra*, meadow grasses *Poa* spp., white clover *Trifolium repens* and buttercups *Ranunculus* spp. In wetter areas, the sward also contains soft rush *Juncus effusus* and marsh thistle *Cirsium palustre*.

5.3.30 **Acid grasslands** cover around 55.63 ha (11.09%) of the NVC study area and 48.22 ha (13.45%) of the site; made up of the U4 and U5 NVC communities. These grasslands contain a characteristic mix of species including sheep's fescue *Festuca ovina*, red fescue, mat grass *Nardus stricta*, sweet vernal grass *Anthoxanthum odoratum*, tormentil *Potentilla erecta* and heath bedstraw *Galium saxatile*. In wetter areas tufted hair-grass *Deschampsia cespitosa* and marsh thistle become more prevalent. Many of these grasslands have also been influenced by grazing and enrichment.

5.3.31 **Marsh/marshy grassland** covers around 50.85 ha (10.14%) of the NVC study area and 28.59 ha (7.98%) of the site, and is made up of NVC communities and sub-communities M23, M23b, M25b and non-NVC communities small sedge mire (SSM), *Carex nigra* (common sedge) mire (Cn) and *Juncus effusus* (soft rush) acid grassland community (Je). The majority of this habitat consists of M23 rush mire, with a notable extent of SSM; see Table

5.8 for respective NVC study area and site coverages. The marshy grassland is generally present where the drainage channels from the higher slopes plateau and the soils become wetter. Soft rush is often the most dominant species in these areas, and it remains common in the heavily grazed stands. Other species commonly found along with the soft rush in these marshy grassland areas include purple moor-grass *Molinia caerulea*, marsh thistle and buttercups. The non-NVC SSM community type is most common in the southwest of the NVC study area, where various water channels have eroded into the peat and where there have been ditches dug in to drain the surrounding land. These SSM areas lack rushes and sub-shrubs and are instead dominated by small sedge species in an assemblage that does not readily fit within the NVC classification, the most common species are carnation sedge *Carex panicea*, yellow sedge *C. viridula*, flea sedge *C. pulicaris* and common sedge. Non-NVC community 'Cn' is present in two patches to the east of the site and is dominated by common sedge.

5.3.32 **Wet modified bog** covers around 18.65 ha (3.72%) of the NVC study area and just 0.88 ha (0.25%) of the site and is made up of degraded, modified and grazed versions of NVC communities M17 and M19 (M17 only within the site). The wet modified bog is primarily located to the south of the NVC study area and outwith the site boundary (Figure 5.2); it has been modified by grazing, drainage and burning.

5.3.33 **Neutral grasslands** (unimproved and semi-improved) cover around 20.05 ha (4%) of the NVC study area and 14.83 ha (4.14%) of the site. Unimproved grassland is made up of coarse MG1 grassland which contains typical species such as cock's-foot grass *Dactylis glomerata*, Yorkshire fog and crested dogs-tail. The semi-improved neutral grasslands are made up of grazed MG5 and MG10 communities, MG5 being dominated by crested dogs-tail and MG10 by a mixture of soft rush and Yorkshire fog; extents and relative proportions of these communities can be found in Table 5.8.

5.3.34 **Dry dwarf shrub heath** covers around 10.64 ha (2.12%) of the NVC study area and 10.44 ha (2.91%) of the site, mainly to the east of the site, and is made up the H9 and H10 NVC communities on gravelly well-drained soils. Both community types being dominated by common heather, with H10 also containing some bell heather *Erica cinerea*.

5.3.35 **Dense/continuous scrub** covers 5.19 ha (1.03%) of the NVC study area and 4.30 ha (1.20%) of the site and is dominated by gorse *Ulex europaeus* (NVC type W23).

5.3.36 All other habitat types (NVC and non-NVC) are either of negligible botanical or nature conservation value (e.g. arable/bare ground) or are limited in extent and often form small fragmented stands. Each of these habitat types or communities typically makes up less than 1% of the NVC study area or site (Tables 5.7 & 5.8) and none are of more than local nature conservation value at the site (Table 5.2). Given their limited extents, full details of these habitat types can be found within Technical Appendix 5.1: National Vegetation Classification and Habitat Survey Report and Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm. With regards the Non-Surveyed Area (NSA) within the site boundary, upon review of aerial imagery in combination with existing data results and surveyor knowledge of the study area, these areas are likely to be comprised of a small number of habitat types extending from adjacent areas; namely, improved grasslands (MG6), wet dwarf shrub heath (M15) and arable land (AR) (see also Figure 5.2).

Peatland

5.3.37 ES Volume 4: Figures 2.4.2 and 2.4.3 (Technical Appendix 2.4: Phase 1 and Phase 2 Peat Probing & Coring Survey) indicate that, according to this map, the site mostly contains no peat, or areas with a shallow depth of peat; generally under 50 cm, and therefore more appropriately referred to as organo-mineral soils. Where peat or organo-mineral soils are present within the site, the depths are typically shallow. There is one isolated, deeper pocket of peat, located in the northeast of the site and this has been avoided in the design and layout of the proposed development (see ES Volume 4: Figure 2.4.3).

5.3.38 The results of these surveys are discussed in ES Volume 4: Technical Appendix 2.4: Phase 1 and Phase 2 Peat Probing & Coring and their influence on the site's design are presented in ES Volume 2: Chapter 2: Development Description and Chapter 3: Design Evolution and Alternatives.

Non-Avian Fauna

5.3.39 This section details the results from the protected species surveys. Full details of the results for each species are included in the following Technical Appendices and Figures (ES Volume 4):

- Protected species (including otter, water vole, badger, pine marten and red squirrel): Technical Appendix 5.2: Protected Species Survey Report, Figure 5.5;
- Bats: Technical Appendix 5.3: Bat Survey Report, Figure 5.6; and
- Extended Phase 1 habitat surveys (2014): Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm.

5.3.40 A summary of each species is provided below:

Otter

5.3.41 There were no field signs of otter recorded during the surveys in 2014, 2018 or 2019. There were no records of protected features (i.e. holts or couches) (see Technical Appendix 5.2: Protected Species Survey Report and Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm for further information on survey results).

5.3.42 There are a number of small watercourses present within the site and protected species study area, all of which were considered to have low suitability for otter. There are limited foraging opportunities offered due to the low suitability for the site supporting fish or amphibians. It is possible that otters could utilise the coastal habitats to the north of the site and could use the watercourses within the site as commuting routes to other habitats, although no evidence of otter was recorded during any of the surveys.

Water Vole

5.3.43 There was no evidence of water vole recorded during the 2014, 2018 or 2019 surveys (see Technical Appendix 5.2: Protected Species Survey Report and Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm for further information on survey results).

5.3.44 The watercourses present within the protected species study area are considered to have low suitability for supporting water vole. Many of the watercourses have a relatively low bank profile which are often very rocky and therefore offer limited burrowing opportunities.

There is also limited availability of riparian vegetation that is considered suitable for supporting water vole.

Badger

5.3.45 There was no evidence of badger recorded during the surveys in 2014, 2018 or 2019. Three mammal holes were recorded within close vicinity of each other in 2018 and these were considered to be of a size and structure suitable for supporting badger. However, no diagnostic fields signs of badger were recorded, and their use could not be confirmed. A potential badger print was recorded to the east of the protected species study area in 2019. Further information can be found in Technical Appendix 5.2: Protected Species Survey Report and on Figure 5.5.

5.3.46 There is limited habitat present for supporting badgers within the protected species study area. There is limited suitable substrate for supporting sett-building due to the nature of the site being typically either shallow and rocky substrates or peaty and waterlogged. There are some more suitable habitats present that offer more free draining soil for sett building and foraging opportunities within the outer fringes of the site and protected species study area, if badgers are present within the wider area of the site.

Pine Marten

5.3.47 There was no evidence of pine marten recorded during the surveys in 2014, 2018 or 2019 (see Technical Appendix 5.2: Protected Species Survey Report and Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm for further information on survey results).

5.3.48 There is limited availability of suitable habitat for pine marten, given the lack of woodland cover. There are therefore limited denning opportunities offered by the site.

Red Squirrel

5.3.49 There was no evidence of red squirrel recorded during any of the surveys (see Technical Appendix 5.2: Protected Species Survey Report and Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm for further information on survey results).

5.3.50 There is an absence of woodland cover in the site and protected species study area, which limits the opportunities for red squirrels to utilise the study area for drey building, foraging or commuting.

Reptiles

5.3.51 There were a number of structures recorded within the study area in 2018 and 2019 which have the potential to act as potential reptile hibernacula. These structures include stone walls and the disused quarry areas with piles of quarry slabs, located to the southeast of the protected species study area near Hopefield House.

Amphibians

5.3.52 There were no amphibians recorded within the protected species study area during the surveys. A number of ponds were identified on Ordnance Survey (OS) maps in advance of the surveys. However, it was not deemed necessary to undertake surveys for great crested newts (*Triturus cristatus*) given that the site is located outwith the known species range[28].

Fish

5.3.53 Fish habitat surveys indicated that none of the watercourses within the protected species study area were suitable for containing fish (see Technical Appendix 5.2 Protected Species Survey Report).

Bats

5.3.54 Four species of bat and one bat genus classification were recorded during the surveys in 2014 (see Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm). Species recorded were common pipistrelle, soprano pipistrelle (*Pipistrellus pygmaeus*), Daubenton's and Natterer's bat (*Myotis nattereri*). Bat passes identified to genus level were *Myotis* spp.

5.3.55 Bat activity line transects recorded no bat passes in May or July 2014, and only one faint pass of a Natterer's bat in September 2014. This single pass equated to 0.11 bat passes for each hour of survey effort (see Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm).

5.3.56 The remote bat detector surveys conducted in 2014 recorded 36 nights of data. The most abundant species recorded during the surveys was common pipistrelle with a total of 98 bat passes, equating to an average of 2.72 bat passes per night (bppn). Six bat passes of soprano pipistrelle were recorded, equating to an average of 0.17 bppn. One bat pass was recorded for both Daubenton's and Natterer's bats, equating to 0.03 bppn for both species. Two unidentified *Myotis* sp. bats were recorded, with an average of 0.05 bppn. The highest number of bat passes (94 bat passes) was recorded at location 1, located towards the centre of the site adjacent to a pond. Location 2 recorded the second highest number of bat passes (10 passes), followed by location 3 (2 bat passes) and location 2 (0 bat passes). Further information can be found in Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm and its associated figures.

5.3.57 Given the results of the 2014 bat surveys, bat activity for all species recorded on site was considered to be very low with the habitats determined to be sub-optimal for bats (see Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm).

5.3.58 The 2014 bat data was reviewed in conjunction with the NVC and habitats data, collected by MacArthur Green in 2018 (see Technical Appendix 5.3: Bat Survey Report). It was concluded that no significant habitat change had occurred at the site since the bat surveys were conducted in 2014. Accounting for the geographical location of the site, which is outwith the range of high collision risk species such as *Nyctalus* spp., it was determined that the likelihood of bat activity levels having significantly changed since 2014 was low to negligible. SNH was consulted (see Table 5.1) regarding the validity of using the 2014 data for the ES, which they confirmed was still relevant for the site.

5.3.59 Temporal bat survey data was also recorded in 2016 by Caledonian Conservation and was assessed by MacArthur Green (see Technical Appendix 5.3: Bat Survey Report). The data recorded 19 bat passes of common pipistrelle during a total of 105 recording nights. This

[28] Oldham R.S., Keeble J., Swan M.J.S. & Jeffcote M. (2000). Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*). Herpetological Journal 10 (4), 143-155.

equates to an average of 0.18 bppn for common pipistrelle (see Technical Appendix 5.3: Bat Survey Report). The bat activity results in 2016 show the site to have had low activity levels and with a limited number of species. The results of the 2016 surveys correspond to those conducted in 2014, which assessed the site as having low bat activity.

5.3.60 An update to the roost surveys was conducted in 2019 by MacArthur Green, which assessed two buildings within the bat study area (Blackheath and Hopefield) to be of moderate potential for supporting roosting bats. However, the proposed development infrastructure layout is beyond all recommended bat disturbance buffers from Blackheath and Hopefield buildings. A stone ruin which is adjacent to the bat roost assessment study area was assessed as having negligible roost suitability. Further information can be found in Technical Appendix 5.3: Bat Survey Report and Figure 5.6.

Future Baseline

5.3.61 In the absence of the proposed development, it is likely that the IEFs would generally remain as they are at present, although numbers and distribution of species may fluctuate naturally. Vegetation and habitat composition and extents in the study area may fluctuate in line with the management of the area, such as through drainage or grazing.

Design Layout Considerations

5.3.62 As part of the iterative design process for the proposed development, ecological constraints identified through baseline survey results were considered in order to prevent or minimise adverse effects on ecological receptors within the site. This involved:

- a minimum 50 m buffer for any infrastructure or construction activity around major watercourses and 25 m buffer around minor watercourses, except where a minimum number of watercourse crossings are required and the diversion of two minor modified watercourses is required (as per Table 5.1 and Technical Appendix 2.5: Hydrological Sensitivities. The layout has sought to minimise the number of watercourse crossings. The application of respective buffers will minimise effects on associated habitats and species;
- avoidance of deeper peatland (>1 m) and active blanket bog areas for the location of turbines and other infrastructure as far as practicable;
- avoidance of areas of potentially high GWDTE for the location of turbines and other infrastructure as far as practicable; and
- the track length and alignment has been designed to utilise existing tracks and reduce the extent of new track and number of watercourse crossings required, where feasible.

5.3.63 For a full description and history of the design layout considerations, please refer to Chapter 3: Design Evolution and Alternatives (ES Volume 2).

Summary of Sensitive Receptors

Scoped-out IEFs

5.3.64 With consideration of the desk-study and baseline data collected, and following the design mitigation and those measures described in the design layout considerations and project assumptions sections above, several potential effects on IEFs can be scoped out of further assessment based on the professional judgement of the EIA team and experience from other relevant projects and policy guidance or standards. The following paragraphs detail the ecological receptors and effects scoped out following the completion of surveys.

Designated Sites

5.3.65 There are no designated sites present within the site. Based on the qualifying interests and distance from the site, all designated sites within 5 km of the site have been scoped out of the assessment based on the lack of connectivity (see also Table 5.6). Similarly, effects on ancient woodland have been scoped out due to lack of connectivity (Figure 5.1).

Habitats

5.3.66 Certain habitats identified are IEFs of local importance at the site, some due to their intrinsic value as being listed as Annex I or SBL habitats (Table 5.8, Technical Appendix 5.1: National Vegetation Classification and Habitat Survey Report and Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm). However, these habitats either; occupy such small areas within the NVC study area and site; are species-poor heavily degraded examples; or, any direct or indirect effects on the habitat are not predicted or are so minor that effects on them are scoped out of the assessment. These habitats comprise: calcareous grassland, marsh/marshy grassland, dry dwarf shrub heath, wet modified bog, flushes (acid/neutral and basic), swamp, and standing water (see Table 5.10).

5.3.67 Other habitats generally considered to be of low nature conservation value and unlikely to be affected by the proposed development are scoped out of the assessment. This includes gorse scrub, acid grassland, neutral grassland, improved grassland, weed dominated ruderal tall-herb habitat, arable fields and bare ground.

5.3.68 Marsh/marshy grassland, which within the NVC study area is of the M23 or M25 NVC communities or the SSM, Cn or Je non-NVC communities, is scoped out of the assessment. M23 is a rush dominated habitat generally of low ecological value unless particularly species-rich examples are found. The M23 within the NVC study area is not species-rich, often consisting of little more than a dense sward of soft rush (see Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm). This is a very common habitat type locally, regionally and nationally and the small direct and indirect losses predicted at the site, as per Table 5.10, are of negligible significance. M23 is considered a potentially high GWDTE[3,4], however designation as a GWDTE does not infer an intrinsic biodiversity value, and GWDTE status has not been used as criteria to determine conservation value in the ecology assessment. There is however a statutory requirement to consider GWDTEs and the data gathered during the NVC surveys has been used to inform this assessment (Technical Appendix 5.1: National Vegetation Classification and Habitat Survey Report and Figure 5.4 for further information on the GWDTE assessment).

Non-Avian Fauna – Protected Species

5.3.69 Otter and water vole were not identified as IEFs and have been scoped out of the assessment. There were no field signs or protected features of either species recorded during the surveys in 2014, 2018 or 2019. There is limited habitat present within the protected species study area which has the potential to support otter and water vole. The watercourses offer limited foraging opportunities for otter, and although they could be used as a link to other habitats, their potential was considered to be low. There was also low suitability for supporting water vole given the relatively low, rocky banks and limited suitable bank-side vegetation. As a precautionary measure, it is recommended that the species are included within a Species Protection Plan (SPP) which will be prepared and implemented prior to construction. The SPP will ensure all reasonably practicable measures are taken so that the provisions of the relevant wildlife legislation are complied with in relation to otter and water vole. Furthermore, pollution prevention measures would be implemented as part of the CEMP during construction to ensure no unacceptable effects occur on watercourses. Thus, any potential direct or indirect effects on otter or water vole arising from the proposed development are considered to be negligible and are not considered further.

5.3.70 Badgers have been scoped out of the assessment. Several mammal holes were recorded in 2018 which were suitable in terms of size and structure for supporting badger, but no diagnostic field signs were recorded. A potential badger print was recorded in 2019, although could not be confirmed due to its poor quality. There was no confirmed evidence of badger recorded during the surveys. There is limited suitable habitat present within the study area for supporting badger for foraging, commuting and sett-building, although there is the potential for them to use the more suitable habitats present within the site and around its periphery. It is recommended that a pre-construction check is undertaken by a suitably trained ecologist or Ecological Clerks of Works (ECoW) within the vicinity of the proposed infrastructure to check the status of the mammal holes recorded during the baseline surveys, and to determine the presence of any new features. Should any of these structures, or any new structures, be located within 30 m of construction activities (or 100 m of piling or blasting activities), all reasonably practicable measures should be taken to safeguard badgers associated with each feature so that the relevant wildlife legislation is complied with. As a precautionary measure, it is recommended that they are included as part of the SPP which will be prepared and implemented in advance of any construction works commencing. Given the lack of confirmed evidence of badger within the site, and the limited habitat available, the potential effect of the proposed development on badgers is considered to be negligible and they are not considered further within this assessment.

5.3.71 Pine marten, wildcat, red squirrel and great crested newt were not identified as IEFs and have been scoped out of the assessment. There is limited suitable habitat present within the study area for supporting pine marten, wildcat and red squirrel, given the general lack of woodland cover and open nature. There is also limited suitable habitat for amphibians, with the site being outwith the known range of great crested newt in Scotland.

5.3.72 Reptiles have not been identified as an IEF and have been scoped out of the assessment. Several features were recorded as potential hibernacula, such as stone walls and the disused quarry with piles of quarry slabs, however the proposed development lies outwith the recommended reptile disturbance buffers for the majority of these features. Many of these structures have low suitability for reptiles and the site is heavily grazed with poor vegetation coverage which is likely to have a high disturbance level. It is recommended that mitigation for these features is put in place to avoid any activities that may cause damage[29] to the structure. Where possible, a suitable disturbance buffer should be put in place around the feature, which should be a minimum of 30 m[29]. Checks for basking reptiles should be undertaken within 30 m of any potential hibernaculum by a suitably trained ecologist or ECoW immediately prior to any works being undertaken. Where it is not possible to avoid features during works, these should be scheduled to avoid the hibernation season (October to March)[29]. These measures will be included as part of the SPP for the site.

[29] Catherine, C. (2018). ARG UK Advice Note 10: Reptile Survey and Mitigation Guidance for Peatland Habitats. Amphibian and Reptile Groups of the United Kingdom.

NON-AVIAN FAUNA – BATS

5.3.73 Bats have not been identified as an IEF and have been scoped out of the assessment. The data collected in 2014 and 2016 concluded that bat activity was low for the site (see paragraph 5.3.57 and Technical Appendix 5.4: Caledonian Conservation Baseline Non-Avian Ecology Report 2014: Hill of Forss Wind Farm) and is considered to remain low given no significant habitat change has occurred at the site since the bat surveys were conducted (see paragraph 5.3.58). The majority of the bat activity recorded on site in 2014 was from common pipistrelles, with some records of bat passes from soprano pipistrelles, Daubenton's and Natterer's bat. There were no records of high collision risk species, such as *Nyctalus* spp. The habitats present within the site were also noted as being sub-optimal for foraging bats. There was also considered to be limited roosting habitat (e.g. trees, tunnels, caves or mines) present within the study area and its vicinity, other than those buildings described in the paragraphs below.

5.3.74 Blackheath property was assessed as having moderate potential for supporting roosting bats. A previous design iteration fell 3.56 m within the 200 m buffer plus rotor radius of a wind turbine, and therefore SNH was consulted on the proposed survey and assessment approach (see Table 5.1). Following further design iterations after this consultation, the proposed development is now sited beyond 200 m plus rotor radius of the property and therefore the roost potential of Blackheath is no longer considered an IEF, and the feature has been scoped-out of the assessment.

5.3.75 Hopefield House was also assessed as having moderate potential for supporting roosting bats, however, as a result of further design iteration the proposed development lies beyond all recommended bat disturbance buffers from these buildings. Therefore, the roost potential of Hopefield House has not been identified as an IEF and has been scoped out of the assessment.

Scoped-In IEFs

5.3.76 A summary of the Nature Conservation Value of the remaining IEFs identified within the site, and therefore 'scoped in' to the assessment, is provided in Table 5.9, together with justification for inclusion.

Table 5.9: Nature Conservation Value of Scoped-In IEFs

IEF	Nature Conservation Value	Justification
Wet dwarf shrub heath	Local	Wet heath is located across the site and NVC study area (see Figure 5.2), covering an area of 192.46 ha in the NVC study area and 123.66 ha (34.49%) of the site. Wet heath is indicated by NVC community M15 and sub-communities M15a, M15b, M15c, M15d and non-NVC type Mvar (Table 5.8). M15 is a very common wet heath type within the region and across the uplands of Scotland. Despite wet heath being listed as an Annex I habitat in the Habitats Directive and part of the SBL upland heathland priority habitat, the habitat within the study area is degraded from a history of drainage, burning and over-grazing and is considered of no greater than Local Nature Conservation Value. This type of habitat is widespread throughout the local area.

5.4 Assessment of Likely Effects

5.4.1 This section provides an assessment of the likely effects of the proposed development on the IEFs identified through baseline studies. The assessment of effects is based on the development description outlined in Chapter 2: Development Description, and is structured as follows:

- Construction effects;
- Operational effects; and
- Cumulative effects.

Project Assumptions

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

- A 12-month construction period is proposed and would include construction of access tracks, hardstandings, turbines and other infrastructure, and site restoration.
- All electrical cabling between the turbines and the associated infrastructure would be underground in shallow trenches which would be reinstated during the construction period and, in all cases, follow the access tracks.
- Any disturbance areas around permanent infrastructure during construction would be temporary and areas reinstated or restored before the construction phase ends. The only excavation in these areas would be for cabling, as noted above, and otherwise would only be periodically used for side-casting of spoil until reinstatement.
- To ensure all reasonable precautions are taken to avoid adverse effects on habitats, protected species and aquatic interests, a suitably qualified ECoW would be appointed prior to the commencement of construction to advise the Applicant and the Contractor on ecological matters. The ECoW would be required to be present on the site during the construction phase and would carry out monitoring of works and briefings with regards to any ecological sensitivities on the site to the relevant staff working for the contractor and subcontractors.
- A SPP will be implemented during the construction phase. The SPP will detail measures to safeguard protected species known to be in the area. Measures will include surveys in advance of construction activities and good practice methods during construction.
- Implementation of appropriate pollution prevention measures (particularly in relation to watercourses) and standard good practice construction environmental management would occur across the site and form part of a CEMP. An Outline CEMP is included as Technical Appendix 2.1 (ES Volume 4) and the final version would be submitted as a condition of consent.

Potential Construction Effects

5.4.3 This section provides an assessment of the likely effects of construction of the proposed development upon the scoped-in IEFs.

5.4.4 Impacts on habitats may include direct loss of habitat, e.g. derived from permanent land-take for infrastructure or temporary land-take for the land required to accommodate construction site compounds etc. Impacts on habitats can also be indirect through increased habitat fragmentation, or changes caused by pollution, or effects to supporting systems such as groundwater or water-table levels.

5.4.5 The most tangible effect during the construction of the proposed development will be direct habitat loss due to the construction of new access tracks, wind turbines, hardstandings, laydown areas, compound and substation; much of this infrastructure will be permanent and maintained through the operational period. Despite the planned restoration of any temporary infrastructure, and taking a precautionary approach, it is assumed for the assessment that the areas of land-take for these particular infrastructures also represent permanent losses of habitat due to the complexities in re-creating habitat types such as wet heath.

5.4.6 There may also be some indirect habitat losses to wetland habitats due to drainage effects. For the purposes of this assessment it is assumed that wetland habitat losses due to indirect drainage effects may extend out to 10 m from infrastructure (i.e. in keeping with indirect expected drainage assumptions within the carbon calculator (see Technical Appendix 2.6: Carbon Balance Assessment). It is expected that any indirect drainage effects will only impact wetland habitats such as wet modified bog, marshy grassland, flushes, wet heath and swamp. No indirect drainage effects are expected to impact or alter the quality or composition of 'dry' habitats such as dry heath or acid grassland; as such only direct habitat loss applies to those habitats.

5.4.7 Table 5.10 below details the estimated direct and indirect losses predicted to occur, for all new infrastructure, by habitat type within the site boundary (habitat types not subject to any predicted direct or indirect losses are omitted from the table).

Table 5.10: Estimated Loss of Habitat for Permanent Infrastructure

Phase 1 Habitat Type Lost30	Specific NVC Community or Habitat Type Lost	Total Extent of Phase 1 Type in Site (ha)	Direct Habitat Loss(ha)	Direct Habitat Loss as % of Phase 1 Extent in Site	Direct & Indirect Habitat Loss (ha)	Direct & Indirect Habitat Loss as % of Phase 1 Extent in Study Area
A2.1: Dense/ continuous scrub*	W23	4.30	0.03	0.70	As per Direct Loss	
B1.1: Unimproved acid grassland*	U5	19.65	0.90	4.58	As per Direct Loss	
B1.2: Semi-improved acid grassland*	U4b	28.56	0.29	1.02	As per Direct Loss	
B2.2: Semi-improved neutral grassland*	MG10	8.04	0.24	2.99	0.63	7.84
B4: Improved grassland*	MG6	57.12	0.47	0.82	As per Direct Loss	
B5: Marsh/marshy grassland*	M23, M25, Je, SSM	28.59	0.33	1.15	0.99	3.46
D1.1: Acid dry dwarf shrub heath*	H10	10.44	0.01	0.10	As per Direct Loss	
D2: Wet dwarf shrub heath	M15	123.66	2.94	2.38	8.46	6.84
E1.7: Wet modified bog*	M17	0.88	0.00	0.00	0.02	2.27
J4: Bare ground*	BG	4.01	0.20	4.99	As per Direct Loss	
Site Area Totals			**5.40**	**1.51**	**12.02**	**3.35**

5.4.8 The following sections assess the effect of these losses for wet dwarf shrub heath (the only scoped-in IEF).

Wet Dwarf Shrub Heath

5.4.9 Effect: Effects upon wet dwarf shrub heath during construction would be direct (through habitat loss occurring during construction of the proposed development) and indirect (through potential drying effects upon neighbouring wet heath habitats occurring from the construction period into the operational period). Direct loss would occur in areas where access tracks pass through this habitat type or where infrastructure such as turbine foundations, crane pads, hardstandings, compound, etc. are sited on these habitat types. In addition, there may be indirect losses as a result of drainage around infrastructure and disruption to hydrological flows.

5.4.10 Nature Conservation Value: As per Table 5.9 above, wet dwarf shrub heath is considered to be of Local Nature Conservation Value.

5.4.11 Conservation Status: Conservation Status of this habitat as assessed in the JNCC report on Northern Atlantic wet heaths with *Erica tetralix*[31] is 'Bad and Stable' at the UK level.

[30] Effects upon habitats with a '*' in Table 5.10 have been scoped-out of the assessment due to the minor nature of habitat loss involved or their low nature conservation value (i.e. not an IEF), as per the sections above.

[31] JNCC (2013). H4010 Northern Atlantic wet heaths with Erica tetralix. URL: http://jncc.defra.gov.uk/pdf/Article17Consult_20131010/H4010_UK.pdf. [June 2019].

5.4.12 Magnitude: The UK has an estimated 467,714 ha[31] of this wet heath type. The majority, around 340,000 to 400,000 ha, is in Scotland[32]. Wet heath covers 192.46 ha (38.36%) of the NVC study area and is indicated by NVC community M15 and sub-communities M15a, M15b, M15c, M15d and non-NVC type Mvar (Table 5.8).

5.4.13 Direct habitat loss is predicted to be 2.94 ha due to infrastructure (Table 5.10). This results in a potential total direct loss equivalent to 2.38% of wet heath within the surveyed site area. However as noted above, 26.77 ha of land within the site boundary was not surveyed (NSA; Tables 5.7 and 5.8) and much of this is wet heath (paragraph 5.3.36), therefore the percentage loss of habitat stated here is an overestimate, and relative losses from the site are actually less.

5.4.14 In addition, there may be some indirect losses because of the zone of drainage around infrastructure (assumed to extend out to 10 m from infrastructure as per paragraph 5.4.6). If indirect drainage effects are fully realised out to 10 m in all wet heath areas then predicted losses increase to 8.46 ha for permanent infrastructure, equating to 6.84% of the site (N.B. this is also an overestimate as per paragraph 5.4.13 above).

5.4.15 The maximum losses predicted equate to less than 0.003% loss at a national (Scottish) level. These losses are however considered to be worst case as detailed below.

5.4.16 It is considered unlikely that indirect drainage effects would have a significant effect on the degraded wet heath present or result in large-scale vegetation shifts to a lower conservation value habitat type, such as acid grassland for example. If drainage effects materialise then this could, depending on the degree of drying, result in some subtle shifts of community or vegetation type, and this would likely be shifts to other sub-communities within the M15 NVC community. In response to more severe drying effects then M15 wet heath would be expected over time to transition towards a dry heath community, which are already present at the site (Table 5.8). Dry heath here is considered to be of the same nature conservation value, and therefore overall it is unlikely there would be a decline in locally important habitat types due to drainage effects on wet heath.

5.4.17 When considering the above habitat losses, and accounting for the abundance, distribution and quality of the habitat within the NVC study area and site as well as at the regional level, an effect magnitude of low spatial and long-term temporal is appropriate.

5.4.18 Significance of Effect: Given the above consideration of Nature Conservation Value, Conservation Status and Magnitude, the effect significance is considered to be **Minor Adverse** and **Not Significant** under the terms of the EIA Regulations.

Potential Operational Effects

5.4.19 All likely direct and indirect effects on wet dwarf shrub heath have been considered in the Potential Construction Effects section above. Indirect effects on habitats would largely occur during the operational phase as potential drying impacts take effect. However, for ease of assessing impacts on habitats these are considered together within the Potential Construction Effects section.

Potential Decommissioning Effects

5.4.20 Due to the distant time frame until their occurrence (>35 years), decommissioning effects are difficult to predict with confidence. In general decommissioning effects are usually

[32] CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (3rd Edition).

considered for the purposes of assessment to be similar to (or likely less than) those of construction effects in nature and are likely to be of shorter duration.

5.4.21 Wet heath is the only IEF assessed at the site as per the construction effects section above. Decommissioning of the site would involve the removal of all infrastructure and restoration of the associated ground. Restoration of the site would seek to return areas to their pre-construction habitat type, or as similar as feasible depending on local substrates, topography, hydrology etc. As a result, decommissioning will not lead to any further direct or indirect habitat losses, rather, it is predicted that due to restoration of upland habitats such as wet heath in these areas, there would be a net positive effect.

Potential Cumulative Construction and Operational Effects

5.4.22 The primary concern regarding the assessment of cumulative impacts is to identify situations where impacts on habitats or species populations that may be acceptable from individual developments, are judged to be unacceptable when their impact is combined with nearby existing or proposed projects that are subject to an EIA process. The main projects likely to cause similar impacts to those associated with the proposed development are other operational wind farms, those under construction or those consented. Several other wind farms are present within the wider area, in planning, under construction and operational.

Wet Dwarf Shrub Heath

5.4.23 Wet dwarf shrub heath has been scoped-out of the cumulative assessment as it is considered unlikely that any significant ecological cumulative effect would arise as a consequence of the proposed development adding to habitat loss associated with other projects. This is due to the minor magnitude of loss of wet dwarf shrub heath due to the proposed development, as outlined above and the proposed wet heath enhancement measures noted below (paragraph 5.5.2). No significant cumulative effects are predicted for wet dwarf shrub heath (**Minor Adverse** and **Not Significant**).

5.5 Mitigation

Mitigation during Construction

5.5.1 There is no mitigation required during construction in addition to the standard in-built mitigation (50 m watercourse buffer from major watercourses and 25 m buffer from minor watercourses) and adoption of good practice as detailed in the project assumptions above (paragraph 5.4.2). For instance, application of good practice floating roads guidance (if any new access tracks subsequently require floating), the presence of an ECoW and implementation of appropriate pollution prevention and standard good practice construction environmental management as part of a CEMP and SPP. An Outline CEMP is included as Technical Appendix 2.1 (ES Volume 4) and the final version CEMP which would be required to be agreed as a condition of consent. To ensure standard good practice measures are effective, pollution prevention proposals will be site specific and adapted to the local ground conditions.

Mitigation during Operation

5.5.2 No IEFs were scoped-in to the assessment of potential operational effects. Potential indirect effects on habitats were considered as part of the construction effects, although any effect would likely span into the operational phase; no significant effects were predicted, and as such there is no additional mitigation is required during operation. Nonetheless, it is recommended that habitat improvement measures for wet heath enhancement are put in place during the operational period (as per ES Volume 2: Chapter 6: Ornithology). Measures should aim to enhance the quality of wet heath habitat, retain boggy ground and create new wet areas by measures such as blocking any active drains and ditches in selected areas. As detailed in paragraph 5.3.28, the wet heath on site is degraded as a consequence of overgrazing, trampling, drainage and burning and so management measures could be applied to reduce these impacts and improve the quality of this habitat further.

Mitigation during Decommissioning

5.5.3 Mitigation measures are likely to be similar to those outlined for the construction phase (outlined in paragraph 5.5.1); they would be identified as part of a decommissioning management plan.

5.6 Assessment of Residual Effects

Residual Construction Effects

5.6.1 No specific mitigation for wet heath is proposed over and above the embedded mitigation (paragraph 5.5.1) and project assumptions (paragraph 5.4.2) described above. Therefore, residual effects on wet heath remain **Minor Adverse** and **Not Significant**.

5.6.2 Although no significant effects are predicted, a habitat enhancement plan for wet heath is recommended as detailed in paragraph 5.5.2. Assuming the implementation of a habitat enhancement plan, residual effects on wet heath may reduce to **Negligible** and **Not Significant**.

Residual Operational Effects

5.6.3 No IEFs were scoped-in to the assessment of potential operational effects. Potential indirect effects on habitats were considered as part of the construction effects, although any effect would likely span into the operational phase; no significant effects were predicted, and as such, no further residual effects during the operational phase are considered.

Residual Decommissioning Effects

5.6.4 These would be the same as the residual construction phase effects (paragraph 5.6.1).

Residual Cumulative Effects

5.6.5 Wet dwarf shrub heath has been scoped-out of the residual cumulative construction assessment given that no significant cumulative effects are predicted for this feature (paragraph 5.4.23).

5.7 Summary

5.7.1 This chapter has considered the potential effects on the ecological features present at the site associated with the construction, operation and decommissioning of the proposed development. The assessment method followed the guidance detailed by CIEEM[10].

5.7.2 It was possible to scope out most species and habitats recorded in the respective study areas from the assessment by virtue of their absence from the site, their low conservation value, the type and frequency of field signs present, the small extent of the sensitive habitat, or the negligible scale of potential effects.

5.7.3 Potential construction and operational effects on wet dwarf shrub heath were assessed. The main effect being direct and indirect habitat loss due to land take for infrastructure and associated hydrological disturbance. Habitat losses would be **Minor Adverse** and **Not Significant**. No significant effects are predicted.

5.7.4 Table 5.12 below summarises the potential effects of the proposed development.

Table 5.12: Summary of Potential Significant Effects of the Proposed Development

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Construction			
Wet dwarf shrub heath – direct habitat loss from infrastructure and indirect loss as a result of drainage.	No specific mitigation proposed. General mitigation proposed – pollution prevention measures, best practice construction methods and CEMP. Habitat enhancement recommended.	Pollution prevention measures, best practice construction methods and a CEMP will be agreed with stakeholders prior to construction. The provision of a CEMP would be required as condition of consent. An ECoW would oversee the construction process and would be required as condition of consent. Habitat enhancement should be agreed in advance of construction as part of a condition to the planning consent.	Not Significant.
Operation			
Operational effects considered within the Construction effects section above.			
Decommissioning			
Decommissioning effects considered within the Construction effects section above.			

5.8 Abbreviations

Abbreviation	**Expanded Term**
AWI	Ancient Woodland Inventory
CEMP	Construction Environment Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
EIA	Environmental Impact Assessment
ES	Environmental Statement
GWDTE	Groundwater Dependent Terrestrial Ecosystems
Ha	Hectares
IEF	Important Ecological Feature
JNCC	Joint Nature Conservancy Council
NBN	National Biodiversity Network
NVC	National Vegetation Classification
SAC	Special Area of Conservation

Abbreviation	Expanded Term
SBL	Scottish Biodiversity List
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
UKBAP	UK Biodiversity Action Plan

5.9 Figure List

Figure Number	Figure Title
Figure 3.2	Layout Design Evolution
Figure 5.1	Ecological Designated Sites within 5 km
Figure 5.2	NVC Study Area and Survey Results
Figure 5.3	Potential Groundwater Dependent Terrestrial Ecosystem Study Area and Survey Results
Figure 5.4	Hydrological Sensitivity of Potential Groundwater Dependent Terrestrial Ecosystems (GWDTEs)
Figure 5.5	Protected Species Survey Results
Figure 5.6	2019 Bat Roost Survey Results
Figure 2.4.1	Phase 1 and 2 Site Location and Sample Locations
Figure 2.4.2	Phase 1 and 2 Peat Depth Sample Locations
Figure 2.4.3	Phase 1 and 2 Interpolated Peat Depths

6 Ornithology

6.1 Introduction

6.1.1 This chapter considers the likely significant effects on ornithology associated with the construction, operation and decommissioning of Cairnmore Hill Wind Farm as described in Chapter 2 of this ES ("the proposed development"). The specific objectives of the chapter are to:

- describe the ornithological baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address any likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

6.1.2 The assessment has been carried out by MacArthur Green and in accordance with Scottish Natural Heritage (SNH) guidelines. All staff contributing to this chapter have undergraduate and/or postgraduate degrees in relevant subjects, have extensive professional ornithological impact assessment and ornithology survey experience, hold professional membership of the Chartered Institute of Ecology and Environmental Management (CIEEM), and abide by the CIEEM Code of Conduct.

6.1.3 Effects on flora and non-avian fauna are addressed separately in Chapter 5: Non-Avian Ecology.

6.1.4 This chapter is supported by the following figures and technical appendices:

- Figure 2.1 Site Layout;
- Figure 6.1 Site Boundary and Study Areas;
- Figure 6.2 Vantage Points and Viewsheds;
- Figure 6.3 Ornithological Designated Sites within 20 km;
- Figure 6.4 Foraging Wildfowl: Barnacle Goose and Brent Goose;
- Figure 6.5 Foraging Wildfowl: Greenland White-fronted Goose;
- Figure 6.6 Foraging Wildfowl: Greylag Goose;
- Figure 6.7 Foraging Wildfowl: Pink-footed Goose;
- Figure 6.8 Foraging Wildfowl: Whooper Swan;
- Figure 6.9 Flight Activity: Greenland White-Fronted Goose;
- Figure 6.10a Flight Activity: Greylag Goose – 2012/2013 Non-breeding Season;
- Figure 6.10b Flight Activity: Greylag Goose – 2013/2014 Non-breeding Season;
- Figure 6.10c Flight Activity: Greylag Goose – 2015/2016 Non-breeding Season;
- Figure 6.10d Flight Activity: Greylag Goose – 2016/2017 Non-breeding Season;
- Figure 6.10e Flight Activity: Greylag Goose – 2013 and 2016 Breeding Season;
- Figure 6.11a Flight Activity: Pink-footed Goose – 2013/2014 Non-breeding Season;
- Figure 6.11b Flight Activity: Pink-footed Goose – 2015/2016 Non-breeding Season;
- Figure 6.11c Flight Activity: Pink-footed Goose – 2016/2017 Non-breeding Season;

- Figure 6.12 Flight Activity: Whooper Swan;
- Figure 6.13 Flight Activity: Barn Owl;
- Figure 6.14 Raptor Activity: 2014 and 2016;
- Figure 6.15 Non-breeding Season Target Species Activity: 2012/2013, 2015/2016, 2016/2017;
- Figure 6.16 Flight Activity: Hen Harrier;
- Figure 6.17 Flight Activity: Merlin;
- Figure 6.18 Flight Activity: Peregrine Falcon;
- Figure 6.19 Flight Activity: Short-Eared Owl;
- Figure 6.20 Breeding Wader Activity: 2013, 2014, 2016, 2017;
- Figure 6.21a Flight Activity: Curlew – Breeding Seasons;
- Figure 6.21b Flight Activity: Curlew – Non-breeding Seasons;
- Figure 6.22a Flight Activity: Golden Plover – Breeding Seasons;
- Figure 6.22b Flight Activity: Golden Plover – Non-breeding Seasons;
- Figure 6.23a Flight Activity: Lapwing – Breeding Seasons;
- Figure 6.23b Flight Activity: Lapwing – Non-breeding Seasons;
- Figure 6.24 Flight Activity: Ringed Plover;
- Figure 6.25 Flight Activity: Arctic Skua;
- Figure 6.26 Flight Activity: Herring Gull;
- Figure 6.27 Cumulative Impact Assessment, Natural Heritage Zone 2;
- Figure 6.28 In-combination Assessment, Caithness Lochs SPA; and
- Technical Appendix 6.1 Ornithology.

6.1.5 Figures and technical appendices are referenced in the text where relevant.

6.2 Assessment Methodology and Significance Criteria

Scope of Assessment

6.2.1 This chapter considers any effects of construction, operation and decommissioning of the proposed development upon those ornithological features identified during the review of desk-based information and field survey data (the extents of the study areas are set out in 6.3 Baseline Conditions below). Impacts upon the following features are assessed:

- Direct habitat loss for birds through construction of the proposed development;
- Displacement of birds through indirect loss of habitat where birds avoid the proposed development and its surrounding area due to construction and decommissioning, turbine operation, maintenance and visitor disturbance. This also includes potential barriers to commuting or migrating birds due to the presence of the proposed development turbines and related infrastructure;
- Habitat modification due to change in land cover (e.g. forestry removal) or changes in hydrological regime, and consequent effects on bird populations; and
- Death or injury of birds through collision with turbine blades, anemometer masts, or fences (if any) associated with the proposed development.

6.2.2 The chapter also assesses the potential for additional cumulative effects when considered in addition to other consented or proposed developments which are subject to EIA.

6.2.3 The assessment is based on the proposed development as described in Chapter 2: Development Description.

6.2.4 The scope of the assessment has been informed by consultation responses summarised in Table 6.1 and the following legislation, guidelines and policies:

- Chartered Institute of Ecology and Environmental Management (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine, 3rd edition. CIEEM, Winchester;
- Directive 2009/147/EC on the Conservation of Wild Birds (Birds Directive);
- Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) (Habitats Directive);
- Eaton *et al.* (2015[1]). Birds of Conservation Concern 4;
- Environmental Impact Assessment Directive 85/337/EEC (as amended);
- Policy Advice Note PAN 1/2013 – Environmental Impact Assessment (Scottish Government 2013);
- SERAD (Scottish Executive Rural Affairs Department) 2000. Habitats and Birds Directives, Nature Conservation; Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and of Wild Flora and Fauna and the Conservation of Wild Birds ('the Habitats and Birds Directives'). Revised Guidance Updating Scottish Office Circular No 6/1995;
- SNH (2000) Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action;
- SNH (2009) Environmental Statements and Annexes of Environmentally Sensitive Bird Information; Guidance for Developers, Consultants and Consultees;
- SNH (2011) Dealing with Construction and Breeding Birds;
- SNH (2013a) Avoidance Rates for Wintering Species of Geese in Scotland At Onshore Wind Farms;
- SNH (2013b) Geese and wind farms in Scotland: new information;
- SNH (2014, revised March 2017) Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms;
- SNH (2016) Assessing connectivity with Special Protection Areas (SPAs);
- SNH (2018a) Assessing Significance of Impacts from Onshore Wind Farms Out-with Designated Areas;
- SNH (2018b) Assessing the cumulative impacts of onshore wind farms on birds;
- SNH (2018c) Environmental Impact Assessment Handbook – Version 5: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland;
- The Highland Biodiversity Action Plan (2015 – 2020);

[1] Eaton M.A., Aebischer N.J., Brown A.F., Hearn R.D., Lock L., Musgrove A.J., Noble D.G., Stroud D.A. and Gregory R.D. (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.

- The Nature Conservation (Scotland) Act 2004 (as amended);
- The Scottish Biodiversity List;
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011;
- The Wildlife and Countryside Act 1981 (as amended); and
- Wind Energy Developments and Natura 2000 (EC 2011[2]).

Consultation

6.2.5 Table 6.1 summarises the consultation responses received regarding ornithology and provides information on where and/or how they have been addressed in this assessment.

6.2.6 Full details on the consultation responses can be reviewed in Technical Appendix 1.1: Consultation Register.

Table 6.1: Consultation Responses

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
The Highland Council 8th August 2016	Scoping	EIA report should provide a baseline survey of the birds present on the site and the presence of any Schedule 1 (of the Wildlife and Countryside Act, 1981 as amended) species should be considered as part of the planning application process.	Provided under Section 6.3 (Baseline Conditions).
		North Caithness Cliffs Special Protection Area (SPA) should be considered in the assessment. Refer to detailed scoping response from SNH.	Refer to paragraphs 6.3.2, and paragraphs 6.3.61 to 6.3.66.
Scottish Natural Heritage (SNH) 28th July 2016	Scoping	Careful consideration should be given to potential effects on the qualifying features of the Caithness Lochs SPA and peregrine falcon associated with the North Caithness Cliffs SPA.	Refer to paragraphs 6.3.2, and paragraphs 6.3.61 to 6.3.66.
		The assessment should include consideration of direct and indirect impacts on these SPAs and their qualifying interests in the context of their conservation objectives. The assessment should also consider any cumulative (in combination) effects.	Noted. SPA features have been considered within the context of the Habitats Regulations Appraisal process (paragraphs 6.2.17 to 6.2.18).
		Highlighted that (at the time of the response) the cumulative collision risk to whooper swan is reaching a level where it may have an adverse effect on the Caithness Lochs SPA population.	Noted. SNH subsequently provided whooper swan data to aid in cumulative assessment (see below, and *Potential Cumulative Effects* section).
		The proposed development lies adjacent to known favoured feeding fields for Greenland white-fronted goose and it is important to consider the potential for disturbance and displacement effects from regularly used feeding areas. Any appropriate mitigation measures should also be considered as part of the assessment process to avoid impacts to areas regularly used by Greenland white-fronted goose (and other species associated	Noted. Refer to Section 6.4.

[2] European Commission (2011). Natura 2000 Guidance Document 'Wind Energy Developments and Natura 2000'. European Commission, Brussels.

Table 6.1: Consultation Responses			
Consultee and Date	**Scoping / Other Consultation**	**Issue Raised**	**Response / Action Taken**
		with the SPA) during the construction and operational phases of the development.	
		It is important to ensure adequate survey coverage of the proposed development. No comment provided on survey methodology (viewsheds, survey areas etc.) as these were not included in the Scoping Report.	Full survey methodology is presented in Technical Appendix 6.1.
		It is noted that the three years of survey did not run continuously. SNH recommended that details of any significant changes (e.g. habitat, land use etc.) between year 2 and year 3 are detailed.	There were no significant changes in land use/management or habitats at the site between Autumn 2014 and Autumn 2015. As detailed in Technical Appendix 6.1, baseline surveys were undertaken across the 2013, 2014, 2016 and 2017 breeding seasons and 2012/2013, 2013/2014, 2015/2016 and 2016/2017 non-breeding seasons.
SNH 17th April 2019	Data request	Requested cumulative/in-combination collision dataset for the Caithness Lochs SPA species (greylag goose, Greenland white-fronted goose and whooper swan).	Provided by Sian Haddon on 19th April 2019 and updated (on request) by Alexander Macdonald on 21st August 2019.
Highland Raptor Study Group (HRSG) 22nd April 2019	Data request	Requested historical data for breeding raptors and owls within 3 km of the site.	Informed by Brian Etheridge on 22nd April 2019 that the HRSG hold no data for this area of Caithness.
RSPB 22nd April 2019	Data request	Requested historical data for breeding raptors and owls within 3 km of the site.	Informed by Tessa Coledale on 14th May 2019 that the RSPB hold no data of raptors or owls within 3 km of the site.

Potential Effects Scoped Out

6.2.7 No potential ornithological effects associated with the impacts outlined in paragraph 6.2.1 have been scoped out of the assessment.

6.2.8 On the basis of the findings of the survey work undertaken, the professional judgement of MacArthur Green, experience from other relevant projects and policy guidance/standards (e.g. SNH 2018a[3]), any species that would be included in the categories detailed below have been scoped out of the assessment since significant effects are unlikely at a population level:

[3] Scottish Natural Heritage (2018a) Assessing Significance of Impacts from Onshore Wind Farms Out-with Designated Areas.

- Common and/or species of low nature conservation importance not recognised in statute as requiring special conservation measures, i.e. bird species not listed on Annex I of the EU Birds Directive[4] or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended);
- Common and/or species of low nature conservation importance not included in non-statutory lists that indicate birds whose populations are at some risk either generally or in parts of their range (e.g. the Birds of Conservation Concern (BoCC) Red list, Eaton *et al.* 2015[1]); and
- Passerine species (not generally considered to be at risk from wind farm developments, SNH 2017[5], 2018a[3]), unless being particularly rare or vulnerable at a national level.

Method of Baseline Characterisation

Extent of the Survey/Study Area

6.2.9 A range of surveys were employed to accurately record baseline ornithological conditions within the site boundary ("the site") and appropriate survey buffers. Terms referred to are as follows (and are detailed on Figure 6.1):

- 'survey area' is defined as the area covered by each survey type at the time of survey; and
- 'study area' is defined as the area of consideration of impacts on each species at the time of assessment and as the area used for any desk-based study.

6.2.10 Details of the spatial extent of each survey area are described in section 6.3 (Baseline Conditions) of this chapter and are detailed on Figure 6.1, Figure 6.2 and Technical Appendix 6.1: Ornithology and associated Annexes.

6.2.11 Following the completion of flight activity surveys, a Collision Risk Analysis Area (CRAA) was defined for the purposes of estimating rates of possible collisions with turbines. The CRAA was created by using Delaunay triangulation in GIS software to create a wind farm area where outer turbine locations were buffered by 500 m (Figure 6.2). As recommended by SNH (2017[5]), using a larger area around the turbines accounts for possible inaccuracies in the recording of flightlines by surveyors, and records any species' flight activity that was in proximity to, but not necessarily within the wind farm area at the time of surveys.

Desk Study

6.2.12 The following data sources were considered as part of the assessment:

- SNH Sitelink (https://sitelink.nature.scot/home) for designated site information;
- HRSG and RSPB for historic raptor breeding data;
- Caithness Lochs SPA whooper swan, greylag goose and Greenland white-fronted goose wind farm development survey dataset (provided by SNH) for cumulative assessment;
- Pink-footed goose and (Icelandic) greylag goose feeding distributions (Mitchell 2012[6]); and

[4] Council Directive 2009/147/EC on the conservation of wild birds (the Birds Directive).

[5] Scottish Natural Heritage (2014, revised March 2017) Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms.

[6] Mitchell, C. (2012). Mapping the distribution of feeding Pink-footed and Iceland Greylag Geese in Scotland. Wildfowl & Wetlands Trust / Scottish Natural Heritage Report, Slimbridge.

- Various EIA reports and monitoring documents for wind farm projects within Natural Heritage Zone (NHZ) 2 North Caithness & Orkney.

Field Survey

6.2.13 Ornithological surveys were undertaken to establish the baseline ornithological conditions at the site (plus appropriate buffers). Fieldwork commenced in September 2012 and was completed in August 2017. Within this period, surveys were undertaken between September 2012 and August 2014 and October 2015 and August 2017. These provided data covering four breeding seasons (2013, 2014, 2016 and 2017) and four non-breeding seasons (2012/2013, 2013/2014, 2015/2016 and 2016/2017).

6.2.14 The following surveys were undertaken within the study areas[7] (see Technical Appendix 6.1: Ornithology for details):

- Flight activity surveys – September 2012 to February 2013, May 2013 to August 2014, October 2015 to August 2017 (see Figure 6.2 for viewshed areas);
- Scarce breeding bird surveys, within the site boundary plus a 2 km buffer (Figure 6.1) – spring/summer 2013, 2014 and 2016;
- Breeding bird surveys, within the site boundary plus a 500 m buffer – spring/summer 2013, 2014, 2016 and 2017;
- Winter walkover surveys, within the site boundary plus a 500 m buffer – December 2012 to February 2013 and December 2015 to February 2016; and
- Foraging goose surveys, within the site boundary plus a 5 km buffer – September 2013 to May 2014.

6.2.15 Field surveys were conducted following the relevant recommended SNH Guidance (2010[8], 2013[9], 2014[5], 2017[5]) depending on survey date. Technical Appendix 6.1: Ornithology provides details of the survey methodologies.

Criteria for the Assessment of Effects

Criteria for Assessing Wider-Countryside Ornithological Interests

6.2.16 The evaluation for wider-countryside interests (interests unrelated to SPAs but including Sites of Special Scientific Interest (SSSIs) and Ramsars) has been made using the following process:

- identifying the potential impacts associated with the proposed development;
- considering the likelihood of occurrence of potential impacts where appropriate;
- defining the sensitivity of a feature to impacts via the Nature Conservation Importance (NCI) of the species present and establishing each population’s conservation status;
- establishing the magnitude of the impact (both spatial and temporal);
- based on the above criteria, making a judgement as to whether or not the identified effect is significant with respect to the EIA Regulations;

[7] The study areas detailed on Figure 6.1 are buffered based on the turbines and track layout as indicated on Figure 2.1.

[8] Scottish Natural Heritage (2005, revised 2010). Survey methods for use in assessing the impacts of onshore windfarms on bird communities.

[9] Scottish Natural Heritage (2013). Recommended bird survey methods to inform impact assessment of onshore windfarms.

- if a potential effect if determined to be significant, suggesting measures to mitigate or compensate the effect where required; and
- considering residual effects after mitigation, compensation or enhancement.

Criteria for Assessing the Likely Significant Effects on a Special Protection Area

6.2.17 The method for assessing the likely significant effects on an SPA is different from that employed for wider-countryside ornithological interests. The Habitats Directive is transposed into domestic legislation by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland). Regulation 48 includes a number of steps to be taken by the competent authority before granting consent (these are referred to here as a Habitats Regulations Appraisal, HRA). In order of application, the first four are:

- Step 1: consider whether the proposal is directly connected to or necessary for the management of the SPA (Regulation 48(1)(b)).
- If not, Step 2: consider whether the proposal (alone or in combination) is likely to have a significant effect on the SPA (Regulation 48(1)(a)).
- If so, Step 3: make an Appropriate Assessment of the implications for the SPA in view of that SPA's conservation objectives (Regulation 48(1)(a)).
- Step 4: consider whether it can be ascertained that the proposal will not adversely affect the integrity of the SPA ("Integrity Test") having regard to the manner in which it is proposed to be carried out or to any conditions or restrictions subject to which they propose that the consent, permission or other authorisation should be given (Regulation 48(5) and 48(6)).

6.2.18 It has already been established that the proposed development does not meet the criteria for Step 1. The results of baseline surveys and scientific conclusions presented in this chapter are therefore used to inform the HRA process, and potentially for the competent authority to conduct an Appropriate Assessment where likely significant effects have been identified.

Criteria for Assessing the Sensitivity of Features

6.2.19 The sensitivity of the environmental features on or near to the site is assessed in line with best practice guidance, legislation, statutory designations and/or professional judgement.

6.2.20 Determination of the level of sensitivity of an Important Ornithological Feature ("IOF") is based on a combination of the feature's National Conservation Importance ("NCI") and conservation status. Table 6.2 details the framework for determining the NCI of features, with IOFs those target species identified to be of High or Moderate NCI (CIEEM 2018[10]).

Table 6.2: Determining Factors of a Feature's NCI

Importance	**Definition**
High	Populations receiving protection due to inclusion as features of an SPA, proposed SPA, Ramsar Site, SSSI or which would otherwise qualify under selection guidelines. Species present in nationally important numbers (>1 % national breeding population).
Moderate	The presence of target species listed in Annex 1 of the Birds Directive (but population does not meet the designation criteria under selection guidelines).

[10] Chartered Institute of Ecology and Environmental Management (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine, 3rd edition. CIEEM, Winchester.

Table 6.2: Determining Factors of a Feature's NCI	
Importance	**Definition**
	The presence of breeding species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The presence of species noted on the latest Birds of Conservation Concern (BoCC) Red list (*et al.* 2015[1]). Regularly occurring migratory species, which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the wind farm. Species present in regionally important numbers (>1 % regional breeding population).
Low	All other species' populations not covered by the above categories.

6.2.21 As defined by SNH, the conservation status of a species is, "the sum of the influences acting on it which may affect its long-term distribution and abundance, within the geographical area of interest" (SNH 2018a[3]).

6.2.22 Conservation status is considered to be favourable under the following circumstances (SNH 2018a[3]):

- *"Population dynamics indicate that the species is maintaining itself on a long-term basis as a viable component of its habitats";*
- *"The natural range of the species is not being reduced, nor is it likely to be reduced for the foreseeable future"; and*
- *"There is (and probably will continue to be) a sufficiently large habitat to maintain its population on a long-term basis".*

6.2.23 SNH states that "an impact should therefore be judged as of concern where it would adversely affect the existing favourable conservation status of a species or prevent a species from recovering to favourable conservation status, in Scotland" (SNH 2018a[3]).

6.2.24 The relevant population scale for assessing potential effects on breeding species is considered to be the appropriate Natural Heritage Zone ("NHZ"), in this case the Orkney and North Caithness NHZ 2. However, for some populations, insufficient information on the NHZ population may exist and, in these circumstances, the regional or national population estimate is used. For wintering or migratory species, the national or flyway population is considered to be the relevant scale for determining effects on the conservation status (SNH 2018a[3]) and this approach is used in this assessment.

Criteria for Assessing Magnitude of Impact

6.2.25 An impact is defined as a change to the abundance and/or distribution of a population as a result of the proposed development. Impacts can be adverse, neutral or beneficial.

6.2.26 In determining the magnitude of impacts, the resilience of a population to recover from temporary adverse conditions is considered in respect of each potentially affected population.

6.2.27 The response of individual species to disturbance during relevant behaviours is considered when determining spatial and temporal magnitude of impact and is assessed using guidance including Bright *et al*. (2006[11]), Hill *et al.* (1997[12]) and Ruddock and Whitfield (2007[13]).

6.2.28 Impacts are judged in terms of magnitude in space and time and there are five levels of spatial and temporal impacts as detailed in Table 6.3 and Table 6.4 below respectively. The examples given in these two tables provide a guideline to the assessment, but professional judgement will be relied upon in each individual case.

Table 6.3: Spatial Magnitude of Impact

Spatial Magnitude	Definition
Very High	Total/near total loss of a bird population due to mortality or displacement. Total/near total loss of productivity in a bird population due to disturbance. Guide: >80 % of population lost through additive mortality.
High	Major reduction in the status or productivity of a bird population due to mortality, displacement or disturbance. Guide: 21-80 % of population lost through additive mortality.
Moderate	Partial reduction in the status or productivity of a bird population due to mortality, displacement or disturbance. Guide: 6-20 % of population lost through additive mortality.
Low	Small but discernible reduction in the status or productivity of a bird population due to mortality, displacement or disturbance. Guide: 1-5 % of population lost through additive mortality.
Negligible	Very slight reduction in the status or productivity of a bird population due to mortality, displacement or disturbance. Reduction barely discernible, approximating to the "no change" situation. Guide: <1 % population lost through additive mortality.

Table 6.4: Temporal Magnitude of Impact

Temporal Magnitude	Definition
Permanent	Impact continuing indefinitely beyond the span of one human generation (taken as approximately 30 years), except where there is likely to be substantial improvement after this period. Where this is the case, Long Term may be more appropriate.
Long Term	Approximately 15-30 years (or longer, see 'Permanent').
Medium Term	Approximately 5-15 years.
Short Term	Up to approximately 5 years.
Negligible	Very minor (<6 months) or no temporal effect.

[11] Bright, J. A., Langston, R. H. W., Bullman, R., Evans, R. J., Gardner, S., Pearce-Higgins, J. and Wilson, E. (2006) Bird Sensitivity Map to provide locational guidance for onshore windfarms in Scotland. RSPB Research Report No. 20.

[12] Hill, D. A., Hockin, D., Price, D., Tucker, G., Morris, R. and Treweek J. (1997). Bird Disturbance: Improving the Quality of Disturbance Research. Journal of Applied Ecology, 34: 275-288.

[13] Ruddock, M. and Whitfield, D. P. (2007) A Review of Disturbance Distances in Selected Bird Species. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.

Criteria for Assessing Cumulative Effects

6.2.29 The significance of cumulative and/or in-combination effects is assessed following the same methodology as detailed above for the proposed development alone. The assessment follows SNH (2018[14]) guidance for cumulative assessment.

Criteria for Assessing Significance

6.2.30 The predicted significance of the effect has been determined through a standard method of assessment based on professional judgement, considering both sensitivity (i.e. each bird species' relative sensitivity to a particular impact) and magnitude of impact. The significance criteria used in this assessment are listed in Table 6.5.

Table 6.5: Determining Significance of Effects

Significance of Effect	Definition
Major	The impact is likely to result in a long term significant adverse effect on the integrity of a feature.
Moderate	The impact is likely to result in a medium term or partially significant adverse effect on the integrity of a feature.
Minor	The impact is likely to adversely affect a feature at an insignificant level by virtue of its limitations in terms of duration or extent, but there will probably be no effect on its integrity.
Negligible	No impact.

6.2.31 '**Major**' and '**Moderate**' impacts are considered to be **significant** in accordance with the EIA Regulations.

6.2.32 '**Minor**' and '**Negligible**' impacts are considered to be **not significant** in accordance with the EIA Regulations.

Limitations and Assumptions

6.2.33 Limitations exist with regard to the knowledge base on how some species, and the populations to which they belong, react to impacts. A precautionary approach is taken in these circumstances, and as such it is considered that these limitations do not affect the robustness of this assessment. It should be noted that surveys prior to September 2016 were undertaken from a single vantage point (VP 1, see Figure 6.2) and surveys from September 2016 onwards were undertaken from two VPs (VP 2 and VP 3), however this is not considered to be a limitation as all the final turbine locations were covered in all survey years. It should also be noted that whilst there have been various revisions to the design and site boundary across the development life history, surveys across all the various seasons covered the study areas detailed on Figure 6.1 as a minimum.

6.3 Baseline Conditions

Current Baseline

6.3.1 The sections below provide information on statutory designations, a summary of target species recorded during flight activity surveys and a summary of results per target species

[14] Scottish Natural Heritage (2012). Assessing the Cumulative Impact of Onshore Wind Energy Developments.

(grouped into species groups) recorded. For each target species recorded it is also determined, based on baseline survey results and/or historic data, whether they can be reasonably scoped out if the assessment at this stage as a result of a lack of likely significant effects.

Designated Sites

6.3.2 Information gathered from the consultation exercise confirmed that there are no statutory conservation designations within the site but that the proposed development would be located within 20 km of three SPAs (with their component Ramsar sites and SSSIs) and one SSSI (Figure 6.3):

- Caithness Lochs SPA (Table 6.6), underpinned by Caithness Lochs Ramsar site, Broubster Leans SSSI, Loch Calder SSSI, Loch Heilen SSSI, Loch Scarmclate SSSI and Loch Watten SSSI – various distances from east to south, 5.5 km[15] to the closest portion of the SPA from the site;
- North Caithness Cliffs SPA (Table 6.7), underpinned by Dunnet Head SSSI and Red Point Coast SSSI – various distances to the north east, west and east, 2.2 km[15] to the closest portion of the SPA from the site;
- Caithness and Sutherland Peatlands SPA (Table 6.8), underpinned by Caithness and Sutherland Peatlands Ramsar, East Halladale SSSI, Loch Caluim Flows SSSI, Strathmore Peatlands SSSI – 9.1 km[15] to the south west of the site; and
- Lambsdale Leans SSSI (Table 6.9) – 12.4 km[15] to the south of the site.

Table 6.6: Summary of Qualifying Features of the Caithness Lochs SPA/Ramsar (and Broubster Leans SSSI[a], Loch Calder SSSI[b], Loch Heilen SSSI[c], Loch Scarmclate SSSI[d] and Loch Watten SSSI[e])

Feature	Qualifying Feature Category	Status[16]	Description
Greenland white-fronted goose Anser albifrons flavirostris non-breeding	SPA, Ramsar, SSSI[b,c]	April 2016: favourable declining	Wintering population of European importance: winter peak mean (1993/94 – 1997/98) of 440 representing 3% of the GB population and 1% of the Greenlandic population.
Greylag goose Anser anser non-breeding	SPA, Ramsar, SSSI[b,c,d,e]	November 2015: favourable maintained	Wintering population of European importance: winter peak mean (1993/94 – 1997/98) of 7,190 representing 7% of the GB and Icelandic population.
Whooper swan Cygnus cygnus non-breeding	SPA, Ramsar, SSSI[b,c]	March 2015: favourable maintained	Wintering population of European importance: winter peak mean (1993/94 – 1997/98) of 240 representing 4% of the GB population and 1% of the Icelandic population.
Breeding bird assemblage	SSSI[a]	June 2007: favourable maintained	Contains a range of breeding wildfowl and waders including: wigeon, teal, snipe, greenshank, dunlin, wood sandpiper and spotted crake. The SSSI is also an important foraging area for hen harrier and short-eared owl that breed outwith the SSSI.

[15] Distances are all measured from the closest turbine to the closest part of the SPA.

[16] As per https://sitelink.nature.scot/site/8477

6.3.3 The Caithness Lochs SPA citation (and Loch Heilen SSSI citation) also states that "the site lies towards the northern limit of these species' wintering distributions and is important to the maintenance of these species' wintering ranges".

Table 6.7: Summary of Qualifying Features of the North Caithness Cliffs SPA (and Dunnet Head SSSI[f] and Red Point Coast SSSI[g])

Feature	Qualifying Feature Category	Status[17]	Description
Fulmar Fulmarus glacialis breeding	SPA	June 2016: favourable maintained	Breeding population of national importance: 14,700 pairs (1985-1987), 3% of the GB population.
Guillemot Uria aalge breeding	SPA, SSSI[f,g]	June 2016: favourable maintained	Breeding population of European importance: 38,300 birds (1985-1987), 1% of the north Atlantic biogeographic population and 4% of the GB population.
Kittiwake Rissa tridactyla breeding	SPA	June 2016: unfavourable declining	Breeding population of national importance: 13,100 pairs (1985-1987), 3% of the GB population.
Peregrine falcon Falco peregrinus breeding	SPA	June 2014: unfavourable declining	Breeding population of European importance: 6 pairs, 0.5% of the GB population.
Puffin Fratercula arctica breeding	SPA	June 2016: favourable maintained	Breeding population of national importance: 2,080 pairs (1985-1987), 0.4% of the GB population.
Razorbill Alca torda breeding	SPA	June 2016: favourable recovered	Breeding population of national importance: 4,000 pairs (1985-1987), 3% of the GB population.
Seabird colony breeding	SPA, SSSI[f]	June 2016: favourable maintained	In addition to those species listed as designated features, the following species breed on the cliffs: shag, herring gull and great black-backed gull.

Table 6.8: Summary of Qualifying Features of the Caithness and Sutherland Peatlands SPA/Ramsar (and East Halladale SSSI[h], Loch Caluim Flows SSSI[j] and Strathmore Peatlands SSSI[k])

Feature	Qualifying Feature Category	Status[18]	Description
Black-throated diver Gavia arctica breeding	SPA	June 2018: favourable maintained	Breeding population of European importance: 26 pairs in 1994, 15% of the GB population.
Common scoter Melanitta nigra breeding	SPA, SSSI[k]	June 2013: unfavourable declining	Breeding population of European importance: 21 pairs (2007) representing <0.1% of the western Siberia/western and north Europe/north western Africa biogeographic population and 40.4% of the GB population.

[17] As per https://sitelink.nature.scot/site/8554

[18] As per https://sitelink.nature.scot/site/8476

Table 6.8: Summary of Qualifying Features of the Caithness and Sutherland Peatlands SPA/Ramsar (and East Halladale SSSI[h], Loch Caluim Flows SSSI[j] and Strathmore Peatlands SSSI[k])

Feature	Qualifying Feature Category	Status[18]	Description
Dunlin Calidris alpina schinzii breeding	SPA, Ramsar, SSSI[h,j,k]	June 2015: favourable maintained/recovered	Breeding population of European importance: 1,860 pairs (1993-1994) representing 20% of the GB population.
Golden eagle Aquila chrysaetos breeding	SPA, SSSI[h,j,k]	August 2016: favourable maintained	Breeding population of European importance: 5 pairs in 1992, 1% of the GB population.
Golden plover Pluvialis apricaria breeding	SPA, SSSI[h,j]	June 2015: favourable maintained/recovered	Breeding population of European importance: 1,064 pairs (1993-1994) representing 5% of the GB population.
Greenshank Tringa nebularia breeding	SPA, SSSI[j,k]	June 2015: favourable maintained/recovered	Breeding population of European importance: 653 pairs (2009) representing 0.9% of the Europe/western Africa biogeographic population and 59.4% of the GB population.
Greylag goose Anser anser breeding	Ramsar	June 2018: favourable maintained	Internationally important population of north Scottish greylag goose.
Hen harrier Circus cyaneus breeding	SPA	June 2016: favourable maintained	Breeding population of European importance: 54 pairs (1993-1994) representing 4% of the GB population.
Merlin Falco columbaris breeding	SPA	June 2004: favourable maintained	Breeding population of European importance: average of 14 pairs (1993-1997) representing 2.8% of the GB population.
Red-throated diver Gavia stellata breeding	SPA	July 2006: favourable maintained	Breeding population of European importance: 46 pairs in 2006, 3.5% of the GB population.
Short-eared owl Asio flammeus breeding	SPA	Condition not assessed	Breeding population of European importance: 30 pairs representing 2% of the GB population.
Wigeon Anas penelope breeding	SPA, SSSI[k]	June 2018: favourable maintained	Breeding population of European importance: 43 pairs (1993/94) representing <0.1% of the western Siberia/north western and north eastern Europe biogeographic population and 10.8% of the GB population.
Wood sandpiper Tringa glareola breeding	SPA	June 2004: favourable maintained	Breeding population of European importance: up to 5 pairs representing 40% of the GB population.
Breeding bird assemblage	Ramsar, SSSI[h,j,k]	June 2015: favourable maintained	The Ramsar site and four SSSIs support a particularly rich range of breeding moorland birds and waterfowl.

Table 6.9: Summary of Qualifying Features of the Lambsdale Leans SSSI			
Feature	**Qualifying Feature Category**	**Status[19]**	**Description**
Breeding bird assemblage	SSSI	June 2005: favourable recovered	Supports breeding/foraging wildfowl and wading bird's characteristic of upland wetlands including: grey heron, greylag goose, teal, wigeon, tufted duck, dunlin, snipe, curlew, redshank, greenshank and common sandpiper.

Flight Activity Summary

6.3.4 A summary of all target species recorded during flight activity surveys at the site is detailed in Table 6.10. This summarises all flights observed during the baseline period (September 2012 to February 2013, May 2013 to August 2014 and October 2015 to August 2017) regardless of the location of the flight in relation to the proposed development. For further details of the flight activity surveys, refer to Technical Appendix 6.1: Ornithology.

6.3.5 Band *et al.* (2007[20]) describe a method of quantifying potential bird collisions with onshore turbines, in which: (i) the activity rate per unit area per season is extrapolated; (ii) the likelihood of a collision with a blade for a bird passing through the rotor swept area is calculated; and (iii) an 'avoidance rate' is applied to account for behavioural adaptation of birds to the presence of turbines. The bird seconds[21] for target species identified to be 'at-risk'[22] were input into a collision risk model (using Band *et al.* 2007[17]) to calculate the predicted collision rates per season for each target species recorded during baseline flight activity surveys and a summary of the collision model results is detailed in Table 6.11 (refer to Annex B of Technical Appendix 6.1: Ornithology for detailed results).

[19] As per https://sitelink.nature.scot/site/902

20 Band, W., Madders, M., and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. In: Janss, G., de Lucas, M. & Ferrer, M (eds.) Birds and Wind Farms. Quercus, Madrid. 259-275.

21 Bird seconds are calculated for each observation as the product of flight duration and number of individuals.

22 'At-risk' is defined as: a flight having at least part of its duration (i) at potential collision height; (ii) within the CRAA; and (iii) recorded within the 2 km viewshed of the associated VP.

Table 6.10: Species Recorded During Flight Activity Surveys, 2012 to 2017				
Species	**Number of Flights Recorded**	**Total Bird Seconds Recorded**	**Number of Flights Recorded 'at-Risk[22]'**	**Bird Seconds Recorded 'at-Risk[22]'**
Arctic skua	5	375	3	168.72
Barn owl	2	60	0	0
Curlew	239	14,775	106	5,295.81
Golden plover	123	382,515	56	90,941.78
Greenland white-fronted goose	15	194,160	4	1,759
Greylag goose	370	1,711,800	132	148,014.91
Hen harrier	52	5,595	4	38.6
Herring gull	123	12,075	53	3,900.99
Lapwing	809	985,890	328	44,215.59
Merlin	4	165	1	13.99
Peregrine falcon	6	195	2	56.34
Pink-footed goose	181	1,829,430	113	849,433.89
Ringed plover	7	3,795	4	1,220.31
Short-eared owl	3	60	0	0
Whooper swan	30	22,905	6	1,771.97

Table 6.11: Collision Modelling Results				
Species	**Mean Breeding Season**	**Mean Non-Breeding Season**	**Mean Annual**	**Equivalent to One Bird Every X Years**
Arctic skua	0.0012	0.0016	0.0028	355
Curlew	0.3043	0.0450	0.3493	2.86
Golden plover	1.4214	1.4186	2.8400	0.35
Greenland white-fronted goose	0	0.0042	0.0042	237
Greylag goose	0	0.6071	0.6071	1.65
Hen harrier	0	0.0005	0.0005	2,004
Herring gull	0.2766	0	0.2766	3.62
Lapwing	0.8428	1.0171	1.8599	0.54
Merlin	0	0.0002	0.0002	4,446
Peregrine falcon	0.0014	0.0003	0.0017	587
Pink-footed goose	0	3.4818	3.4818	0.29
Ringed plover	0.0027	0.0906	0.0932	10.72
Whooper swan	0	0.0224	0.0224	45

Geese and Swans

6.3.6 Table 6.12 contains a summary of observations of foraging geese and swans recorded within the 5 km survey area during the 2013/2014, 2015/2016 and 2016/2017 non-breeding seasons. These records are also detailed on Figure 6.4 to Figure 6.8.

Table 6.12: Foraging Wildfowl Survey Summary

		Barnacle Goose (Fig 6.4)	**Brent Goose (Fig 6.4)**	**Greenland White-Fronted Goose (Fig 6.5)**	**Greylag Goose (Fig 6.6)**	**Pink-Footed Goose (Fig 6.7)**	**Whooper Swan (Fig 6.8)**
2013/2014 Non-Breeding Season	No. of Records	-	1	20	214	62	16
	No. of Birds	-	1	445	30,140	10,952	418
	Flock Size (Range)	-	2	1-70	1-1,600	1-2,500	2-115
	Flock Size (Average)	-	2	22	141	177	26
2015/2016 Non-Breeding Season	No. of Records	1	-	7	79	19	16
	No. of Birds	3	-	227	14,690	3,746	293
	Flock Size (Range)	3	-	1-95	1-1,200	1-950	2-90
	Flock Size (Average)	3	-	32	186	197	18
2016/2017 Non-Breeding Season	No. of Records	1	-	19	173	77	13
	No. of Birds	3	-	629	13,750	10,860	82
	Flock Size (Range)	3	-	1-86	1-700	1-835	1-20
	Flock Size (Average)	3	-	33	79	141	6

BARNACLE GOOSE

6.3.7 Foraging goose surveys recorded two flocks of three barnacle geese within the survey area during April and October 2016 (Table 6.12, Figure 6.4). Barnacle geese were not recorded during any other surveys. The closest of these fields is 1.2 km to the east of the site (Figure 6.4).

6.3.8 As the site does not appear to be used by the species, any disturbance to foraging barnacle goose as a result of the construction, operation and decommissioning of the proposed development is considered to be negligible/non-existent. Considering this species' minimal activity within the wider study area, **barnacle goose is scoped out of the assessment**.

BRENT GOOSE

6.3.9 Two brent geese were recorded on one occasion (over 1 km from the site) during surveys for foraging wildfowl during the 2013/2014 non-breeding season (Figure 6.4). Brent geese were not recorded during any other surveys.

6.3.10 Considering this species' minimal activity within the wider study area, **brent goose is scoped out of the assessment**.

Greenland White-Fronted Goose

6.3.11 Flight activity surveys recorded 15 flights, of which four flights were identified to be 'at-risk' (Table 6.10, Figure 6.9) which predicted a mean non-breeding season collision risk of 0.004, or one every 237 years (Table 6.11).

6.3.12 Surveys for foraging wildfowl recorded no feeding Greenland white-fronted goose within 500 m of planned infrastructure, and within 1 km of planned infrastructure on only one occasion (during the 2016/2017 non-breeding season, Figure 6.5). Table 6.12 contains a summary of all Greenland white-fronted goose foraging activity recorded within the 5 km survey area.

6.3.13 Greenland white-fronted goose is listed in Annex 1 of the EU Birds Directive and as Red in the BoCC 4 list. Non-breeding Greenland white-fronted goose is also a designated feature of the Caithness Lochs SPA (Table 6.6). Considering the presence of foraging activity within 1 km of the site, **Greenland white-fronted goose is scoped in to the assessment**.

Greylag Goose

6.3.14 Flight activity surveys recorded 370 flights, of which 132 flights were identified to be 'at-risk' (Table 6.10, Figure 6.10a-e) which predicted a mean non-breeding season collision rate of 0.607 collisions per year, or one every 1.65 years (Table 6.11).

6.3.15 Surveys for foraging wildfowl recorded feeding greylag goose within 500 m of the site on 10 occasions (on five occasions during the 2013/2014 non-breeding season, on three occasions during the 2015/2016 non-breeding season and on two occasions during the 2016/2017 non-breeding season) and within 1 km of the site on a further 16 occasions (on nine occasions during the 2013/2014 breeding season, two occasions during the 2015/2016 non-breeding season and on five occasions during the 2016/2017 non-breeding season) (Figure 6.6). As shown on Figure 6.6, greylag goose foraging activity within 1 km of the site was focussed to the north west of the site with the main concentrations in the fields north of the A836 to the north west of the site. Table 6.12 contains a summary of all greylag goose foraging activity recorded within the 5 km survey area. A comparison between the foraging data gathered during the baseline surveys and the Mitchell (2012[6]) greylag goose foraging data (Figure 6.6) shows a strong correlation between the 1 km grid squares identified for foraging greylag goose by Mitchell (2012[6]) and the baseline data although the surveys have identified additional 1 km grid squares used by greylag geese, adjacent to those identified by Mitchell (2012[6]) (Figure 6.6).

6.3.16 Two populations of greylag goose can be found in Scotland, the breeding British population and the migratory Icelandic population. Both species are listed as Amber in the BoCC 4 list. Non-breeding (Icelandic) greylag goose are a designated feature of the Caithness Lochs SPA (Table 6.6) and breeding (British) greylag goose are a designated feature of the Caithness Peatlands Ramsar (Table 6.8). Considering the presence of foraging activity within 500 m of the site and the predicted risk of collision, **greylag goose is scoped in to the assessment**.

Pink-Footed Goose

6.3.17 Flight activity surveys recorded 181 flights, of which 113 flights were identified to be 'at-risk' (Table 6.10, Figure 6.11a-c) which predicted a mean non-breeding season collision rate of

3.48 collisions per year, or one every 0.29 years (Table 6.11). It should be noted that current SNH guidance[23] on potential wind farm impacts on pink-footed geese states: "*SNH will now no longer require CRM to be completed for pink-footed geese in support of wind farm applications in the wider countryside, although the process should be followed as usual for assessing impacts on designated site pink-footed goose populations*". Although the species is not a qualifying feature of any nearby designated site, to support the current assessment, the pink-footed goose data was entered into the collision model to check on the potential level of mortality which would be predicted.

6.3.18 Surveys for foraging wildfowl recorded feeding pink-footed goose within 500 m of proposed infrastructure on two occasions (during the 2013/2014 non-breeding season) and within 1 km of proposed infrastructure on a further eight occasions (on seven occasions during the 2013/2014 breeding season and on one occasion during the 2015/2016 non-breeding season) (Figure 6.7). As shown on Figure 6.7, pink-footed goose foraging activity within 1 km of the site was focussed to the north west of the site with the main concentrations in the fields north of the A836 to the north west site (in a pattern similar to the greylag goose feeding distribution). Table 6.12 contains a summary of all pink-footed goose foraging activity recorded within the 5 km survey area. A comparison between the foraging data gathered during the baseline surveys and the Mitchell (2012[6]) pink-footed goose foraging data (Figure 6.7) indicates that pink-footed goose foraging is more widely distributed around the site than indicated by the 1 km grid squares identified for foraging pink-footed goose by Mitchell (2012[6]).

6.3.19 Pink-footed goose is listed as Amber in the BoCC 4 list. Considering the presence of foraging activity within 500 m of the site and the predicted risk of collision, **pink-footed goose is scoped in to the assessment**.

WHOOPER SWAN

6.3.20 Flight activity surveys recorded 30 flights, of which six flights were identified to be 'at-risk' (Table 6.10, Figure 6.12) which predicted a mean non-breeding season collision rate of 0.022 collisions per year, or one every 45 years (Table 6.11).

6.3.21 Whooper swans were recorded on the lochan at Hill of Forss (within the site) on one occasion during the 2013/2014 non-breeding season and on seven occasions during the 2015/2016 non-breeding season. All bar one of these records were of birds landing or taking off from the lochan and were recorded during flight activity surveys and consisted of between two and 13 birds. There was no evidence of whooper swan routinely using the lochan at Hill of Forss as a roosting site.

6.3.22 Surveys for foraging wildfowl recorded feeding whooper swan over 1 km the north west, north east and south of the proposed infrastructure (Table 6.12, Figure 6.8) with the closest foraging record located just over 1 km to the north west of the nearest proposed infrastructure (near West Brims Farm).

6.3.23 Whooper swan is listed in Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside Act and as Amber in the BoCC 4 list. Non-breeding whooper swan are also a designated feature of the Caithness Lochs SPA (Table 6.6). Considering the presence of

[23] https://www.nature.scot/professional-advice/planning-and-development/renewable-energy-development/types-renewable-technologies/onshore-wind-energy/wind-farm-impacts-birds

whooper swan on the lochan at Hill of Forss, **whooper swan is scoped in to the assessment**.

Raptors and Owls

Barn Owl

6.3.24 Surveys for breeding raptors and owls during the 2013, 2014 and 2016 breeding seasons recorded no evidence of barn owl within 1 km with the exception of one record of very old barn owl pellets just over 500 m to the north of the site in February 2016. It was also noted by surveyors that the high densities of jackdaw nesting in any potential barn owl nesting sites was likely to have made these unsuitable for barn owl.

6.3.25 Flight activity surveys recorded two flights (Table 6.10, Figure 6.13), however neither were identified to be 'at-risk' and therefore no collision risk is predicted for barn owl.

6.3.26 Considering this species' low on-site activity, absence of breeding within 1 km and no predicted risk of collision, **barn owl is scoped out of the assessment**.

Hen Harrier

6.3.27 No evidence of breeding hen harrier within 2 km of the site was identified during the 2013, 2014 or 2017 breeding seasons with a ringtail hen harrier recorded on one occasion during April 2014 (Figure 6.14). There was noted to be little suitable breeding habitat available within the study area.

6.3.28 Hen harrier were recorded on seven occasions within the 2 km study area during the 2012/2013, 2015/2016 and 2016/2017 non-breeding seasons (Figure 6.15), however the records were widely distributed across the study area with no evidence of a roost site.

6.3.29 Flight activity surveys recorded 52 flights, of which four flights were identified to be 'at-risk' (Table 6.10, Figure 6.16) which predicted a mean rate of 0.0005 collisions per year (Table 6.11), or one every 2,004 years.

6.3.30 Considering this species' low on-site activity, no recorded breeding activity and negligible predicted risk of collision, **hen harrier is scoped out of the assessment**.

Merlin

6.3.31 No evidence of breeding merlin within 2 km of the site was identified during the 2013, 2014 or 2017 breeding bird seasons. A single bird was recorded flying over the site in both January and April 2016 (Figure 6.15 and Figure 6.14 respectively).

6.3.32 Flight activity surveys recorded four merlin flights, of which one flight was identified to be 'at-risk' (Table 6.10, Figure 6.17) which predicted a mean non-breeding season rate of 0.0002 collisions per year (Table 6.11), or one every 4,446 years.

6.3.33 Considering this species' low on-site activity, no recorded breeding activity and negligible predicted risk of collision, **merlin is scoped out of the assessment**.

PEREGRINE FALCON

6.3.34 No evidence of breeding peregrine falcon within 2 km of the site was identified during the 2013, 2014 or 2017 breeding bird seasons. A single bird was recorded flying over the site during winter walkover surveys in January 2016 (Figure 6.15).

6.3.35 Flight activity surveys recorded six flights, of which two flights were identified to be 'at-risk' (Table 6.10, Figure 6.18) which predicted a mean collision rate of 0.0003 collisions per year (Table 6.11), or one every 587 years.

6.3.36 Considering this species' low on-site activity, no recorded breeding activity and negligible predicted risk of collision, **peregrine falcon (the wider-countryside population) is scoped out of the assessment**. For consideration of the North Caithness Cliffs SPA population, refer to Table 6.14 and paragraphs 6.3.61 to 6.3.67.

SHORT-EARED OWL

6.3.37 Flight activity surveys recorded three short-eared owl flights (Table 6.10, Figure 6.19), none of which were identified to be 'at-risk' and therefore no collision risk is predicted.

6.3.38 No evidence of breeding short-eared owl within 2 km of the site was identified during the 2013, 2014 or 2017 scarce breeding bird surveys. A single bird was recorded flying over the site during winter walkover surveys in December 2015 (Figure 6.15).

6.3.39 Considering this species' low on-site activity, no recorded breeding activity and negligible risk of collision, **short-eared owl is scoped out of the assessment**.

Waders

6.3.40 Table 6.13 contains a summary of breeding wader activity located within 500 m of the site, with breeding activity also shown on Figure 6.20.

Table 6.13: Breeding Wader Activity, 2013 to 2017

Species	**2013**	**2014**	**2016**	**2017**
Curlew	3	2	3-5	2-3
Lapwing	3	2	4-8	3-5
Ringed plover	0	0	0-1	0

CURLEW

6.3.41 Flight activity surveys recorded 239 flights, of which 106 flights were identified to be 'at-risk' (Table 6.10, Figure 6.21a-b) which predicted a mean annual collision risk of 0.349 (Table 6.11), or one every 2.86 years (Table 6.11). The majority of curlew activity was recorded during the breeding season (April to July), with a mean breeding season collision risk of 0.304, or one every 3.29 breeding seasons (Table 6.11).

6.3.42 Breeding bird surveys recorded breeding curlew within the 500 m study area during each of the survey years with an estimated minimum of two and a maximum of five territories in any one year (Table 6.13, Figure 6.20).

6.3.43 Curlew is listed as Red in the BoCC 4 list. Considering the presence of up to six breeding pairs within 500 m of the proposed development, and in combination with the predicted collision rate, **curlew is scoped in to the assessment**.

GOLDEN PLOVER

6.3.44 Flight activity surveys recorded 122 flights, of which 56 flights were identified to be 'at-risk' (Table 6.10, Figure 6.22a-b) which predicted a mean collision rate of 2.84 per year (Table 6.11), or one every 0.35 years. The majority of golden plover activity was of wintering/non-breeding flocks recorded between August and April with only thirteen of the total 122 flights recorded during flight activity surveys recorded between May and July. Of the flights recorded between May and July, nine of these were of flocks between three and 34 birds and surveys across the four breeding seasons did not identify any breeding activity within the study area. Consequently, golden plover activity recorded at the site is all considered to be of non-breeding, migrating or wintering individuals.

6.3.45 Non-breeding golden plover were infrequently recorded utilising the site itself (i.e. for feeding/roosting) on seven occasions with the majority of golden plover activity recorded flying over the site (32 occasions during walkover surveys and 122 occasions during flight activity surveys) or foraging further afield in the surrounding area. The greater flight activity recorded during the non-breeding season was noted to relate to the large flocks noted gathering in the surrounding lowland fields during migration (autumn and spring).

6.3.46 Although golden plover is listed in Annex 1 of the EU Birds Directive, it is Green-listed in the BoCC 4 list. The species was however recorded regularly in flight, and considering the mean annual predicted rate of collision of more than one bird a year (3.17 per year), **golden plover (the wider countryside population) is scoped in to the assessment**. For consideration of the Caithness and Sutherland Peatlands SPA population, refer to Table 6.14 and paragraphs 6.3.61 to 6.3.67.

LAPWING

6.3.47 Flight activity surveys recorded 810 flights, of which 328 flights were identified to be 'at-risk' (Table 6.10, Figure 6.23a-b) which predicted a mean collision rate of 1.86 per year (Table 6.11). Lapwing were recorded across all seasons, however as with curlew, the majority of flight activity was recorded between April and July (645 flights). Of the remaining flights, 119 flights were recorded in the migratory months of March and August and 46 flights between the months of September and February. Therefore, for lapwing, separate consideration of the mean breeding (0.843 per breeding season, Table 6.11) and mean non-breeding (1.017 per non-breeding season, Table 6.11) collision rates is considered to be appropriate.

6.3.48 Breeding bird surveys recorded breeding lapwing within the 500 m study area during each of the survey years with an estimated minimum of two and a maximum of eight territories in any one year (Table 6.13, Figure 6.20).

6.3.49 Lapwing is listed as Red in the BoCC 4 list. Considering the presence of up to six breeding pairs within 500 m of the proposed development, and in combination with the predicted collision rate, **lapwing is scoped in to the assessment**.

RINGED PLOVER

6.3.50 Flight activity surveys recorded seven flights, of which four flights were identified to be 'at-risk' (Table 6.10, Figure 6.24) which predicted a mean collision rate of 0.093 per year, or one every 10.7 years (Table 6.11). The majority of ringed plover flight activity (six out of seven records) was recorded between September and February, with a mean non-breeding season collision rate of 0.091, or one every 11.04 non-breeding seasons (with a resulting mean breeding season collision rate of 0.003, or one every 373 breeding seasons). Forrester *et al.* (2012[24]) estimate a Scottish breeding population of 4,900 to 6,700 breeding pairs and a wintering population of 23,000 to 25,000 birds. Considering an annual adult mortality of 0.228 (BTO Bird Facts[25]) and using the lower population estimate for both the breeding and wintering populations, this would equate to a background loss of 2,234/5,244 birds per year from the breeding/wintering Scottish population. The additional predicted loss of 0.003 and 0.091 birds per season from the breeding and non-breeding populations respectively of ringed plover due to collisions would therefore equate to an additional mortality of 0.0001 % (breeding population) and 0.002 % (non-breeding population), both of which would be considered to be negligible (Table 6.3).

6.3.51 Breeding bird surveys recorded a single potential ringed plover territory within 500 m of the proposed infrastructure during 2016 surveys (Table 6.13, Figure 6.20). Ringed plover were not recorded during any other surveys.

6.3.52 Considering this species' low on-site activity, limited breeding activity and negligible predicted risk of collision, **ringed plover is scoped out of the assessment**.

WOODCOCK

6.3.53 Woodcock were recorded on two occasions during the 2015/2016 winter walkover surveys (Figure 6.15). Woodcock were not recorded during any other survey types.

6.3.54 Considering this species' very low on-site activity, no record of breeding and no predicted risk of collision, **woodcock is scoped out of the assessment**.

Other Target Species

ARCTIC SKUA

6.3.55 Flight activity surveys recorded five flights, of which three flights were identified to be 'at-risk' (Table 6.10, Figure 6.25) which predicted a mean collision rate of 0.003 per year, or one every 355 years (Table 6.11). Arctic skua was not recorded during any other surveys.

6.3.56 Considering this species' very low on-site activity and negligible predicted risk of collision, **arctic skua is scoped out of the assessment**.

HERRING GULL

6.3.57 Flight activity surveys recorded 123 flights, of which 53 flights were identified to be 'at-risk' (Table 6.10, Figure 6.26) which predicted a mean breeding collision risk of 0.277, or one

[24] Forrester, R.W., Andrews, I.J., McInerny, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C. & Grundy, D.S. (eds) 2012. The Digital Birds of Scotland. The Scottish Ornithologists' Club, Aberlady.

[25] https://app.bto.org/birdfacts/results/bob4700.htm

every 3.6 years (Table 6.11). Wilson *et al.* (2015[26]) estimated that there may be 3,455 breeding pairs of herring gull within NHZ 2 and considering an annual adult mortality rate of 0.12 (BTO Bird Facts[27]), this would equate to a loss of 829.2 birds per year from the NHZ population. The additional predicted loss of 0.318 birds per year due to collisions would therefore equate to an increased mortality rate by 0.04 % which would be considered to be negligible (Table 6.3).

6.3.58 Herring gull were also recorded overflying the site during winter walkover surveys (Figure 6.15) and were noted to be foraging in the low-level fields at the northern end of the proposed development in small numbers (ten or less) on occasion. Much greater numbers of herring gulls were noted to be present in the fields to the north of the A836 (over 500 m to the north of the site).

6.3.59 Herring gull is listed as Red on the BoCC 4 list. Herring gull are also included on the North Caithness Cliffs SPA seabird breeding colony species list (Table 6.7). Breeding herring gull can range both inland and offshore to forage, however considering the moorland/ upland nature of the site, its value as a foraging resource for any herring gull breeding at the North Caithness Cliffs SPA is considered to be much lower than the surrounding agricultural fields, coastal and offshore foraging habitats. Considering this species' low on-site activity and negligible predicted risk of collision, **herring gull (the wider countryside and North Caithness Cliffs SPA populations) is scoped out of the assessment**.

Future Baseline

6.3.60 In the absence of the proposed development, assuming the continuation of current land management practices, and allowing for changes in bird behaviour related to climate change (e.g. delayed, reduced or increased breeding attempts depending on the species range), the bird populations are likely to continue to be present in largely similar abundances and distributions to those described in the baseline (Section 6.3).

Consideration of SPA Connectivity

6.3.61 Table 6.14 details the species listed on the three SPAs within 20 km of the site in relation to the recommended connectivity distances (SNH 2016[28]). For the North Caithness Cliffs SPA, only peregrine falcon has been included in Table 6.14 as all the other species for which the SPA is designated (Table 6.7) are considered to be true seabirds and as such the site is, at best, of limited importance to these species (in addition, the site is located inland from the SPA and would not be located within any flyways for these species between the SPA and their offshore feeding areas). It should also be noted that herring gull are included in the seabird breeding assemblage (favourable maintained, June 2016; Table 6.7) which is listed as a designated feature of the North Caithness Cliffs SPA. Whilst herring gull was recorded during baseline surveys (paragraphs 6.3.57 to 6.3.59), the importance of the site for foraging herring gull is considered to be limited (the vast majority of herring gulls were observed foraging and commuting over the low-lying fields to the north of the site, Technical Appendix 6.1 Annex C). As such connectivity with the SPA is considered to be trivial at best.

[26] Wilson, M. W., Austin, G. E., Gillings, S. and Wernham, C. V. (2015). Natural Heritage Zone Bird Population Estimates. SWBSG Commissioned Report number SWBSG 1504.

[27] https://app.bto.org/birdfacts/results/bob5920.htm

[28] Scottish Natural Heritage (2016) Assessing connectivity with Special Protection Areas (SPAs).

6.3.62 Foraging ranges are not provided in SNH (2016[28]) for common scoter, wigeon or wood sandpiper and so approximate foraging ranges have been supplied on the basis of comparative species[29] for which foraging ranges are detailed in the SNH (2016[28]) connectivity guidance.

Table 6.14: SPA Qualifying Species and Connectivity Likelihood to the Proposed Development (SNH 2016[28])

SPA Species	SNH (2016) Foraging Range	Caithness Lochs SPA – 5.4 km	North Caithness Cliffs SPA – 2.4 km	Caithness and Sutherland Peatlands SPA – 9.1 km
Black throated-diver	10 km	N/A	N/A	Potential connectivity
Dunlin	500 m	N/A	N/A	No connectivity
Golden eagle	6 km	N/A	N/A	No connectivity
Golden plover	3 km	N/A	N/A	No connectivity
Greenland white-fronted goose	8 km	Potential connectivity	N/A	N/A
Greenshank	2 km	N/A	N/A	No connectivity
Greylag goose	15-20 km	Potential connectivity	N/A	Potential connectivity (Ramsar only)
Hen harrier	2 km	N/A	N/A	No connectivity
Merlin	5 km	N/A	N/A	No connectivity
Peregrine falcon	2 km	N/A	Limited connectivity	N/A
Red-throated diver	8 km	N/A	N/A	No connectivity
Short-eared owl	2 km	N/A	N/A	No connectivity
Whooper swan	5 km	Limited connectivity	N/A	N/A
Common scoter	1-8 km	N/A	N/A	No connectivity
Wigeon	8 km	N/A	N/A	No connectivity
Wood sandpiper	500 m	N/A	N/A	No connectivity

6.3.63 Considering the information detailed in Table 6.14 and the information recorded during baseline surveys, there is potential for connectivity between the site and the Caithness Lochs SPA species (wintering Greenland white-fronted goose, greylag goose and whooper swan) and as such, due to potential likely significant effects, the **Caithness Lochs SPA (and associated SSSIs/Ramsar) is scoped in to the assessment.**

6.3.64 The Caithness Lochs SPA conservation objectives are detailed below:

1) To avoid deterioration of the habitats of the qualifying species (Greenland white-fronted goose, greylag goose and whooper swan) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and
2) To ensure for the qualifying species that the following are maintained in the long term:
    a) Population of the species as a viable component of the SPA;
    b) Distribution of species within the site;
    c) Distribution and extent of habitats supporting the species;
    d) Structure, function and supporting processes of habitats supporting the species; and

[29] Comparative species are: wood sandpiper = dunlin, common scoter = curlew, and wigeon = red-throated diver

e) No significant disturbance of the species.

6.3.65 Considering the information detailed in Table 6.14, there is potential for connectivity between the site and the Caithness and Sutherland Peatlands SPA and Ramsar site, for breeding black-throated diver and breeding greylag goose. Black-throated diver were not recorded during any of the baseline surveys undertaken between 2013 and 2017 and no suitable waterbodies for breeding black-throated diver were identified within 2 km of the site. Greylag geese were only recorded during baseline surveys for the proposed development during the migratory and wintering seasons, and therefore unlikely to be part of the Ramsar site breeding population. Considering the results of baseline surveys, there is no connectivity between the proposed development and breeding black-throated diver or greylag goose, and no likely significant effects are predicted. Consequently, **the Caithness and Sutherland Peatlands SPA (and associated SSSIs/Ramsar site) is scoped out of the assessment and no adverse effects on the SPA are predicted.**

6.3.66 Considering the information detailed in Table 6.14, there is some potential for limited connectivity, and therefore a potential likely significant effect, between the site and the North Caithness Cliffs SPA breeding peregrine falcon population (the North Caithness Cliffs SPA is 2.4 km to the north of the site). Peregrine falcon were infrequently recorded across the site, with no evidence of breeding within 2 km of the site and no suitable breeding habitat noted to be available within the site. There was also noted to be limited suitable breeding habitat in the surrounding area, with exception of the sea cliffs (including those of the North Caithness Cliffs SPA) which are over 2 km from the site. The site would therefore be unlikely to form an integral part of the territory of any breeding pair located on the sea cliffs (especially given the large prey resource also located around the sea cliffs). Consequently, **the North Caithness Cliffs SPA (and associated SSSIs) is scoped out of the assessment and no adverse effects on the SPA are predicted**.

6.3.67 Lambsdale Leans SSSI includes a breeding bird assemblage as a qualifying feature (Table 6.9) and of the species named within the citation, only breeding greylag goose would be within potential foraging range (15-20 km) of the site (12.4 km from the SSSI). Greylag geese were only recorded during baseline surveys for the proposed development during the migratory and wintering seasons, and are therefore unlikely to be part of the SSSI breeding population. Consequently, **the Lambsdale Leans SSSI is scoped out of the assessment.**

Summary of Scoped-In Important Ornithological Features

6.3.68 The assessment is applied to those scoped-in IOFs detailed in Table 6.15 of Moderate or High NCI (Table 6.2) that are known to be present within the site or surrounding area (as confirmed though survey results and consultations outlined above).

Table 6.15: Scoped-In IOFs

Feature	NCI	Reason for Inclusion
Greenland white-fronted goose	High	Caithness Lochs SPA connectivity, Annex 1, migratory species.
Greylag goose	High	Caithness Lochs SPA connectivity, migratory species.
Whooper swan	High	Caithness Lochs SPA connectivity, Annex 1/Schedule 1, migratory species.
Pink-footed goose	Moderate	BoCC Amber listed, migratory species.

Table 6.15: Scoped-In IOFs		
Feature	**NCI**	**Reason for Inclusion**
Curlew	Moderate	BoCC Red listed, sensitive to wind farm developments.
Lapwing	Moderate	BoCC Red listed, sensitive to wind farm developments.
Golden plover	Moderate	Annex 1, BoCC Green listed.

6.3.69 In addition, it is necessary to consider the conservation status of any scoped-in IOFs and these are detailed in Table 6.16.

Table 6.16: Conservation Status of Scoped-In IOFs		
IOF	**Conservation Status**	**Information**
Greenland white-fronted goose	Annex 1, BoCC Red list (WI)	Most recent counts of all known Greenland white-fronted goose wintering locations in Britain found totals of 10,774 birds in autumn 2017 and 10,942 in spring 2017 (Fox et al. 201830). Wilson et al. (201531) estimated a peak wintering abundance of 492 birds in NHZ 2 in 2005. The British population's long-term trend (1989/90 to 2014/15) has shown a 31 % decrease, with the ten-year trend (2004/05 to 2014/15) showing a 35 % decrease (Hayhow et al. 201732), and, is therefore in **unfavourable conservation status.**
Greylag goose	Schedule 1, BoCC Amber (WI, WL)	The Scottish population is estimated to be at least 85,000 wintering birds (in addition to the resident breeding population) with over 95 % of the Icelandic population wintering in Scotland (Forrester *et al.* 2012[24]). Mitchell *et al.* (2010[33]) estimates a north and west Scotland breeding (British) greylag goose population of 34,500 birds. The breeding (British) greylag goose population is considered to be in **favourable conservation status** with a marked 58 % increase between 2004/05 and 2014/15[34]. The wintering (Icelandic) greylag goose population is also considered to be in **favourable conservation status** with a 10 % increase between 2004/05 and 2014/15[35].
Whooper swan	Annex 1, Schedule 1, BoCC Amber list (BR, WL)	The Scottish wintering population is estimated to be 4,142 birds (Forrester *et al.* 2012[24]) with Wilson *et al*. (2015[31]) estimating an NHZ 2 peak wintering abundance of 706 birds in 2005. Wintering whooper swan in Scotland are almost exclusively from Iceland and population trends provided by the WWT[36] indicate that whooper swans are likely to be in **favourable conservation status**.
Pink-footed goose	BoCC Amber list (WL)	The Scottish population is estimated to be 200,000 in October and 100,000-150,000 in winter/spring (Forrester *et al.* 2012[24]), with Wilson *et al*. (2015[31]) estimating a peak wintering abundance of 20,746 in NHZ 2 in 2005. Mitchell and Hearn (2004[37]) noted that pink-footed goose populations have increased greatly from the mid-1950s (20,000-30,000

[30] Fox, T., Francis, I., Noriss, D. and Walsh, A. (2018). Report of the 2017/2018 International Census of Greenland White-Fronted Geese. Greenland White-fronted Goose Study and National Parks & Wildlife Service.

[31] Wilson, M. W., Austin, G. E., Gillings S. and Wernham, C. V. (2015). Natural Heritage Zone Bird Population Estimates. SWBSG Commissioned report number SWBSG_1504. pp72. Available from:www.swbsg.org

[32] Hayhow DB, Ausden MA, Bradbury RB, Burnell D, Copeland AI, Crick HQP, Eaton MA, Frost T, Grice PV, Hall C, Harris SJ, Morecroft MD, Noble DG, Pearce-Higgins JW, Watts O, Williams JM, The state of the UK's birds 2017.

[33] Mitchell, C., Griffin, L., Trinder, M. & Newth, J. (2010). The population size of breeding greylag geese Anser anser in Scotland in 2008/09. Scottish Natural Heritage Commissioned Report No. 371.

[34] https://monitoring.wwt.org.uk/our-work/goose-swan-monitoring-programme/species-accounts/british-greylag-goose/

[35] https://monitoring.wwt.org.uk/our-work/goose-swan-monitoring-programme/species-accounts/iceland-greylag-goose/

[36] https://monitoring.wwt.org.uk/our-work/goose-swan-monitoring-programme/species-accounts/whooper-swan/

[37] Mitchell, CR & RD Hearn. 2004. Pink-footed Goose Anser brachyrhynchus (Greenland/Iceland population) in Britain 1960/61 – 1999/2000. Waterbird Review Series, The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.

Table 6.16: Conservation Status of Scoped-In IOFs		
IOF	**Conservation Status**	**Information**
		birds) to mid-1990s (200,000-250,000 birds) and pink-footed goose has remained on the Amber list between the BoCC 3 (2009) and BoCC 4 (2015) reports. Overall, the wintering population is considered to be in **favourable conservation status**.
Curlew	BoCC Red list (BDMp[1], BDp[2])	The national curlew population was most recently estimated to be 68,000 pairs in 2009 (BTO BirdTrends[38]) with the NHZ 2 population estimated by Wilson *et al.* (2015[31]) to be 3,233 (2,915-3,551) pairs in 2005. The recent inclusion of the species on the BoCC Red list suggests that the national and regional populations are in **unfavourable conservation status**.
Lapwing	BoCC Red list (BDp[1], BDp[2])	The national lapwing population was estimated to be 130,000 pairs in 2009 (BTO BirdFacts[39]) and the Scottish population is estimated to be between 71,500 and 105,600 pairs (Forrester *et al.* 2012[24]). The BTO BirdTrends[38] programme has reported a national decline by 43 % across the UK, and 57 % in Scotland between 1995 and 2014. The BTO's map of change in relative density between 1994-96 and 2007-09 indicates that decreases have been the strongest in lowland regions and the south and that some increase may have occurred in some upland and northern regions of Britain. The NHZ trend is unknown but the regional and national populations are on balance likely to be in **unfavourable conservation status**.
Golden plover	Annex 1, BoCC Green list	The British wintering population is estimated to be 400,000 (Gillings and Fuller 2009[40]) with the Scottish population estimated to be up to 60,000 in the autumn, 35,000 in mid-winter and 30,000 in the spring (Forrester *et al.* 2012[24]). The north east Scotland estuarine coastal estimates represent around 13% of the Scottish coastal total which would indicate a regional spring, autumn and winter population between 3,900 and 7,800 individuals. Given that in the region of 15,000 to 20,000 birds also winter inland and that rocky coasts are not included in the coastal estimates (Forrester *et al.* 2012[24]), the adjusted regional golden plover population for north east Scotland is estimated to lie between 5,850 and 10,400 birds. Additionally, golden plover continues to be included on the BoCC Green list. Overall, the wintering population is considered to be in **favourable conservation status.**
BoCC criteria (Eaton *et al*. 2015[31]) for Conservation Status: **HD** = Historical Decline. A severe decline in the UK between 1800 and 1995, without substantial recent recovery. **BDp** = Breeding Population Decline. Severe decline in the UK breeding population size, of >50%, over 25 years (BDp[1]) or the entire period used for assessments since the first BoCC review, starting in 1969 ("longer-term") (BDp[2]) **BDMp** = Breeding Population Decline. Moderate decline in the UK breeding population size, of more than 25%, over 25 years (BDMp[1]) or the entire period used for assessments since the first BoCC review, starting in 1969 ("longer-term") (BDMp[2]). **BDMr** = Breeding Range Decline. Moderate decline (by more than 25% but less than 50%) in the last 25 years (BDMr[1]) or over longer term BDMr[2]). **BR =** Breeding rarity. **WL** -= Non-breeding localisation. **WI** = Non-breeding international importance.		

[38] https://www.bto.org/about-birds/birdtrends/2016

[39] https://app.bto.org/birdfacts/results/bob4930.htm

[40] Gillings, S. & Fuller, R.J. 2009. How many Eurasian Golden Plovers Pluvialis apricaria and Northern Lapwings Vanellus vanellus winter in Great Britain? Results from a large-scale survey in 2006/07. Wader Study Group Bull. 116(1): 21–28.

6.4 Assessment of Likely Effects

6.4.1 This section provides an assessment of the likely effects of the proposed development on the IOFs identified through the baseline studies and scoping-in assessment. The assessment of effects is based on the project description outlined in Chapter 2: Development Description and is structured as follows:

- Construction effects – disturbance and habitat loss;
- Operational effects – collision risk;
- Operational effects – displacement;
- Decommissioning effects; and
- Cumulative/In Combination effects.

Project Assumptions

6.4.2 The assessment below also makes the following assumptions:

- All electrical cabling between the proposed turbines and the associated infrastructure will be underground in shallow trenches which would be reinstated post-construction and, in most cases, follow the proposed access tracks.
- Any disturbance areas around permanent infrastructure during construction will be temporary and areas will be reinstated or restored before the construction period ends. The only excavation in these areas will be for cabling as noted above and otherwise may only be periodically used for side-casting of spoil until reinstatement.
- To ensure all reasonable precautions are taken to avoid negative effects on ornithological interests during construction and decommissioning, the developer will appoint a suitably qualified Ecological Clerk of Works (ECoW) prior to the commencement of construction and decommissioning and they will advise the developer and the Principal Contractor on all ornithological matters (with the assistance of a suitably qualified/licenced ornithologist if required). The ECoW will be required to be present on the site during the construction and decommissioning periods and will carry out monitoring of works and briefings with regards to any ornithological sensitivities on the site to the relevant staff within the principal contractor and subcontractors.
- A Breeding Bird Protection Plan (BBPP) will be implemented during construction and decommissioning of the proposed development. The BBPP will detail measures to ensure legal compliance and safeguard breeding birds known to be in the area. The BBPP shall include pre-construction surveys and good practice measures during construction. Pre-construction surveys will be undertaken to check for any new breeding bird activity in the vicinity of the construction/decommissioning works.
- Work on the proposed development, including vegetation clearance and construction of the site access tracks, turbine hard standings and site compound and erection of the turbines is predicted to last for approximately 12 months. The number of bird breeding seasons potentially disrupted would depend on the month in which construction commences and the breeding season of the potentially affected species. The main breeding season of most birds at the site extends from April to July (Forrester *et al.* 2012[24]). For the purposes of this assessment it is assumed that, for any given species of bird, construction activities would commence during the breeding season and would therefore potentially affect a maximum of up to two breeding seasons, assuming that construction will take approximately 12 months.

Likely Significant Effects

6.4.3 For the purposes of the assessment, effects relating to non-breeding Greenland white-fronted goose, whooper swan and greylag goose also require consideration within the context of the Caithness Lochs SPA via the HRA process. Effects are therefore considered within the context of the Caithness Lochs SPA population in addition to the wider countryside population. With regards to the HRA (as detailed above in paragraphs 6.2.17 to 6.2.18), and as previously stated, the proposed development is not directly connected to, or necessary for the management of, the SPA (Step 1) and it is considered likely to have a significant effect, either alone or in combination, on the SPA (Step 2). Step 3 therefore requires an Appropriate Assessment to be undertaken on the implications for the SPA's conservation objectives. This chapter provides information to inform the Appropriate Assessment.

Potential Construction Effects

6.4.4 The main potential effects of construction activities across the proposed development are the displacement and disruption of breeding, foraging and roosting birds as a result of noise and visual disturbance over a short-term period (either the duration of a particular construction activity within working hours, or the duration of the whole construction period).

6.4.5 Effects on birds would be confined to areas in the locality of temporary construction compounds, turbines, tracks and other infrastructure. Few attempts have been made to quantify the impacts of disturbance of birds due to activities of this type, and much of the available information is inconsistent. However, as a broad generalisation, larger bird species such as raptors, or those that feed in flocks in the open tend to be more susceptible to disturbance than small birds living in structurally complex habitats (such as woodland, scrub and hedgerow) (Hill *et al.* 1997[41]).

6.4.6 Direct habitat loss would also occur due to the proposed development's construction, which would be both temporary (e.g. construction compounds, laydown areas) and longer term (access tracks and turbines). This has the potential to impact on breeding, foraging or roosting individuals.

Geese and Swans

6.4.7 **Effect – foraging displacement**: In a recent review, Olsson (2018[42]) found that although there are large variations in responses among geese species, individual populations, seasons, sources and levels of disturbance, disturbance effects on geese have been observed at distances up to 500 m (see for example, Vickery and Gill, 1999[43], Jensen *et al.*, 2017[44]).

[41] Hill, D.A., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. (1997). Bird disturbance: improving the quality of disturbance research. Journal of Applied Ecology 34:275-288.

[42] Olsson, C. (2018). Foraging and movement patterns by geese in agricultural landscapes. Swedish University of Agricultural Sciences, Uppsala.

[43] Vickery, J. A. & Gill, J. A. 1999. Managing grassland for wild geese in Britain: a review. Biological Conservation, 89, 93-106.

[44] Jensen, G. H., Pellissier, L., Tombre, I. M. & Madsen, J. (2017). Landscape selection by migratory geese: implications for hunting organisation. Wildlife Biology, 12.

6.4.8 Construction phase activities may therefore disturb birds from foraging areas located within 500 m of the proposed development[45] by virtue of increased activity resulting from the construction phase (mainly as a result of increased human activity).

6.4.9 **Effect – roosting**: wintering whooper swan may be displaced from intermittently roosting/resting on the lochan at Hill of Forss (located within the site) during construction.

6.4.10 Sensitivity:

- Greenland white-fronted goose – high NCI (Table 6.15) and unfavourable conservation status (Table 6.16). High sensitivity;
- Greylag goose – high NCI (Table 6.15) and favourable conservation status (Table 6.16). Medium-high sensitivity;
- Whooper swan – high NCI (Table 6.15) and favourable conservation status (Table 6.16). Medium-high sensitivity; and
- Pink-footed goose – moderate NCI (Table 6.15) and favourable conservation status (Table 6.16). Low-medium sensitivity.

6.4.11 **Magnitude of Effect**: foraging geese and swans are widely distributed in the lowland areas (comprising of arable/semi-improved grassland fields) that surround the site (Figures 6.5 to 6.8) and birds have been recorded in one main area within 500 m of infrastructure relating to the proposed development. It is worth noting that no foraging geese or swans were recorded within 500 m of the turbine locations (in fact there are only four foraging records within 1 km of the turbines, all of greylag goose), but rather there are foraging records within 500 m of the track that heads north to the A836.

6.4.12 Madsen (1985[46]) monitored the impact of roads and landscape features on field utilization of pink-footed geese in autumn and spring. It was found that the disturbance distance of roads with traffic volume of more than 20 cars per day was around 500 m in autumn, but less in spring. Lanes with 0–10 cars per day also had a depressing effect on utilization. Windbreaks, banks, and other features which hinder an open view, had disturbance distances of approximately 200–300 m. Larger, more heavily used roads have been reported to result in a smaller disturbance effect, as geese tend to get used to the constant disturbance, compared to smaller roads where traffic is more irregular (Giroux and Patterson, 1995[47], Jensen *et al*., 2017[44]).

6.4.13 To the north, greylag goose and pink-footed goose have been recorded foraging in the fields surrounding Burn of Brims Farm (just to the north of the A836) and construction activities relating to the building/upgrading of the main track that will connect the proposed development to the A836 may temporarily displace foraging birds. Approximately the northernmost 350 m of this track may be within 500 m of these foraging geese, however the presence of the A836 may act as a barrier/may have already habituated birds in these fields to vehicular activity. It is likely that any birds foraging within 500 m of the track will move further north west (towards West Brims Farm) to the other fields where foraging

[45] This precautionary buffer distance that has been previously applied in relation to foraging/roosting geese at other wind farm sites by MacArthur Green and SNH.

[46] Madsen, J. (1985) Impact of disturbance on field utilisation of Pink-footed Geese in West Jutland, Denmark. Biological Conservation, 33, 53-63.

[47] Giroux, J.-F. & Patterson, I. J. (1995). Daily movements and habitat use by radiotagged Pink-footed Geese Anser brachyrhynchus wintering in northeast Scotland. Wildfowl, 46, 31-44.

geese and swans were also recorded. The effect on foraging geese and swans foraging near Burn of Brims Farm is considered to be an effect of **negligible** and **short-term** magnitude at a population level.

6.4.14 Whooper swan were infrequently recorded on the lochan at Hill of Forss (once during the 2013/2014 non-breeding season and on seven occasions during the 2015/2016 non-breeding season) with between two and 13 birds recorded. The 2015/2016 records were scattered across the season, with one record in November, four records in December and two records in January. No observations of foraging whooper swan were recorded within 1 km of the proposed development and surveys during the 2012/2013 and 2016/2017 non-breeding seasons did not locate any evidence of whooper swan using the lochan at Hill of Forss. Considering the baseline results, it is considered that the use of the lochan by wintering whooper swan is sporadic and the lochan does not appear to be an established roosting location. The effect of construction-related disturbance on roosting/resting whooper swan is considered to be of **negligible** and **short-term** magnitude at a population level.

6.4.15 The habitat directly surrounding the proposed development is considered to be of limited suitability to foraging geese and swans, being mainly wet heath/wet modified bog/marshy grassland and this is confirmed by the results of the foraging goose and swan surveys. Consequently, the loss of some of these habitats as a result of the proposed development is considered to be negligible.

6.4.16 **Significance of Effect (EIA):** the unmitigated effect during construction on foraging geese and swans and roosting/resting whooper swan is considered to be no more than **minor adverse** at respective population levels, and is therefore **not significant** in the context of the EIA regulations.

6.4.17 **Significance of Effect (HRA):** In light of the potential connectivity (for Greenland white-fronted goose, greylag goose and whooper swan) between the proposed development and the Caithness Lochs SPA, the effect must also be considered within the context of the HRA process and the information provided here may also inform an appropriate assessment.

6.4.18 Based on the above considerations, there are considered to be **no adverse effects on the integrity of the Caithness Lochs SPA** under the HRA process (paragraphs 6.2.17 to 6.2.18 and paragraph 6.3.64) due to construction-related disturbance-displacement effects.

Curlew and Lapwing

6.4.19 **Effect**: breeding and/or foraging curlew and lapwing may be displaced from the site during construction, either by disturbance or direct habitat loss.

6.4.20 **Sensitivity**: moderate NCI (Table 6.15) and unfavourable conservation status (Table 6.16). Medium-high sensitivity for both species.

6.4.21 **Magnitude of Effect**: between two and five curlew and two and eight lapwing territories were identified within 500 m of the proposed infrastructure in any one year. The curlew NHZ 2 breeding population is estimated to be 3,233 pairs (Wilson *et al.* 2015[31]), and the potential (temporary) loss of between 2-5 curlew territories would result in a loss of up to 0.15 % of the breeding population. It should however be noted that it is unlikely that all breeding curlew activity would be entirely lost from the population during construction as there is additional suitable breeding habitat surrounding the site and it is more likely that any curlew that may have bred near the site would be displaced to adjacent habitat. As a worst-case (where breeding would be lost rather than displaced), an effect of **low** and **short-term** magnitude is predicted.

6.4.22 The NHZ 2 lapwing population is unknown, but based on the Scottish population of 71,500 to 105,600 pairs, and considering the breeding distribution map presented in Forrester *et al.* (2012[24]), there is likely to be a minimum of 5,000 breeding pairs in Caithness. The potential (temporary) loss of 2-8 lapwing territories would result in a loss of up to 0.16 % of the breeding population. It should however be noted that it is unlikely that all breeding lapwing activity would be entirely lost from the population during construction as there is additional suitable breeding habitat surrounding the site and it is more likely that any lapwing that may have bred near the site would be displaced to adjacent habitat. As a worst-case (where breeding would be lost rather than displaced), an effect of **low** and **short-term** magnitude is predicted.

6.4.23 **Significance of Effect**: the unmitigated effect during construction for curlew and lapwing is considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

Golden Plover

6.4.24 **Effect:** wintering golden plover may be displaced from the site during construction, either by disturbance or direct habitat loss.

6.4.25 **Sensitivity:** moderate NCI (Table 6.15) and favourable conservation status (Table 6.16). Low-medium sensitivity.

6.4.26 **Magnitude of Effect:** non-breeding golden plover were infrequently recorded on the site during baseline surveys with the vast majority of records of birds flying over the site. Of the birds recorded on the site, flock sizes were mainly between one and six birds with two records of flocks of 50 birds. A small number of foraging golden plover may therefore be displaced during construction however given the abundance of similar suitable habitat within the wider area, any effect is considered to be of **negligible** and **short-term** magnitude.

6.4.27 **Significance of Effect:** the unmitigated effect during construction for golden plover is considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

Potential Operational Effects – Collision Risk

6.4.28 Birds that utilise the airspace within the site at potential collision heights during the lifetime of the proposed development will be at risk of collision with turbines. The risk of collision with moving wind turbine blades may be related to various factors including the amount of flight activity over the site, the topography of the site, the species' behaviour, and the ability of birds to detect and manoeuvre around rotating turbine blades. Collision risk modelling was undertaken as part of the baseline survey analysis (refer to Table 6.11 and Technical Appendix 6.1: Ornithology) which results in a figure for the likely collision rate at the wind farm which is then (for those species 'scoped in' to the assessment) assessed within the context of the species' relevant populations to determine the significance of any losses.

6.4.29 **Effect:** birds flying within the turbine area may be subject to a collision risk with turbines or other infrastructure, thereby potentially affecting survival rates at a population level. For Greenland white-fronted goose, greylag goose and whooper swan, survival rates at the Caithness Lochs SPA population level may also be affected and are considered below within an HRA context.

Whooper Swan

6.4.30 **Sensitivity:** Medium-high.

6.4.31 **Magnitude of Effect:** whooper swan were recorded in relatively low numbers across the four non-breeding seasons (2012/2013 – one record, 2013/2014 – eight records, 2015/2016 – 14 records, 2016/2017 – seven records) and a mean non-breeding collision rate of 0.022 (or one every 45 non-breeding seasons) is predicted for whooper swan (Table 6.11, Annex B of Technical Appendix 6.1: Ornithology).

6.4.32 The NHZ 2 wintering population is estimated to be 706 birds (Wilson *et al.* 2015[31]) and the additional mortality due to collision would be an increase over the baseline mortality rate (0.199, BTO BirdFacts[48]) of 0.016 %. This increase in baseline mortality is considered to be of **negligible** and **long-term** magnitude.

6.4.33 The Caithness Lochs SPA wintering population is estimated to be 240 birds (Table 6.6) and the additional mortality due to collision would be an increase over the baseline mortality rate of 0.047 %.

6.4.34 **Significance of Effect (EIA):** the unmitigated effect on the NHZ 2 whooper swan population is considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

6.4.35 **Significance of Effect (HRA):** based on the above consideration, there are considered to be **no adverse effects on the integrity of the Caithness Lochs SPA** under the HRA process (paragraphs 6.2.17 to 6.2.18 and paragraph and paragraph 6.3.64).

Greenland White-Fronted Goose

6.4.36 Sensitivity: High.

6.4.37 **Magnitude of Effect:** Greenland white-fronted geese were recorded in relatively low numbers across two non-breeding seasons (2012/2013 and 2013/2014 – no records, 2015/2016 – one record, 2016/2017 – 14 records) and a mean non-breeding collision rate of 0.004 (or one every 237 non-breeding seasons) is predicted for Greenland white-fronted goose (Table 6.11, Annex B of Technical Appendix 6.1: Ornithology).

6.4.38 The NHZ 2 wintering population is estimated to be 492 birds (Wilson *et al.* 2015[31]) and the additional mortality due to collision would be an increase over the baseline mortality rate (0.276, BTO BirdFacts[49]) of 0.003 %. This increase in baseline mortality is considered to be of **negligible** and **long-term** magnitude.

[48] https://app.bto.org/birdfacts/results/bob1540.htm
[49] https://app.bto.org/birdfacts/results/bob1590.htm

6.4.39 The Caithness Lochs SPA wintering population is estimated to be 440 birds (Table 6.6) and the additional mortality due to collision would be an increase over the baseline mortality rate of 0.005 %.

6.4.40 **Significance of Effect (EIA):** the unmitigated effect on the NHZ 2 Greenland white-fronted goose population is considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

6.4.41 Significance of Effect (HRA): based on the above consideration, there are considered to be no adverse effects on the integrity of the Caithness Lochs SPA under the HRA process.

Greylag Goose

6.4.42 Sensitivity: Medium-high.

6.4.43 **Magnitude of Effect:** greylag geese were recorded frequently across the four non-breeding seasons (2012/2013 – 31 records, 2013/2014 – 86 records, 2015/2016 – 51 record, 2016/2017 – 198 records) and a mean non-breeding collision rate of 0.607 (or one every 1.65 non-breeding seasons) is predicted for greylag goose (Table 6.11, Annex B of Technical Appendix 6.1: Ornithology).

6.4.44 The Scottish wintering population (no NHZ 2 population estimate provided) is estimated to be at least 85,000 birds (Table 6.16) and the additional mortality due to collision would be an increase over the baseline mortality rate (0.276, BTO BirdFacts[50]) of 0.004 %. This increase in baseline mortality is considered to be of **negligible** and **long-term** magnitude.

6.4.45 The Caithness Lochs SPA wintering population is estimated to be 7,190 birds (Table 6.6) and the additional mortality due to collision would be an increase over the baseline mortality rate of 0.05 %.

6.4.46 **Significance of Effect (EIA):** the unmitigated effect on the NHZ 2 greylag goose population is considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

6.4.47 Significance of Effect (HRA): based on the above consideration, there are considered to be no adverse effects on the integrity of the Caithness Lochs SPA under the HRA process.

Pink-Footed Goose

6.4.48 Sensitivity: Low-medium.

6.4.49 **Magnitude of Effect:** pink-footed geese were recorded frequently across the four non-breeding seasons (2012/2013 – no records, 2013/2014 – 35 records, 2015/2016 – 30 records, 2016/2017 – 116 records) and a mean non-breeding collision rate of 3.48 (or one every 0.29 non-breeding seasons) is predicted for pink-footed goose (Table 6.11, Annex B of Technical Appendix 6.1: Ornithology).

6.4.50 The NHZ 2 wintering population is estimated to be at least 20,746 birds (Table 6.16) and the additional mortality due to collision would be an increase over the baseline mortality rate

[50] https://app.bto.org/birdfacts/results/bob1610.htm

(0.171, BTO BirdFacts[51]) of 0.098 %. This increase in baseline mortality is considered to be of **low** and **long-term** magnitude.

6.4.51 **Significance of Effect:** the unmitigated effect on the NHZ 2 pink-footed goose population is considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

Curlew and Lapwing

6.4.52 Sensitivity: Medium-high.

6.4.53 **Magnitude of Effect:** curlew were regularly recorded during the breeding seasons and tended to be absent from the site between August and February with only four of the total 239 flightlines recorded observed between these months. Flight activity was largely associated with breeding territories with around half of all recorded flights at potential collision height (with 80 % of these potential collision height flights identified to be 'at-risk[22]' and therefore included in the collision modelling). A mean annual collision rate of 0.349 (one every 2.9 breeding seasons) is predicted for curlew (Table 6.11, Annex B of Technical Appendix 6.1: Ornithology). The NHZ 2 breeding population is estimated to be 3,233 pairs (Wilson *et al.* 2015[31]) and the additional mortality due to collision would be an increase over the baseline mortality rate (0.264, BTO BirdFacts[52]) of 0.020 %. The increase in baseline mortality for curlew is considered to be of **negligible** and **long-term** magnitude.

6.4.54 Lapwing showed a similar spatial and temporal distribution to curlew, with around half of all recorded flights at potential collision height (with 89 % of these potential collision height flights identified to be 'at-risk[22]'. A mean annual collision rate of 1.86 (one every 0.54 years) is predicted for lapwing at the proposed development (Table 6.11, Annex B of Technical Appendix 6.1: Ornithology). The Caithness breeding population is considered to be at least 5,000 pairs (paragraph 6.4.22) and the additional mortality due to collision would be an increase over the baseline mortality rate (0.295, BTO BirdFacts[39]) of 0.063 %. The increase in baseline mortality for lapwing is considered to be of **negligible** and **long-term** magnitude.

6.4.55 **Significance of Effect**: the unmitigated effect on the NHZ 2 curlew and regional lapwing populations is considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

Golden Plover

6.4.56 **Sensitivity:** Low-medium.

6.4.57 **Magnitude of Effect:** considering their presence during the non-breeding season, the regional migrating and wintering populations are considered to be the appropriate reference populations of which the north east Scotland wintering population is considered to be between 5,850 and 10,400 birds (Table 6.16). Considering an annual adult mortality of 0.27 (BTO Bird Facts[53]), this would equate to a background loss of 1,580 to 2,808 birds per year from the north east Scotland regional population. The additional predicted loss of 1.42

[51] https://app.bto.org/birdfacts/results/bob1580.htm
[52] https://app.bto.org/birdfacts/results/bob5410.htm
[53] https://app.bto.org/birdfacts/results/bob4850.htm

birds per year due to collisions would therefore equate to an additional mortality between 0.05 and 0.09 %. The increase in baseline mortality for golden plover is considered to be of **negligible** and **long-term** magnitude.

6.4.58 **Significance of Effect:** the unmitigated effect on the north east Scotland wintering golden plover population is considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

Potential Operational Effects – Displacement

General Evidence of Displacement of Breeding Birds

6.4.59 The displacement of nesting and foraging birds from the site has the potential to extend beyond the construction phase, as described above, and to occur during the operational phase. It is recognised that disturbance may occur due to maintenance activities throughout the operational phase, although since these are likely to be of shorter duration and smaller extent than construction activities, effects will be lower than those predicted for construction effects (see previous section).

6.4.60 Displacement away from operational turbines has been found to occur in a number of individual wind farm studies, although the effects vary considerably between sites and species. Devereux *et al.* (2008[54]) showed that wind farms had no, or at most a minimal, effect on the local distribution of wintering farmland birds and across a range of breeding bird species but predominantly waders and passerines at upland wind farms, Pearce-Higgins *et al.* (2012[55]) found no displacement effects on any bird species at operating wind farms, other than where such displacement had already occurred during construction, and for some species the effects during construction were reversed during operation with numbers returning to pre-construction numbers. Consistent with the findings of Pearce-Higgins *et al.* (2012[55]), Hale *et al.* (2014[56]) found no evidence of displacement due to wind turbines in breeding grassland songbirds. However, Sansom *et al.* (2016[57]) suggested that breeding golden plovers may be affected by operational turbines up to 400 m away.

6.4.61 A North American study of redheads (which are ducks) found that breeding numbers at ponds within the wind farm were reduced by 77% compared to the situation pre-construction despite a three-fold increase in breeding numbers in the area outwith but near to the wind farm (Lange *et al.* 2018[58]), suggesting that breeding ducks largely avoided nesting within the wind farm area itself.

6.4.62 Pearce-Higgins *et al.* (2009[61]) observed certain species experiencing localised population increases with proximity to wind farm infrastructure installations, so while some birds may be displaced locally, others may benefit from the introduction of new structures into the

[54] Devereux, C.L., Denny, M.J.H. and Whittingham, M.J. (2008). Minimal effects of wind turbines on the distribution of wintering farmland birds, Journal of Applied Ecology 45: 1689-1694.

[55] Pearce-Higgins, J.W., Stephen, L., Douse, A. and Langston, R.H.W. (2012). Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis. Journal of Applied Ecology, 49: 386-394.

[56] Hale, A.M., Hatchett, E.S., Meyer, J.A. and Bennett, V.J. (2014). No evidence of displacement due to wind turbines in breeding grassland songbirds. Condor 116: 472-482.

[57] Sansom, A., Pearce-Higgins, J.W. and Douglas, D.J.T. (2016). Negative impact of wind energy development on a breeding shorebird assessed with a BACI study design. Ibis 158: 541-555.

[58] Lange, C.J., Ballard, B.M. and Collins, D.P. (2018). Impacts of wind turbines on redheads in the Laguna Madre. Journal of Wildlife Management 82: 531-537.

habitat, or some other consequence of construction. This finding was further supported by Pearce-Higgins *et al.* (2012[55]) who reported significant increases in breeding numbers of skylarks and stonechats at wind farms.

6.4.63 An additional consideration is the displacement of birds from larger areas where the turbines act as a barrier to bird movement. The likelihood of this effect occurring tends to increase with wind farm size, where large turbine arrays can force birds to alter their regular flight-paths, resulting in an increase in distance flown and so energy expended. However, a review of the literature suggests that none of the barrier effects identified have significant effects on populations (Drewitt and Langston 2006[59]). This was also the conclusion from modelling of energy costs to those bird species most likely to be sensitive to barrier effects (large and long-lived breeding birds such as seabirds) by Masden *et al*. (2010[60]).

6.4.64 It should also be noted that whilst it has been suggested that curlew nest densities may be reduced within 800 m of turbines (Pearce-Higgins *et al.* 2009[61]), Whitfield *et al.* (2010[62]) offers little support to the hypothesis that breeding curlew are displaced by operational turbines (even at 200 m). In addition, the authors suggested that breeding curlew are not sensitive to disturbance and that there is no correlation between nesting success and turbine proximity (Whitfield *et al.* 2010[62]). There is direct evidence of this at the operational Tangy I and Tangy II wind farms where a curlew territory has been recorded within 50 m of a turbine during the 2012 (Tangy II baseline) and 2017 (Tangy IV baseline surveys, Tangy IV EIAR[63]), indicating that curlew at Tangy Wind Farm have continued to breed within the vicinity of operational turbines, further supporting the apparent tolerance to wind farms in this species, and possibly indicating habituation to the presence of turbines.

General Evidence of Displacement of Geese by Wind Farms

6.4.65 Rees (2012[64]) reviewed evidence for behavioural responses of geese to wind farms in literature published up to early 2012. She concluded that there was insufficient evidence at that time to determine whether landscape-scale displacement of foraging geese occurred as a result of wind farms. However, she concluded that geese tend to avoid foraging within 100 m of wind turbines, and that geese tended to alter flight direction when between 5 and 1 km distant, to avoid entering wind farms and so may experience a barrier effect. This was confirmed by Plonczkier and Simms (2012[65]), who used radar to track flights of geese near to an operational offshore wind farm, and concluded that geese showed very high macro-avoidance, over 94% of flocks adjusting their flight direction to avoid entering the wind farm.

6.4.66 Rees (2012[64]) concluded that available evidence at that time was insufficient to assess the scale or extent of displacement of geese. Several detailed studies have however improved

[59] Drewitt, A.L. and Langston, R.L.H. (2006). Assessing the impacts of wind farms on birds, Ibis 148: 29-42.

[60] Masden, E.A., Haydon, D.T., Fox, A.D. and Furness, R.W. (2010). Barriers to movement: Modelling energetic costs of avoiding marine windfarms amongst breeding seabirds. Marine Pollution Bulletin 60: 1085-1091.

[61] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. and Bullman, R. (2009). Distribution of breeding birds around upland Windfarms. Journal of Applied Ecology 46: 1323-1331.

[62] Whitfield, D.P., Green, M. and Fielding, M.H. (2010). Are breeding curlew Numenius arquata displaced by wind energy developments? Natural Research Projects Ltd, Banchory.

[63] https://publicaccess.argyll-bute.gov.uk/online-applications/applicationDetails.do?keyVal=PEY7L8CH0GB00&activeTab=summary

[64] Rees, E.C. (2012). Impacts of wind farms on swans and geese: a review. Wildfowl 62: 37-72.

[65] Plonczkier, P., and Simms, I.C. (2012). Radar monitoring of migrating pink-footed geese: behavioural responses to offshore wind farm development. Journal of Applied Ecology, 49, 1187-1194.

the evidence base. While Larsen and Madsen (2000[66]) found that pink-footed geese tended to avoid foraging within 100 m of wind turbines, Madsen and Boertmann (2008[67]) showed that these birds demonstrated habituation to the presence of turbines, foraging in 50% smaller avoidance distances than they had initially shown when the wind farms first became operational. Habituation of foraging habitat use by geese and other birds to the presence of operational wind farms has also been shown by Farfan *et al*. (2017[68]).

6.4.67 Zehtindjiev *et al*. (2017[69]) concluded that wind farms in agricultural habitat did not cause any displacement at a landscape scale of red-breasted geese wintering in Bulgaria. Harrison *et al*. (2018[70]) did find local displacement by wind turbines of white-fronted geese wintering in Bulgaria, but considered that the displacement was very small scale, with densities reduced <100 m from turbines. The main determinant of foraging goose density in their study was distance from the roost site rather than presence of wind farms or other human structures such as roads and power lines which had only very local effects (Harrison *et al*. 2018[70]).

Geese and Swans

6.4.68 **Effect – foraging, roosting and flight path displacement**: the turbines and operational activities (e.g. turbine maintenance) may displace birds flying between established foraging and roosting areas or disturb birds from foraging areas located within 100 m of the proposed infrastructure.

6.4.69 Sensitivity:

- Greenland white-fronted goose – High;
- Greylag goose – Medium-high;
- Whooper swan – Medium-high; and
- Pink-footed goose – Low-medium.

6.4.70 **Magnitude of Effect**: foraging geese and swans are widely distributed in the lowland areas (comprising of arable/semi-improved grassland fields) that surround the site (Figures 6.5 to 6.8), however no foraging geese or swans were recorded within 500 m of the turbine locations (in fact there are only four foraging records within 1 km of the turbine locations, all greylag goose), but only within 500 m of the track that heads north to the A836. Considering that no geese or swans were recorded foraging within 500 m of the turbine locations, displacement as a result of turbine operation, or maintenance activities on the turbines themselves is considered unlikely and vehicular movements along the tracks extending to the north and south of the site are also not considered likely to disturb feeding

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66 Larsen J. K. and Madsen, J. (2000). Effects of wind turbines and other physical elements on field utilization by pink-footed geese (Anser brachyrhynchus): A landscape perspective. Landscape Ecology 15: 755–764.

67 Madsen, J. and Boertmann, D. (2008). Animal behavioural adaptation to changing landscapes: spring-staging geese habituate to wind farms. Landscape Ecology 23: 1007-1011.

68 Farfan, M.A., Duarte, J., Real, R., Munoz, A.R., Fa, J.E. and Vargas, J.M. (2017). Differential recovery of habitat use by birds after wind farm installation: A multi-year comparison. Environmental Impact Assessment Review 64: 8-15.

69 Zehtindjiev, P., Vasilev, V., Marinov, M.P., Ilieva, M., Dimitrov, D., Peev, S., Raykov, I., Raykova, V., Ivanova, K., Bedev, K. and Yankov, Y. (2017). No evidence for displacement of wintering red-breasted geese Branta ruficollis (Pallas, 1769) (anseriformes) at a wind farms area in northern Bulgaria: Long-term monitoring results. Acta Zoologica Bulgarica 69: 215-228.

70 Harrison, A.L., Petkov, N., Mitev, D., Popgeorgiev, G., Gove, B. and Hilton, G.M. (2018). Scale-dependent habitat selection by wintering geese: implications for landscape management. Biodiversity and Conservation 27: 167-188.

geese[71]. The effect on foraging geese and swans is considered to be an effect of **negligible** and **long-term** magnitude.

6.4.71 Whooper swan were infrequently recorded on the lochan at Hill of Forss (paragraph 6.4.14), which does not appear to be an established roosting location. The potential loss of this lochan for migratory whooper swan is therefore considered to be an effect of **low** and **long-term** magnitude at a population level. The Hill of Forss lochan is 6.3 km to the north of the Caithness Lochs SPA and considering the foraging range of 5 km (SNH 2016) is considered unlikely to be a core roosting location for whooper swan from the Caithness Lochs SPA.

6.4.72 **Significance of Effect (EIA):** the unmitigated effect during operation on foraging geese and swans and roosting/resting whooper swan is considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

6.4.73 In light of the potential connectivity for Greenland white-fronted goose, greylag goose and whooper swan between the proposed development and the Caithness Lochs SPA, the effect must also be considered within the context of the HRA process and the information provided here may also inform an appropriate assessment should SNH advise the competent authority that this is required.

6.4.74 Significance of Effect (HRA): based on the above consideration, there are considered to be no adverse effects on the integrity of the Caithness Lochs SPA under the HRA process.

Curlew and Lapwing

6.4.75 **Effect**: breeding and/or foraging curlew and lapwing may be displaced from the site during construction, either by disturbance or direct habitat loss.

6.4.76 **Sensitivity**: Medium-high.

6.4.77 **Magnitude of Effect**: between two to five curlew and two to eight lapwing territories were identified within 500 m of the proposed infrastructure in any one year. The curlew NHZ 2 breeding population is estimated to be 3,233 pairs (Wilson *et al.* 2015[31]), and the potential loss of a maximum worst-case of six curlew territories would result in a loss of up to 0.15 % of the breeding population, an effect of **low** and **long-term** magnitude.

6.4.78 The NHZ 2 population is unknown for lapwing, however based on the Scottish population of 71,500 to 105,600 pairs, and considering the breeding distribution map presented in Forrester *et al.* (2012[24]), there is likely to be a minimum of 5,000 breeding pairs in Caithness. The potential loss of a maximum worst-case of eight lapwing territories would result in a loss of up to 0.16 % of the breeding population, an effect of **low** and **short-term** magnitude.

6.4.79 It should be noted for both species that it is unlikely that the worst-case number of pairs of each species would be permanently lost from the breeding populations as there will continue to be suitable similar habitat outwith the proposed development that some pairs (if not all) may be displaced into. In addition, as detailed in paragraphs 6.4.59 to 6.4.64 there is evidence to indicate that there is limited correlation between nesting success of waders and

[71] As with most bird species, geese are most sensitive to human or animal disturbance (e.g. dogs) and quickly habituate to vehicles.

turbine proximity and that therefore birds may continue to nest successfully in proximity to turbines.

6.4.80 **Significance of Effect**: the unmitigated effect during operation for curlew and lapwing is considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

Golden Plover

6.4.81 **Effect:** wintering golden plover may be displaced from the site during operation, either by disturbance or direct habitat loss.

6.4.82 **Sensitivity:** Low-medium.

6.4.83 **Magnitude of Effect:** The results of an ongoing long-term study of golden plover breeding success within an active wind farm suggests minimal effects on the species' behaviour (Fielding & Howarth 2015[72]). Similarly, Pearce-Higgins *et al.* (2012[73]) reported no significant effect of wind farm construction or operation on golden plover densities. More recently Sansom *et al*. (2016[74]) have shown information to suggest that breeding golden plovers may be affected by operational turbines up to 400m away. In addition, golden plover are known to have frequently overwintered at operational wind farms in central Scotland with operational monitoring not identifying any signs of disturbance/displacement (Black Law and Dersalloch Wind Farms). Considering these results and given the abundance of similar suitable habitat within the wider area, only small numbers of wintering golden plover may be displaced by the presence of the operational wind farm. The effect is considered to be of **negligible** and **long-term** magnitude.

6.4.84 **Significance of Effect:** the unmitigated effect during construction for golden plover is considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

Potential Decommissioning Effects

6.4.85 Decommissioning effects, because of the long timeframe until their occurrence (around 35 years), are difficult to predict with confidence. For the purpose of this chapter they are considered to be similar to those of construction effects in nature, but of shorter duration, with the result being a restored habitat within an area where displaced birds will be able to return. Thus, effects assessed during construction are considered to apply to decommissioning.

Potential Cumulative and In-Combination Effects

6.4.86 This section presents information about the potential cumulative effects of the proposed development combined with other projects that are located within NHZ 2. Greenland white-

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[72] Fielding, A. H. and Haworth, P. F. (2015). Final report on the eleven-year monitoring programme (2005-2015) for the impact of the Farr wind farm on golden plover. http://www.alanfielding.co.uk/fielding/pdfs/Farr%20windfarm%20GP%20Final.pdf

[73] Pearce-Higgins, J.W., Stephen, L., Douse, A. and Langston, R.H.W. (2012). Greater impacts of Windfarms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis. Journal of Applied Ecology 49: 386-394.

[74] Sansom, A., Pearce-Higgins, J. W., and Douglas, D. J. T. (2016). Negative impact of wind energy development on a breeding shorebird assessed with a BACI study design. Ibis 158: 541-555.

fronted goose, greylag goose and whooper swan are also considered within an HRA context relating to the in-combination effects on the Caithness Lochs SPA.

6.4.87 SNH (2018b[75]) provides guidance on assessing the cumulative effects on birds and this assessment follows the principles set out in that guidance. As noted in Table 6.1, SNH has also provided a dataset (issued on 21st August, 2019)[76] detailing information for projects in NHZ 2 or NHZ 5 that are within range of the Caithness Lochs SPA, to aid the in-combination assessment.

6.4.88 Cumulative effects may include cumulative disturbance-displacement, collision mortality, habitat loss or barrier effects. Some cumulative impacts (such as collision risk) may be summed quantitatively, but according to SNH (2018b[75]) "*In practice, however, some effects such as disturbance or barrier effects may need considerable additional research work to assess impacts quantitatively. A more qualitative process may have to be applied until quantitative information becomes available for developments in the area, e.g. from post-construction monitoring or research*".

6.4.89 The main projects likely to cause similar effects to those associated with the proposed development are other operational wind farms, or those under construction, consented or in the planning process within NHZ 2 (Table 6.18, Figure 6.27) for the cumulative assessment (EIA) or those within foraging range (defined per species, as per SNH, 2016[77]) of the Caithness Lochs SPA (Table 6.19, Figure 6.28) for the in-combination assessment (HRA). No other projects or activities subject to the EIA process have been identified for inclusion in the cumulative or in-combination assessments.

6.4.90 Wind farm projects at scoping stage have been scoped out of the cumulative assessment because they usually do not have sufficient information on potential effects to be included, as the baseline survey period is ongoing or results have not been published. Projects that have been refused (and are no longer capable of appeal) or withdrawn have also been scoped out of the cumulative assessment.

6.4.91 Small projects with three or fewer turbines have also been scoped out from the cumulative assessment as often these projects are not subject to the same level of detail of ornithological impact assessment and so there are no directly comparable data. Because of the small scale of such projects, effects are likely to negligible on the IOFs assessed here. Other small-scale renewable projects such as micro-hydro schemes have also been scoped out for similar reasons. Table 6.18 and Table 6.19 identify the wind farm projects that have been considered in the cumulative assessment and in-combination assessment respectively, and the relevant IOFs (Table 6.17) that were recorded during baseline assessments for these projects. The information relating to the in-combination assessment (Table 6.19) has been provided by SNH from their cumulative and in-combination database (issued on 21st August 2019[76]).

6.4.92 It should also be noted that it is highly unlikely that all projects within NHZ 2/within foraging range of the Caithness Lochs SPA would be consented, and even less likely that all would

[75] Scottish Natural Heritage (2018b) Assessing the cumulative impacts of onshore wind farms on birds.

[76] This dataset was reviewed and updated in May 2020 by MacArthur Green to check for any new projects/status changes to projects within the in-combination study area between August 2019 and May 2020.

[77] Greenland white-fronted goose = 8 km, greylag goose = 20 km, whooper swan = 5 km (SNH 2016).

become operational at the same time, and so the additive values represent a highly precautionary assessment of potential cumulative/in-combination effects.

6.4.93 Based on the conclusions of the predicted effects of the proposed development alone for the NHZ 2 populations of curlew and lapwing, the effects detailed in Table 6.17 have been taken forwards into the cumulative assessment below.

6.4.94 Following the Assessment of Likely Significant Effects on the Caithness Lochs SPA for Greenland white-fronted goose, whooper swan and greylag goose from the proposed development alone, in-combination effects on the SPA as listed in Table 6.17 have been considered below.

Table 6.17: Effects Scoped-In to the Cumulative/In-Combination Assessment

Species	Construction/Decommissioning	Operation
Golden plover (NHZ 2)	-	-
Curlew (NHZ 2)	Breeding disturbance/displacement	Collision Breeding disturbance/displacement
Lapwing (NHZ 2)	Breeding disturbance/displacement	Collision Breeding disturbance/displacement
Pink-footed goose (NHZ 2)	-	-
Greenland white-fronted goose (NHZ 2)	-	-
Greenland white-fronted goose (SPA)	Foraging disturbance	Collision
Greylag goose (NHZ 2)	-	-
Greylag goose (SPA)	Foraging disturbance	Collision
Whooper swan (NHZ 2)	-	-
Whooper swan (SPA)	Foraging disturbance	Collision

6.4.95 Cumulative collision assessments on the regional populations of golden plover, Greenland white-fronted goose, greylag goose, pink-footed goose and whooper swan have been scoped out of the cumulative assessment either due to the negligible effects of the addition of less than one collision across the 35-year lifespan of the proposed development (Greenland white-fronted goose and whooper swan) to the cumulative collision risk, or the negligible effects of the additional mortality as a result of the predicted collisions associated with the proposed development upon the regional/national wintering populations (golden plover 0.05 to 0.09 %, greylag goose 0.004 %, pink-footed goose 0.098 %). Additionally, in the case of pink-footed and greylag geese, the cumulative impacts resulting from wind farms are trivial in comparison to the estimated shooting bag numbers (estimated to be 25,000 pink-footed geese annually in Britain by Frederiksen 2002[78] and 8,000 greylag geese annually in Scotland by Trinder *et al.* 2010[79]). Whilst these estimates are now 9-17 years old (and no accurate recording of shooting bags is undertaken in the UK), it is important to note that shooting bag numbers are likely to continue to be several orders of magnitude higher than any cumulative collision estimates. In-combination assessments for Greenland white-

[78] Frederiksen, M. 2002. Indirect estimation of the number of migratory Greylag and Pink-footed Geese shot in Britain. Wildfowl 53: 27–34.

[79] Trinder, M., Mitchell, C., Swann, B. and Urquhart, C. 2010. Status and population viability of Icelandic Greylag Geese *Anser anser* in Scotland. Wildfowl 60: 64-84.

fronted goose, greylag goose and whooper swan are included due to the smaller SPA populations (i.e. in comparison to the Scottish/regional wintering populations).

Table 6.18: Scoped-In Wind Farm Projects Within NHZ 2 (Cumulative Assessment)

Project	**Status**	**Number of Turbines**	**Information Available**	**Curlew**	**Lapwing**
Baillie - Bardnaheigh Farm	Operational	21	No info available		
Burgar Hill	Operational	6	No info available		
Forss 2 (Extension)	Operational	4	No info available		
Hammars Hill Wind Energy Project	Operational	5	Technical description and Environmental Studies	✓	✓
Lochend	Operational	4	Ornithology Chapter	✓	✓
Spurness	Operational	5	No info available		
Stroupster	Operational	13	Ornithology Technical Appendix 5.1	✓	✓
Wathegar	Operational	5	Ornithology Chapter		
Wathegar 2	Operational	9	Ornithology Chapter	✓	✓
Cogle Moss	Consented	12	Ornithology Chapter	✓	✓
Costa Head	Consented	4	No info available		
Hesta Head	Consented	5	No info available		
Slickly	Application	11	Ornithology Chapter	✓	✓

Table 6.19: Scoped-In Wind Farm Projects Within Foraging Range (Species Specific[77]) of the Caithness Lochs SPA (In-Combination Assessment) (Data Supplied by SNH[76]) – the '✓' Indicates that the Species Were Recorded in the Baseline Surveys Rather Than Scoped-In to the Project Assessments

Project	**Status**	**Number of Turbines**	**Greenland White-fronted Goose (8 km)**	**Greylag Goose (20 km)**	**Whooper Swan (5 km)**
Bad a Cheo	Operational	13	✓	✓	
Baillie Hill	Operational	21	✓	✓	✓
Camster	Operational	25		✓	
Causeymire	Operational	21			
Forss 2	Operational	4		✓	
Lochend	Operational	4	✓	✓	✓
Stroupster	Operational	13			
Wathegar	Operational	5			
Wathegar 2	Operational	9		✓	
Achlachlan 1 + 2	Operational + Consented	5 + 3		✓	
Burn of Whilk	Consented	9		✓	
Camster 2	Consented	11		✓	✓
Cogle Moss	Consented	12		✓	✓

Table 6.19: Scoped-In Wind Farm Projects Within Foraging Range (Species Specific[77]) of the Caithness Lochs SPA (In-Combination Assessment) (Data Supplied by SNH[76]) – the '✓' Indicates that the Species Were Recorded in the Baseline Surveys Rather Than Scoped-In to the Project Assessments

Project	Status	Number of Turbines	Greenland White-fronted Goose (8 km)	Greylag Goose (20 km)	Whooper Swan (5 km)
Halsary	Consented	15		✓	Birds recorded but outwith 5 km
Limekiln	Consented	21		✓	
Drum Hollistan 2[80]	Application	7	Birds recorded but outwith 8 km	✓	Birds recorded but outwith 5 km
Golticlay	Application	19		✓	
Limekiln Extension	Application	5	✓	✓	
Slickly	Application	11		✓	

Curlew and Lapwing (NHZ 2 Populations)

PREDICTED CUMULATIVE EFFECTS DURING CONSTRUCTION

6.4.96 A total of six wind farms (from those where information was publicly available) within NHZ 2 considered curlew and lapwing as part of their impact assessment (Table 6.18), of which four are already operational. Of the remaining two projects, Cogle Moss Wind Farm is already consented and it is therefore reasonably unlikely that the proposed development will be on a similar construction timescale to Cogle Moss Wind Farm. Slickly Wind Farm is at application stage and there is therefore the potential for the (temporary) loss of an additional breeding pair of curlew and lapwing (Slickly EIA predicted the potential loss of one pair each of curlew and lapwing) which would equate to a cumulative loss of 3-6 pairs of curlew (up to 0.18 % of the NHZ 2 population) and 3-9 pairs of lapwing (up to 0.18 % of the estimated NHZ 2 population).

6.4.97 In addition, as detailed above in the assessment for the proposed development alone, it should be noted for both species that it is unlikely that all breeding pairs of each species would be permanently lost from the breeding populations as:

- there will continue to be suitable similar habitat (nearby) in the Caithness region that some pairs (if not all) may be displaced into; and
- there is evidence to indicate that there is limited correlation between nesting success and turbine proximity (as detailed in paragraphs 6.4.59 to 6.4.64) and that therefore at least some pairs may continue to nest successfully in proximity to turbines.

6.4.98 In summary, the potential worst-case (assuming that all pairs across both projects would be lost from the breeding population rather than displaced) cumulative loss of breeding curlew and lapwing in NHZ 2 due to construction disturbance is considered to be **low** and **short-term** magnitude (i.e. the same as for the proposed development alone, paragraphs 6.4.20

[80] The original Drum Hollistan was refused in June 2019.

to 6.4.23). The cumulative construction effect is therefore considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

PREDICTED CUMULATIVE EFFECTS DURING OPERATION – COLLISION RISK

6.4.99 Of the wind farms within NHZ 2 (from those where information was publicly available) that considered curlew and lapwing as part of their impact assessment (Table 6.18), only Slickly Wind Farm undertook collision modelling for curlew or lapwing with an estimated annual collision rate of 0.08 for curlew and 1.28 for lapwing. This would result in an estimated cumulative annual collision rate of 0.429 for curlew (0.025 % additional mortality, paragraph 6.4.53) and 3.14 for lapwing (0.106 % additional mortality, paragraph 6.4.54).

6.4.100 Although there may be a low risk of collisions at the other sites where curlew and lapwing are present, the level of cumulative collision effect on the NHZ 2 populations of curlew and lapwing is considered to remain the same as for the proposed development alone and as such the cumulative collision effect is therefore considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

PREDICTED CUMULATIVE EFFECTS DURING OPERATION – DISPLACEMENT

6.4.101 A total of six wind farms within NHZ 2 considered curlew and lapwing as part of their impact assessment (Table 6.18), of which four are already operational. Information on the predicted effects on these species, and potential mitigation at these wind farms was limited. However, a total[81] (including the proposed development) of 27-44 curlew territories (0.84-1.36 % of the NHZ 2 breeding population) and 21-30 lapwing territories (0.42-0.60 % of the NHZ 2 breeding population) are potentially at risk of some level of disturbance or displacement at these wind farms. As detailed above in the assessment for the proposed development alone, it should be noted for both species that it is unlikely that all breeding pairs of each species would be permanently lost from the breeding populations as:

- there will continue to be suitable similar habitat in the Caithness region that some pairs (if not all) may be displaced into;
- some of the territories recorded at these projects may have been over 500 m from the turbines and were therefore not at risk of disturbance (it is often not clear in reports exactly where territories were recorded in relation to the final turbine design and ambiguity often exists over 'survey area' versus 'study area'); and
- there is evidence to indicate that there is limited correlation between nesting success and turbine proximity (as detailed in paragraphs 6.4.59 to 6.4.64) and that therefore at least some pairs may continue to nest successfully in proximity to turbines.

6.4.102 It should also be noted that for the projects where breeding curlew and lapwing were detailed in the documents available, there is a good deal of uncertainty regarding how many breeding pairs may be truly affected by disturbance-displacement at each project, the magnitude of any potential effects and any mitigation/habitat management that may offset any potential effects. These values should therefore be seen as worst-case estimates[81].

[81] From the information available.

Table 6.20: Cumulative Disturbance/Displacement Effects for NHZ 2 Projects: Predicted Loss of Breeding Pairs

Species	NHZ Pop. (pairs)	Possible Loss of Pairs						% of NHZ Pop.
		Operational	Construction	Consented	Application	Proposed Development	Total	
Curlew	3,233	19-26[82]	0	5-12[83]	1	2-5	27-44	0.84-1.36
Lapwing	5,000	15-18[84]	0	3	1	2-8	21-30	0.42-0.60

6.4.103 Overall, considering the NHZ 2 breeding pair population estimates, the potential worst-case (assuming that all pairs would be lost from the breeding population rather than displaced) cumulative loss of breeding curlew and lapwing in NHZ 2 is considered to be **low** and of **long-term** magnitude. The cumulative operational effect is considered to be **minor adverse** and is therefore **not significant** in the context of the EIA regulations.

Caithness Lochs SPA Species

PREDICTED IN-COMBINATION EFFECTS DURING CONSTRUCTION

6.4.104 SNH provided a copy of their cumulative/in-combination spreadsheet[76] for Greenland white-fronted goose, greylag goose and whooper swan (Caithness Lochs SPA qualifying features) which included information on any potential for disturbance, displacement or foraging loss as a result of the construction of the wind farm project. Of the wind farm projects that identified a potential effect for any of the SPA species, three wind farm projects predicted potential foraging displacement for Greenland white-fronted goose, greylag goose and/or whooper swan, of which two of these projects are now operational (Baillie Hill Wind Farm and Lochend Wind Farm). Halsary Wind Farm predicted a negligible disturbance / displacement / foraging loss for greylag goose and whooper swan with no likely significant effect on the integrity of the Caithness Lochs SPA; however, considering that Halsary Wind Farm is already consented, it is reasonably unlikely that the proposed development will be on a similar construction timescale to Halsary Wind Farm and consequently any in-combination construction effects are considered to be similar to the construction effects of the project alone. As such, the potential in-combination construction effects for Greenland white-fronted goose, greylag goose and whooper swan populations associated with the Caithness Lochs SPA, are considered to be the same as those for the proposed development alone.

6.4.105 Therefore, there are considered to be no adverse in-combination effects on the integrity of the Caithness Lochs SPA under the Habitats Regulations.

[82] This range is due to Stroupster Wind Farm identifying 1-8 curlew territories.

[83] This range is due to Cogle Moss Wind Farm identifying 5-12 curlew territories.

[84] This range is due to Stroupster Wind Farm identifying 4-7 lapwing territories.

PREDICTED IN-COMBINATION EFFECTS DURING OPERATION – COLLISION RISK

6.4.106 From the cumulative/in-combination spreadsheet for Caithness Lochs SPA provided by SNH[76], Table 6.21 provides a summary of the predicted collision rates associated with wind farm projects where the birds recorded have been identified to be connected to their Caithness Lochs SPA population.

Table 6.21: In-Combination Collision Rates for the Caithness Lochs SPA Species[85]

Species		**Greenland White-Fronted Goose**	**Greylag Goose**	**Whooper Swan**
SPA Population (individuals)		440	7,190	240
Annual Collision Rate	Operational	0.34	6.59	0.19
	Construction	0	0	0
	Consented	0	9.54	0.38
	Application	0.021	2.98	0
	Cairnmore Hill	0.004	0.607	0.022
	Total	0.37	19.72	0.60
Baseline Mortality Rate		0.279	0.17	0.199
Baseline Mortality (individuals)		122.76	1,222.3	47.76
Additional In-Combination Mortality		0.30 %	1.61 %	1.25 %

6.4.107 The mean annual/non-breeding season collision rate for Greenland white-fronted goose, greylag goose and whooper swan associated with the proposed development was predicted to be 0.004, 0.607 and 0.022 respectively (or one bird every 238, 1.6 and 45 years respectively). When also including the predicted collision rates from any installed, under construction, approved and application projects (Table 6.21), an in-combination annual collision rate of 0.37, 19.27 and 0.60 individuals respectively is predicted (one every 2.7, 0.05 and 1.7 years respectively). For Greenland white-fronted goose, this equates to an increase of less than 1 % in the baseline mortality of the SPA population. For greylag goose and whooper swan, whose SPA populations are considered to be in a favourable, maintained condition, this equates to an increase of less than 2 % in the baseline mortality on the SPA population (based on the precautionary assumption that all potential mortality would be related to SPA individuals).

6.4.108 Based on the above information, it can therefore be reasonably concluded that there would be **no adverse in-combination effects on the integrity of the Caithness Lochs SPA** under the Habitats Regulations.

PREDICTED IN-COMBINATION EFFECTS DURING OPERATION – DISPLACEMENT

6.4.109 SNH provided a copy of their cumulative/in-combination spreadsheet[76] for Greenland white-fronted goose, greylag goose and whooper swan which included information on any potential for displacement as a result of the operation of the wind farm project. Of the wind farm projects that identified a potential effect for any of the SPA species, three projects (Baillie Hill Wind Farm and Lochend Wind Farm – operational, Halsary Wind Farm – consented)

[85] Where required, any predicted collision rates have been updated to the current avoidance rates for these species: whooper swan 99.5 %, Greenland white-fronted goose and greylag goose 99.8 %.

indicated a potential for disturbance / displacement / foraging loss post mitigation for Greenland white-fronted goose, greylag goose and/or whooper swan.

6.4.110 Lochend Wind Farm (operational since May 2017) is located 1.8 km to the east of the of the SPA (Figure 6.28) and a disturbance / displacement / foraging loss for Greenland white-fronted goose, greylag goose and whooper swan was predicted for during the construction period only, which following a consent condition from SNH to mitigate this potential effect, there was considered to be no likely significant effect on the integrity of the Caithness Lochs SPA.

6.4.111 Baillie Wind Farm has been operational since August 2013 and is located approximately 2.6 km to the north of the SPA (Figure 6.28). Foraging wildfowl surveys undertaken for the baseline surveys for the proposed development included a 5 km survey area which encompassed Baillie Wind Farm. These surveys were undertaken during the 2013/2014, 2015/2016 and 2016/2017 non-breeding seasons and therefore consists of data from after Baillie Wind Farm became operational. A comparison of the three non-breeding seasons of foraging data (Figures 6.5, 6.6 and 6.8) indicates that birds are continuing to use the same foraging areas across the years including those locations within approximately 500 m of Baillie Wind Farm. This is particularly clear for greylag geese, which continue to show a strong correlation between the 1 km foraging grid squares identified by Mitchell (2012[6]), regardless of the more recent presence of Baillie Wind Farm.

6.4.112 Considering the limited foraging activity recorded within 500 m of the proposed development, the relatively low suitability of foraging habitat at the site itself, the continued evidence of foraging adjacent to Baillie Wind Farm and the evidence detailed in paragraphs 6.4.65 to 6.4.67 that foraging geese habituate to/are not displaced from foraging areas by wind turbines, any significant in-combination operational displacement due to the proposed development and Baillie Wind Farm is unlikely.

6.4.113 Halsary Wind Farm (consented) is located 5.3 km to the south of the SPA (Figure 6.28) and predicted a negligible disturbance / displacement / foraging loss for greylag goose and whooper swan with no likely significant effect on the integrity of the Caithness Lochs SPA

6.4.114 Considering all of the above, there are considered to be **no adverse in-combination effects on the integrity of the Caithness Lochs SPA** under the Habitats Regulations.

6.5 Mitigation

Mitigation during Construction

6.5.1 With no unmitigated significant effects predicted, no specific mitigation is required. However as detailed in paragraph 6.4.2 a BBPP will be produced and will be approved by the planning authority in consultation with SNH prior to implementation. This would seek to ensure that any breeding birds, their nests, eggs or young are not directly affected by construction activities. In addition, as detailed in paragraph 6.4.2 an ECoW will be appointed prior to the commencement of construction to ensure all reasonable precautions are taken to avoid negative effects on ornithological interests.

Mitigation during Operation

6.5.2 With no unmitigated significant effects predicted, no specific mitigation is required. However, in order to maintain/improve habitat suitability for breeding/wintering waders within the site, it would be proposed to retain boggy ground and create new wet areas (including scrapes and small areas of shallow open water) within the site, but away from turbines, by measures such as blocking any active drains and ditches in selected areas. In addition, controlled grazing would be used to create a variable sward length to maintain areas of shorter vegetation for foraging whilst retaining taller vegetation for nesting.

Mitigation during Decommissioning

6.5.3 An equivalent mitigation strategy to that described in paragraph 6.5.1 will ensure that any disturbance risk to breeding curlew and lapwing or to foraging golden plover, geese and swans is minimised.

6.6 Assessment of Residual Effects

6.6.1 Given that no specific mitigation is required, the residual effects relation to construction (disturbance/displacement), operation (disturbance/displacement and collision risk) and decommissioning (disturbance/displacement) remain as considered in Section 6.4 above, i.e. **not significant** within the context of the EIA Regulations, and **no adverse effect on the integrity of the Caithness Lochs SPA** under the Habitats Regulations.

6.7 Summary

6.7.1 In summary, this chapter reports on the baseline ornithological conditions recorded within and around the proposed development and presents an assessment of likely significant effects on populations of identified target species.

6.7.2 IOFs identified which are considered likely to experience significant effects as a result of the proposed development and that were taken forward into the ES are: Greenland white-fronted goose, greylag goose, whooper swan, pink-footed goose, golden plover, curlew and lapwing. Due to the proximity of the Caithness Lochs SPA and the potential for connectivity with the proposed development, the SPA populations of Greenland white-fronted goose, greylag goose and whooper swan were also assessed under the Habitats Regulations.

6.7.3 Effects related to direct and indirect habitat loss, construction disturbance and displacement, operational displacement, collision risk and cumulative effects were all considered. The residual effects are considered to be **Not Significant** within the context of the EIA Regulations, and to have **no adverse effect on the integrity of the Caithness Lochs SPA** under the HRA process. Cumulative/in-combination effects for Greenland white-fronted goose, greylag goose, whooper swan, curlew and lapwing were assessed in relation to other relevant developments in NHZ 2/as detailed by the SNH Caithness Lochs SPA dataset and concluded to be **Not Significant/have no adverse effect on the integrity of the SPA**.

6.7.4 Table 6.22 summarises the residual effects following any proposed mitigation as detailed in Sections 6.4 and 6.5.

Table 6.22: Summary of Potential Significant Effects of the Proposed Development			
Likely Significant Effect	**Mitigation Proposed**	**Means of Implementation**	**Outcome/Residual Effect**
Construction/Decommissioning			
Greenland white-fronted goose	None required	N/A	Not Significant.
Greylag goose	None required	N/A	Not Significant.
Whooper swan	None required	N/A	Not Significant.
Caithness Lochs SPA	None required	N/A	No Adverse Effect on the Integrity of the SPA.
Pink-footed goose	None required	N/A	Not Significant.
Curlew	BBPP	To be agreed prior to commencement of construction and overseen by ECoW	Not Significant.
Lapwing	BBPP	To be agreed prior to commencement of construction and overseen by ECoW.	Not Significant.
Golden plover	None required	N/A	Not Significant.
Operation			
Greenland white-fronted goose	None required	N/A	Not Significant.
Greylag goose	None required	N/A	Not Significant.
Whooper swan	None required	N/A	Not Significant.
Caithness Lochs SPA	None required	N/A	No Adverse Effect on the Integrity of the SPA.
Pink-footed goose	None required	N/A	Not Significant.
Curlew	Wader habitat improvement	To be agreed prior to commencement of construction.	Not Significant.
Lapwing	Wader habitat improvement	To be agreed prior to commencement of construction.	Not Significant.
Golden plover	Wader habitat improvement	To be agreed prior to commencement of construction.	Not Significant.

6.8 Glossary and Abbreviations

Term	Definition
Appropriate Assessment	An assessment required by the Habitats Directive where a project (or plan) would be likely to have a significant effect on a European Site, either alone or in combination with other plans or projects (part of the Habitats Regulations Assessment process in the UK and the Appropriate Assessment process in Ireland).
Barrier effects	Where a wind farm creates an obstacle to regular movements of birds to and from breeding colonies or migration.
Collision Risk Analysis Area (CRAA)	The three-dimensional airspace within and surrounding the proposed turbine area where birds in flight are theoretically at risk of a collision with operational turbines. This forms the basis of calculations used in collision risk modelling.

Term	Definition
Conservation objective	Objective for the conservation of biodiversity (e.g. specific objective within a management plan or broad objectives of policy).
Conservation status	The sum of the influences acting on a species which may affect its long-term distribution and abundance, within a geographical area of interest.
Cumulative effect	Additional changes caused by a proposed development in conjunction with other developments or the combined effect of a set of developments taken together.
Habitats Regulations Appraisal	An assessment of projects (or plans) potentially affecting European Sites in the UK, required under the Habitats Directive and Regulations.
Important Ornithological Features	Ornithological features requiring specific assessment within an EIA. Ornithological features can be important for a variety of reasons (e.g. quality and extent of designated sites, species rarity).
Integrity (of a designated site)	The coherence of its ecological structure and function across its whole area which enables it to sustain the habitats, complex of habitats and/or population levels of the species for which it was classified (or designated).
Nature Conservation Importance	A level of importance attributed to a species population or habitat which may relate for example, to the quality or extent of designated sites or habitats, to habitat/species rarity, to the extent to which they are threatened throughout their range, or to their rate of decline.

Abbreviation	Expanded Term
BBPP	Breeding Bird Protection Plan
BoCC	Birds of Conservation Concern
BTO	British Trust for Ornithology
CRAA	Collision Risk Analysis Area
CRM	Collision Risk Modelling
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
ES	Environmental Statement
HRA	Habitats Regulations Appraisal
HRSG	Highland Raptor Study Group
IOF	Important Ornithological Feature
NCI	Nature Conservation Importance
NHZ	Natural Heritage Zone
RSPB	Royal Society for the Protection of Birds
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
VP	Vantage Point

7 Archaeology and Cultural Heritage

7.1 Introduction

7.1.1 This chapter considers the likely effects on cultural heritage associated with the construction, operation and decommissioning of the proposed development. The specific objectives of the chapter are to:

- describe the cultural heritage baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

7.1.2 This chapter is supported by the following figures and technical appendices:

- Figure 7.1: Cultural Heritage: Inner Study Area;
- Figure 7.2: Cultural Heritage: Outer Study Area;
- Figure 7.3: Cultural Heritage: Cumulative Schemes;
- Figures 7.4 to 7.13: Cultural Heritage visualisations;
- Technical Appendix 7.1: Heritage Assets within Inner Study Area;
- Technical Appendix 7.2: Assets within Outer Study Area and within 5 km of the proposed development; and
- Technical Appendix 7.3: Assets within Outer Study Area and between 5 km and 10 km of the proposed development.

7.1.3 Figures and technical appendices are referenced in the text where relevant.

7.2 Assessment Methodology and Significance Criteria

Scope of Assessment

7.2.1 This chapter considers:

- direct impacts on cultural heritage assets;
- impacts on the settings of heritage assets in the wider landscape; and
- cumulative impacts on the settings of heritage assets in the wider landscape.

7.2.2 The chapter assesses cumulative effects as arising from the addition of the proposed development to other cumulative developments, which are the subject of a valid planning application or consent. Operational and under construction developments are considered as part of the baseline and are taken to be such for the assessment of effects on the settings of heritage assets. Developments that are consented but not yet under construction and those that are the subject of valid planning applications are considered as being potential additions to the baseline and are considered in the cumulative impact assessment.

7.2.3 The assessment is based on the proposed development as described in Chapter 2: Development Description.

7.2.4 The scope of the assessment has been informed by consultation responses summarised in Table 7.1 and the following guidelines/policies:

- Scottish Planning Policy 2014 (SPP);
- Historic Environment Policy Statement (2019);
- The Highland-wide Local Development Plan (2012): Policy 57 (Natural, Built and Cultural Heritage);
- Highland Historic Environment Strategy: Supplementary Planning guidance (2013);
- Highland Council Standards for Archaeological Work (2012);
- Chartered Institute for Archaeologists (2014) 'Standard and Guidance for Historic Environment Desk-Based Assessment';
- SNH and Historic Environment Scotland (2018) 'Environmental Impact Assessment Handbook';
- Historic Environment Scotland (2016) 'Managing Change in the Historic Environment: Setting'; and
- Planning Advice Note (PAN) 2/2011.

Consultation

7.2.5 Table 7.1 summarises the consultation responses received regarding archaeology and cultural heritage and provides information on where and/or how they have been addressed in this assessment. The following organisations made comment on archaeology and cultural heritage: The Highland Council (THC); Historic Environment Scotland (HES); Highland Council Historic Environment Team (HET).

7.2.6 Full details on the consultation responses can be reviewed in Technical Appendix 1.1: Consultation Register.

Table 7.1: Consultation Responses

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
THC (08/08/2016)	Scoping Opinion	The EIA should recognise the Policies with the HwLDP). For cultural heritage, Policy 57 applies.	Noted. Compliance with policy is reviewed within the Planning Statement, which accompanies the application.
		The ES chapter will need to follow Highland Council Standards for Archaeological Work, specifically Sections 3 and 4, the latter of which considers Environmental Statements.	Noted. The assessment follows the guidance provided in THC's Standards and guidance provided by HES.
		Provided detailed comments from HES and THC's HET which must be taken into account.	Noted. Comments from HES and THC's HET have been taken into account in the assessment (see below).
HES (22/07/2016)	Scoping Opinion	Confirmed that there are no scheduled monuments, category A listed buildings, inventory battlefields, gardens and designed landscapes or World Heritage Sites	Noted. There are no designated heritage assets within the site.

Table 7.1: Consultation Responses			
Consultee and Date	**Scoping / Other Consultation**	**Issue Raised**	**Response / Action Taken**
		within the proposed development site.	
		Advised that there is a large number of heritage assets within their remit in the vicinity of the development whose settings have the potential to be adversely impacted by it. A list was provided of the assets which appear likely to experience impacts: • Thing's Va, broch 1000 m E of Blackheath, Scrabster (SM 587) • Scrabster Mains, broch 1000 m W of (SM 579) • Brims Castle (SM 5510) • Crosskirk, St Marys Chapel and broch S of Chapel Pool (SM 90086) • Mill of Knockglass, long cairn 100 m SSE of, Bridge of Westfield (SM 469) • Mill of Knockglass, cairn 220 m S of, Bridge of Westfield (SM 470) • Mill of Knockglass, chambered cairn 320 m SSE of, Bridge of Westfield (SM 471) • Knockglass, broch 300m SSW of Mill of Knockglass (SM 562) • Hill of Shebster, chambered cairn (SM476) • Cnoc Freiceadain, long cairns (SM 90078) • Scrabster Castle, (SM 2630) • Holborn Head, fort, Scrabster (SM 559) • Green Tullochs, broch and cairn 640 m NNW of Borrowstone Mains, (SM 554)	Noted. A draft list of visualisations was circulated to Consultees (HES and HET) for comment. The blade tip ZTV shows that there is no visibility from Holborn Head, fort, Scrabster (SM 559) but there is visibility of the proposed development in the backdrop to the view of the fort when approached from the sea. LVIA VP 7 shows the context and the site is included in the assessment.
		Were generally content with the overall methodology set out in the Scoping Report.	Noted. The approach to the assessment follows that set out in the Scoping Report. The methodology adopted is set out in Section 7.2.
		Noted that, even where a detailed ZTV indicates that no intervisibility would be possible from any assets identified, the potential may remain for turbines to appear in the background of key views towards these assets, and this should be considered as part of the assessment.	Noted. Where heritage assets may be seen with the proposed development in the background (e.g. Holborn Head, fort, Scrabster (SM 559)), this is taken into account in the assessment.
HET (26/07/2016)	Scoping Opinion	Advised that the methodology as set out in the scoping report is generally acceptable.	Noted.

Table 7.1: Consultation Responses			
Consultee and Date	**Scoping / Other Consultation**	**Issue Raised**	**Response / Action Taken**
			The approach to the assessment follows that set out in the Scoping Report. The methodology adopted is set out in Section 7.2.
		Advised that the assessment must consider in detail the impact on the amenity of the historic environment assets, as experienced by modern-day visitors, many of whom will not have expertise in the historic environment or reading modern landscapes.	Noted. The assessment of effects on heritage assets adopts the approach recommended in HES guidance.
		Advised that the assessment will need to include a detailed walkover survey of the development area including any land required for associated infrastructure, incorporating the results of the 2014 survey over the northern part of the area.	Noted. Walk-over surveys of the site were undertaken in 2014 and in 2016 covering all areas of proposed infrastructure.
		The assessment should consider any potential impacts to upstanding features and also the potential for buried remains, features and deposits to be present within the landscape. Areas subject to survey must be clearly marked on a map.	Noted. Archaeological potential discussed in Section 7.3. The extent of surveyed area is shown on Figure 7.1.
		The indirect impact assessment will need to include a study of cumulative impacts. Where indirect impacts are predicted, these will be illustrated using photomontages that comply with THC visualisation standards.	Noted. Cumulative impacts are assessed in Section 7.4.
		Where impacts are unavoidable, HET expect proposed methods to mitigate this impact to be discussed in detail, including both physical (i.e. re-design) and where appropriate, compensatory and off-setting.	Noted. Mitigation proposals are set out in Section 7.5.
HES (09/09/2016)	Post-scoping consultation	Agreed with the locations proposed for viewpoints to be used for visualisations from scheduled monuments. Also agreed with the selection of viewpoints to be produced as photomontages and those as wireframes. The visualisations produced should utilise a viewing angle sufficient to allow assessment of the potential cumulative impact of the proposed development with the turbines of the nearby Baillie Wind Farm and other proposed developments.	Noted. The visualisations provided are in accordance with the Standards required of THC.
		Advised that the use of a specific radius is not necessarily sufficient to understand the potential impacts on	Noted.

Table 7.1: Consultation Responses			
Consultee and Date	**Scoping / Other Consultation**	**Issue Raised**	**Response / Action Taken**
		assets with sensitive settings, and HES do not recommend that specific distances are used to limit the identification of assets which may be assessed in an ES. In this case, HES does not consider that assets outside the 10 km buffer require to be assessed.	No heritage assets beyond 10 km have been identified as requiring assessment for adverse effects on their settings.
		Advised that there are a number of assets which will have significant intervisibility with the proposed development. However, HES is content that an assessment based on the list of assets provided would be adequate to allow HES to reach a view on the application.	Noted. Visualisations are provided to inform the assessment of impacts on setting.
HET (15/09/2016)	Post-scoping consultation	Confirmed that the methodology proposed is acceptable.	Noted. The approach to the assessment follows that set out in the Scoping Report. The methodology adopted is set out in Section 7.2.
		Satisfied that 10 km is an acceptable assessment distance for identification of heritage assets that could have their settings affected.	Noted. No heritage assets beyond 10 km have been identified as requiring assessment for adverse effects on their settings.
		Identified no monuments or viewpoints, additional to those specified in the draft list issued, that require to be included.	Noted.

Potential Effects Scoped Out

7.2.7 On the basis of the desk-based and survey work undertaken, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, the following topic areas have been 'scoped out'.

- Disturbance from vibration, dewatering or changes in hydrology resulting in indirect effects on cultural heritage assets; and
- Effects on the settings of cultural heritage assets more than 10 km from the proposed development. No assets beyond 10 km were identified by statutory consultees as requiring assessment (see Table 7.1), and none whose settings would be significantly affected by the development were identified during the study. The proposed assessment zone of 10 km for such effects was deemed by the statutory consultees to be acceptable.

Method of Baseline Characterisation

Extent of the Study Area

7.2.8 Two study areas were used for the assessment:

- The Inner Study Area (Figure 7.1): the proposed development red line boundary ("the site") forms the study area for the identification of heritage assets that could receive direct impacts arising from the construction of the proposed development. The current land-use of this area is mostly rough grazing pastureland/moorland spread over three separate landholdings, with some areas of improved pasture grazing around former and existing farmsteads (Blackheath, Hopefield, Lythmore and Forss Holdings). Figure 7.1 shows the site boundary, the proposed development layout and the locations of heritage assets identified and described in the gazetteer (Technical Appendix 7.1).
- An Outer Study Area (Figure 7.2): a 10 km study area, extending from the outermost turbines of the proposed development, was used for the identification of cultural heritage assets whose settings may be affected by the proposed development ("external receptors"). The study area extent was agreed by HES and THC as being appropriate and no assets beyond 10 km were identified, either by the consultees, or through preliminary assessment of the 35 km blade tip Zone of Theoretical Visibility (ZTV) as requiring inclusion in the assessment. Category C Listed Buildings within 5 km of the proposed development are included in the assessment. Figure 7.2 shows the proposed development, together with the blade tip height ZTV and the location of heritage assets within the 5 km and 10 km study areas from which there would be a theoretical view of the turbines and which are included in the assessment. Lists of these heritage assets is provided in Technical Appendices 7.2 and 7.3, which also provide tabulated summary assessments of the predicted impacts on their settings on a case-by-case basis.

7.2.9 The consideration of cumulative effects on the settings of heritage assets also uses the 10 km study area. Figure 7.3 shows the proposed development in its wider landscape context, together with the blade tip height ZTV. The locations of the heritage assets that have theoretical visibility of one or more turbines of the proposed development, and the locations of other wind energy developments in the wider area are also shown. The cumulative schemes included in the assessment reflect those listed in Chapter 4: Landscape and Visual Amenity which have been agreed with THC.

Desk Study

7.2.10 The following information sources were consulted as part of the desk-based assessment:

- Historic Environment Scotland Spatial Data Warehouse[1]: provided up-to-date data on the locations and extents of Scheduled Monuments, Listed Buildings, Conservation Areas, Inventory status Garden and Designed Landscapes and Inventory status Historic Battlefields;
- Highland Council Historic Environment Record (HER): provided a digital database extract in GIS for all assets within the Site boundary;
- The National Record of the Historic Environment[2] (NHRE) database (Canmore): for any information additional to that contained in the HER;
- Relevant bibliographic references were consulted to provide background and historic information;
- Map Library of the National Library of Scotland: for Ordnance Survey maps and other historical map resources;

[1] http://portal.historicenvironment.scot/spatialdownloads

[2] http://pastmap.org.uk/

- Historic Land-Use Assessment Data for Scotland[3] (HLAMap): for information on the historic land use character of the Site and the surrounding area; and
- Scottish Palaeoecological Archive Database[4] (SPAD) (Coles et al. 1998): consulted for information on sites with palaeoenvironmental and palaeoecological potential.

Field Survey

7.2.11 An initial walk-over field survey of the northernmost part of the site was carried out in 2014. Subsequently, the site boundary was extended and a further walk-over field survey of the whole of the proposed developable area within the Inner Study Area (shown outlined in blue on Figure 7.1) was undertaken between the 5th and 6th September 2016, with the following aims:

- to assess the present baseline condition of the heritage assets identified through the desk-based assessment;
- to identify any further features of cultural heritage interest not detected from the desk-based assessment; and,
- to assess the Inner Study Area for its potential to contain currently unrecorded, buried archaeological remains.

7.2.12 Identified sites were recorded on pro-forma monument recording forms and by digital photography, and their positions (and where appropriate their extents) were logged using a Global Positioning System (GPS). The survey data has been compiled in a GIS and will be provided to Highland Council Historic Environment Team ("HET") for inclusion in the Highland Council Historic Environment Record ("HER").

7.2.13 The baseline character and assessed relative sensitivity of the heritage assets identified within the Inner Study Area through desk-based assessment and field survey is set out in Technical Appendix 7.1: Heritage Assets within Inner Study Area. Interpretative statements on the relative importance and sensitivity of heritage assets are included below in the Baseline Conditions section (Section 7.3).

7.2.14 Field visits were undertaken to heritage assets in the Outer Study Area between the 5th and 6th September 2016 in order to assess their baseline settings. The baseline setting of each relevant receptor or related group of receptors has been characterised on a case-by-case basis, based upon its properties and location, and takes into account the factors set out in guidance on setting issued by HES[5] (i.e. the location and orientation of the site; importance of views of or from principal facades; the importance, if applicable, of designed settings; and, any obvious views or vistas).

Criteria for the Assessment Effects

Criteria for Assessing the Sensitivity of Receptors

7.2.15 Cultural heritage assets are given weight through the designation process. Designation ensures that sites and places are recognised by law through the planning system and other regulatory processes. The level of protection and how a site or place is managed varies

[3] http://hlamap.org.uk/

[4] http://www.geo.ed.ac.uk/spad/

[5] Historic Environment Scotland (2016) 'Managing Change in the Historic Environment: Setting', Edinburgh: Historic Environment Scotland

depending on the type of designation and its laws and policies (HES, 2019)[6]. Table 7.2 summarises the relative sensitivity of those heritage assets relevant to the proposed development (excluding in this instance World Heritage Sites and Marine Resources).

Table 7.2: Sensitivity of Heritage Assets	
Sensitivity of Asset	**Definition / Criteria**
High	Sites of national importance, including: Scheduled Monuments and sites proposed for scheduling Category A Listed Buildings Gardens and Designed Landscapes (Inventory) Historic Battlefields (Inventory)
Medium	Sites of regional importance, including: Archaeological sites and areas of distinctive regional importance Category B Listed Buildings Conservation Areas
Low	Sites of local importance, including: Archaeological sites of local importance Category C Listed Buildings Unlisted buildings and townscapes with local (vernacular) characteristics
Negligible	Sites of little or no importance, including: Artefact find-spots (where the artefacts are no longer in situ and where their provenance is uncertain) Unlisted buildings of minor historic or architectural interest Poorly preserved examples of particular types of minor historic landscape features (e.g. quarries and gravel pits, dilapidated sheepfolds, etc) Previously recorded sites that have either been excavated and are no longer present of that been lost through other means (e.g. lost to opencast mine working or quarrying)

Criteria for Assessing the Magnitude of Change

7.2.16 Criteria for assessing the magnitude of direct (construction phase) effects, which measures the degree of change to the baseline condition of a feature that would result from the construction of one or more elements of the proposed development, are presented in Table 7.3.

Table 7.3: Magnitude of Change	
Level of Magnitude	**Definition**
High	A fundamental change to the physical condition of an asset, leading to total loss of the asset or major alteration to its character. Comprehensive change in the surroundings of an asset, such that its baseline setting is substantially or totally altered and key visual links and relationships with the surroundings are lost or substantially affected
Medium	A material change to the physical condition of a heritage asset, resulting in partial loss or clear alteration of its character. Considerable changes to the surroundings of an asset, such that the character of the asset and its baseline setting is partly and materially altered and key visual links and relationships with the surroundings are materially affected
Low	A slight but detectable change to the physical condition of a heritage asset, resulting in minor alteration of its character.

[6] Historic Environment Scotland (2019) 'Designation Policy and Selection Guidance'; Historic Environment Scotland, Edinburgh

Table 7.3: Magnitude of Change	
Level of Magnitude	**Definition**
	A slight but noticeable change in the surroundings of an asset, resulting in superficial alteration of its baseline setting while key visual links and relationships with the surroundings are unaffected.
Negligible	A barely distinguishable change to the physical condition of a heritage asset. A very slight and barely distinguishable change in the surroundings of an asset, resulting in no obvious alteration of its baseline setting or to key visual links and relationships with the surroundings.

Criteria for Assessing Cumulative Effects

7.2.17 The assessment of cumulative effects on heritage assets is based upon consideration of the effects of the proposed development on the settings of assets with statutory designations and non-statutory designations within the Outer Study Area, in addition to the likely effects of other operational, under construction, consented and proposed (at the application stage) developments.

7.2.18 As noted above (paragraph 7.2.2), operational and under construction developments are considered as part of the baseline and are taken to be such for the assessment of effects on the settings of heritage assets. Developments that are consented but not yet under construction and those that are the subject of valid planning applications are considered as being potential additions to the baseline and are considered in the cumulative impact assessment.

Criteria for Assessing Significance

7.2.19 The sensitivity of the assets (Table 7.2) and the magnitude of the predicted change (Table 7.3) are used to inform an assessment of the significance of the effect (direct effect or effect on setting), summarised using the formula set out in the matrix in Table 7.4. Where two outcomes are possible through application of the matrix, professional judgement has been employed to determine the level of significance described in the following assessment.

Table 7.4: Significance of Effect				
Magnitude of Change	**Sensitivity of Asset**			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major / Moderate	Moderate / Minor	Minor
Medium	Major / Moderate	Moderate	Moderate / Minor	Minor / Negligible
Low	Moderate / Minor	Moderate / Minor	Minor / Negligible	Minor / Negligible
Negligible	Minor	Minor / Negligible	Minor / Negligible	Negligible

7.2.20 Major and Moderate effects are considered to be significant for the purposes of the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (EIA Regulations). Minor and Negligible effects are considered to be 'not significant'.

Limitations and Assumptions

7.2.21 The desk-based assessment draws on the records in the HER, provided in a digital GIS dataset first acquired in September 2014 ahead of a field survey at that time and reacquired in March

2019 to complete the baseline assessment for the amended site boundary. It is assumed that those records were up-to-date at the time of acquisition.

7.2.22 The field surveys carried out in 2014 and 2016 covered the whole of the site as it was defined at the time of the surveys. The site boundary has since been modified (Chapter 3: Design Evolution and Alternatives) and an additional element of desk-based assessment (2019) has been carried out covering the extent of current site (as shown in Fig 2.1 and Fig 7.1, 7.2 and 7.3). As the previous field survey covered the whole of the proposed developable area (as shown on Figure 7.1), no further field survey has been carried out covering the amended area of the site, as this was included in the previous field survey. The baseline assessment draws on the results of the desk-based assessments and field surveys carried out, and sufficiently characterises the cultural heritage across the site. No development is proposed in the areas not covered by field survey, the extent of which is shown on Figure 7.1.

7.2.23 The desk-based assessment draws on the results of surveys carried out during a University of Edinburgh Field School Project in the 1980s (Mercer 1981[7]). That survey work recorded a number of features within the Inner Study Area, including: mounds (possible cairns); other potential prehistoric remains (including a possible burial cist and a hut-circle); and later (post-medieval) settlement remains. However, it became apparent during the field survey undertaken in 2016 for this assessment that the grid coordinates recorded by that earlier survey work were inaccurate and that many of the features recorded were not present at the positions previously recorded. As the sites recorded by Mercer are listed in the HER they have been retained in the gazetteer (Technical Appendix 7.1) and they are shown (at the locations recorded by Mercer) on Figure 7.1. Where it was established that the sites recorded by Mercer are at a different location this is explained below, in the baseline assessment.

7.2.24 Designated heritage assets within the Outer Study Area have been identified from the HES database downloaded from the HES website in October 2018. That data is assumed to have been current and up-to-date at the time of acquisition.

7.3 Baseline Conditions

Current Baseline

Heritage Assets within the Inner Study Area

7.3.1 Fifty-six heritage assets (1-56) have been identified within the Inner Study Area. The locations and extents of these are shown on Figure 7.1 and Technical Appendix 7.1: Heritage Assets within Inner Study Area provides detailed gazetteer information on their character and baseline condition. The heritage importance and relative sensitivity of these assets is summarised below.

7.3.2 There are no Scheduled Monuments or Listed Buildings within the Inner Study Area and no part of the Inner Study Area lies within an Inventory status Garden and Designed Landscape, Inventory status Historic Battlefield or Conservation Area.

PREHISTORIC REMAINS

7.3.3 The HER and Canmore record that Mercer (1981[8]) recorded the presence of three mounds (2, 7 and 17) identified, at the time, as the remains of possible prehistoric burial cairns. No trace

Mercer, R.J. (1981) Archaeological Field Survey in Northern Scotland, Vol II, 1980-1981, Edinburgh: University of Edinburgh, Department of Archaeology

[8] ibid

of two of these mounds (2 and 7) was identified during the field survey for this assessment. The area, in which the first mound (2) was recorded, is heather covered ground disturbed by farm vehicle tracks and cattle trampling and it is additionally noted that the cited grid reference is possibly incorrect; a mound (20), matching the description provided by Mercer, was found during the field survey in 2016 lying around 200 m west. The recorded location for the second mound (7) lies under a field boundary, marked by a wide linear bank and fence, within an improved pasture field. The cited locations of both mounds are considered to be of no heritage importance and of negligible sensitivity.

7.3.4 The third mound (17), described as possibly being the remains of a prehistoric burial cairn, was recorded by Mercer (1981) at 306593, 968895. Field survey for this assessment did not identify any remains of a mound conforming to the description provided by Mercer at this location, although a slight, possible turf mound (4 m by 0.2 m) was found close to the cited location. The mound is poorly preserved and difficult to define and is unlikely to be the remains of a burial cairn; it is considered to be of no heritage importance and of negligible sensitivity.

7.3.5 The remains of a possible, partially robbed, burial cairn (42), corresponding to the description provided by Mercer for the site (17) described above, were found ca. 100 m west of the location cited by Mercer: at 306491, 968875. The cairn survives as a circular grass-covered mound (5 m in diameter and 0.8 m high) positioned in a prominent location on a west-facing slope in an area of rough pasture. It is considered to be potentially of regional importance and medium sensitivity.

7.3.6 The HER and Canmore note that (Mercer 1981) recorded the remains of a possible prehistoric hut circle (5a) and a nearby circular enclosure (5b), defined by a turf and stone bank. No trace of the hut circle (5a) was found during field survey for this assessment; however, the faint outline of the enclosure (5b) was identified, defined by a very poorly preserved bank (1 m wide by 0.1 m high) covered in high grass. Both the possible hut circle and the enclosure are considered to be of no more than local heritage importance and of low sensitivity.

7.3.7 Remains of a probable burnt mound (49) of possible Bronze Age date, partly truncated by a farm track and damaged by ploughing, lie to the east side of the farm track north of Hopefield. The remains are considered to be of local heritage importance and of low sensitivity.

MEDIEVAL OR LATER SETTLEMENT FARMSTEADS

7.3.8 The desk-based study and field survey have identified three farmsteads (4, 45 and 54); one of which, Hopefield (54), remains in occupation. One of the others, Taldale (4) survives as footings of a former building and turf banks of accompanying enclosures. Blackheath Farm (45) survives as ruined buildings. These farmsteads are all considered to be of local heritage importance and of low sensitivity.

OTHER FARM BUILDINGS/CROFTS

7.3.9 In addition to the farmsteads described above, the study has recorded a number of other unnamed buildings (1, 3, 12, 24, 27, 28, 33, 35, 36, 48, 52, 55 and 56) that are either former crofts or other farm buildings, distributed across the site.

7.3.10 Seven of the former buildings (1, 3, 24, 27, 28, 33 and 56) have surviving remains in the form of buildings footings and enclosure banks. These are assessed as being of local heritage importance and low sensitivity.

7.3.11 Six of the former buildings (12, 35, 36, 48, 52 and 55) have no surviving remains and are assessed as being of no heritage importance and negligible sensitivity.

7.3.12 One building (39), with an attached enclosure (40), recorded by Mercer (1981) was found by the field survey to have been incorrectly recorded; the features that are described by Mercer were found over 200 m to the northwest of Mercer's cited location. These features (33a and 33b) are assessed as being of local heritage importance and of low sensitivity.

ENCLOSURES AND OTHER STRUCTURES

7.3.13 A circular sheepfold (8) with four radial arms roughly aligned to the cardinal points lies in open rough pasture south of and probably formerly associated with the former Taldale farmstead (4). It is reasonably well-preserved and is assessed as being of local heritage importance and low sensitivity.

7.3.14 The denuded remains of second enclosure (16), also probably a former sheepfold, are assessed as being of little heritage importance and negligible sensitivity.

7.3.15 A horseshoe shaped turf bank enclosure (21) and small D-shaped enclosure (34) are the remains of structures likely to be associated with the former farming land-use. They are of unknown function or date but are assessed as being of no more than local heritage importance and of low sensitivity.

7.3.16 No remains of two roughly circular structures (41), recorded by Mercer (1981), were identified during the field survey in 2016; although a section of wall, possibly that described by Mercer was found. The remains described appear to have been poorly preserved in 1981 and are assessed as being of little heritage importance and negligible sensitivity.

RIG AND FURROW/CULTIVATION

7.3.17 Two areas of former rig and furrow cultivation (37 and 38), recorded by Mercer (1981) and traces of which are still visible on modern aerial photography, were not detected by the field survey in 2016. The remnant rig and furrow is of little heritage importance and is assessed as being of negligible sensitivity.

WATER MANAGEMENT FEATURES

7.3.18 A mill lade (6), formerly drawing water from a number of watercourses within the site and leading northwards to Burn of Brims farm, survives in varying condition along its length: partly as an underground channel and partly as an open ditch. As a surviving feature associated with water management, possibly serving local grain mills, the lade is assessed as being of no more than local heritage importance and low sensitivity.

7.3.19 Two other former ponds and dams (14 and 51), of which nothing now survives, are of little heritage importance and of negligible sensitivity.

QUARRIES

7.3.20 Eight quarries (9, 10a-b, 25, 26, 30, 31 and 47) are depicted on the Ordnance Survey 1st Edition map (1876/77), with three of these (10a-b, 30 and 31) continuing to be shown on the Ordnance Survey 2nd Edition map (1906). Field survey identified seven of these former quarries (9, 10a-b, 25, 26, 30 and 31), which survive in varying conditions cut into the slopes of Hill of Forss and Cairnmore Hillock. Large quantities of worked Caithness stone slabs and stone debris are present in and around the large, disused quarry (25) at Hopefield, which appears to still be in occasional use; while another quarry (26) appears to have been cut recently with a mechanical excavator suggesting that it too is in occasional use. One additional quarry (43) was identified during the field survey, in an area of rough pasture at Hill of Forss. This quarry is not shown on the early Ordnance Survey maps (1877-1949) and is likely to be modern in date. The quarries, which attest to historic exploitation of the Caithness sandstone during the 19th century, are of little heritage importance and of negligible sensitivity.

7.3.21 A road (22) is shown on the Ordnance Survey 1st Edition map (1877) leading from the A836, passing southeast of Blackheath Farm (45) and leading to the Hopefield Quarry (25). The former road survives as farm access tracks over much of its original length, although the westernmost part is now in a state of abandonment. The road is of little heritage importance and is assessed as being of negligible sensitivity.

7.3.22 The remains of an old windmill (50), of at least early 19th century date, survive at the east end of the old Hopefield Quarry workings (25). The windmill, which was used to drive a water pump to drain the quarries, is assessed as being of local heritage importance and low sensitivity.

MISCELLANEOUS FEATURES

7.3.23 Seven wells (13, 15, 23, 29, 32, 46 and 53) are depicted on the Ordnance Survey 1st and 2nd Edition maps (1876-77 & 1906) around Hill of Forss. None of the wells were found during the field survey, although natural springs were noted at the locations of two of the wells (29 and 32) and it may be that such springs were once used as a source of water both for domestic purposes and for watering livestock. The former wells are of no heritage importance and of negligible sensitivity.

7.3.24 A long, linear mound (11), recorded by Mercer (1981) as being ca 30 m long, was found during the field survey to be over 50 m in length and of entirely modern construction. It is of no heritage importance and is assessed as being of negligible sensitivity.

7.3.25 A sub-rectangular, grassy platform (18), identified during the field survey in 2016 and covered with a low pile of large boulders, may be the remains of a former building or may simply be a pile of field clearance stone. There are no traces of any possible structure at this location (and none shown on any historic maps) and the platform is assessed as being of no heritage importance and of negligible sensitivity.

7.3.26 A possible marker cairn (19) was recorded during the field survey in 2016, adjacent to an enclosure (16). The cairn is of little heritage importance and is assessed as being of negligible sensitivity.

7.3.27 A low, oval turf-covered mound (20), recorded during the field survey in 2016 in an area of reedy vegetation, is unlikely to be the remains of a cairn or any other structure and is assessed as being of no heritage importance and of negligible sensitivity.

7.3.28 A grass and thistle covered boulder heap (44), on the edge of a rough pasture field, is a modern field clearance cairn and is assessed as being of no heritage importance and of negligible sensitivity.

Assessment of Archaeological Potential of the Inner Study Area

7.3.29 The majority of the identified heritage assets across the site are related to historic, post-medieval farming land-use with some notable former industrial scale quarry workings around Hopefield Farm. Relict elements of that former farming activity survive in the form of the denuded remains of long abandoned crofts; largely limited to preserved footings of former buildings and turf and stone banks of old enclosures. HLAmap[9] records the site as a patchwork of 19th and 20th century holdings and smallholdings with some rectilinear fields and farming around Blackheath and Hopefield. An area on Lythmore Moss is shown as being traditional peat cutting and there are small areas of rough grazing, where there is no evidence of agricultural improvement.

7.3.30 There is some evidence of prehistoric activity within the site, in the form of a probable burial cairn, a possible cist, and remains of a probable burnt mound; each of which is potentially of Bronze Age date. A possible hut circle, potentially of either Bronze Age or Iron Age date, was also recorded in the 1980s; although no trace of that feature, or any other evidence of prehistoric settlement or activity, was found during the field surveys for this assessment (2014 and 2016). However, there is ample evidence in the wider landscape for prehistoric occupation and settlement in this part of Caithness. Chambered cairns, of Neolithic date, are recorded near Westfield, a short distance southwest of the site, and Iron Age brochs are recorded at Brimside, to the west of the site and Thing's Va broch lies to the east. Both chambered cairns and brochs are plentiful in the local landscape and the possibility that hitherto unidentified, buried remains of prehistoric activity survive within the site cannot be discounted.

7.3.31 The peat depth assessment (Technical Appendix 2.5: Phase 1 and 2 Peat Depth & Coring Survey) shows that there are limited areas of deep peat deposit within the site; with some notable peat accumulation being evident around the lochan on Hill of Forss, between turbine locations T6 and T7, where peat depth up to 3.5 m has been identified. Over most of the site, the peat depth is less than 0.5 m.

7.3.32 Based on the available evidence, both from within the site and in the wider landscape, it is considered that there is a moderate probability of hitherto unidentified archaeological remains being present within the site; especially for remains of prehistoric date.

Heritage Assets within the Outer Study Area

7.3.33 Within the Outer Study Area, there are 49 Scheduled Monuments (two of which are Properties in Care (PiC)), 72 Listed Buildings (one of which is Category A Listed) and one Conservation Area from which there is some predicted theoretical visibility of the proposed development. There are no Inventory Garden and Designed Landscapes and no Inventory Historic Battlefield Sites within the Outer Study Area. However, not all of these assets are in locations from which there would be visibility of the proposed development and many of the listed buildings lie within the urban environment at Thurso.

7.3.34 The blade tip height ZTV for the proposed development was used to identify those cultural heritage assets within the Outer Study Area from where there could be theoretical visibility of one or more of the proposed wind turbines. Those assets from which there is potential theoretical visibility of the proposed development are shown on Figure 7.2 and are listed in Technical Appendices 7.2 and 7.3. Assets where there is no visibility are excluded.

Future Baseline

7.3.35 If the proposed development was not to proceed, there would likely be no change to the baseline condition of the various heritage assets and features that presently survive within the site. The current land-use as rough pasture grazing would be likely to continue and those

[9] https://map.hlamap.org.uk/

heritage assets that survive within the site would be subject only to natural decay and erosion processes.

7.3.36 Other wind farm developments in the area, both operational and consented or proposed, would have their own effects on the settings of heritage assets identified by this study. Those effects would be removed by the future decommissioning of those projects. For the purpose of this assessment, taking account of the inherent uncertainty about future wind farm development and decommissioning in the wider area, it has been assumed that the future baseline would remain the same as the current baseline.

7.4 Assessment of Likely Effects

Potential Construction Effects

7.4.1 Any ground-breaking activities associated with the construction of the proposed development, (such as those required for turbine bases and crane hardstandings, access tracks, cable routes, compounds, etc.) have the potential to disturb or destroy features of cultural heritage interest within the site. Other construction activities, such as vehicle movements, materials storage, soil and overburden storage and landscaping also have the potential to cause permanent and irreversible effects on the cultural heritage within the site.

7.4.2 Five heritage assets have been identified that could, without mitigation, be affected by construction of the proposed development:

- The remains of a small croft (**1**) comprising the grass-covered footings of a former building and the remains of possible outbuilding surviving as a low platform lie close to the proposed access track to T5 and an area of temporary hardstanding. Without mitigation, the remains could be directly affected by construction works or track micrositing. The remains are an asset of local heritage importance and of low sensitivity and have been avoided through design and can easily be avoided by construction phase mitigation and micrositing of the proposed development. The potential effect on the remains of the croft is likely to be of negligible magnitude; the resultant effect being **minor** and **not significant**.
- The proposed access from the A836 runs parallel with and directly alongside the alignment of a former mill lade (**6**) which survives as a linear ditch (ca 0.7 m wide and ca 0.5 m deep) running parallel with the current farm track. The lade is an asset of local heritage importance and of low sensitivity. The potential effect on the lade is likely to be of negligible magnitude, as the watercourse can easily be avoided; the resultant effect would be **minor** and **not significant**.
- The remains of an old sheepfold (**8**) lie close to the site of the construction compound. It is intended that this sheepfold be retained and fully restored for use as an information point; therefore, any potential for an impact from the proposed construction compound would be avoided by micrositing. The remains are an asset of local heritage importance and of low sensitivity. The proposed restoration of the sheepfold would a beneficial effect of low magnitude; the resultant positive effect being **minor** and **not significant**.
- The proposed access from the A836 passes a sub-rectangular grassy platform (**18**), 5 m long by 4 m wide, covered with a low pile of large boulders that may be either field clearance or possibly the remains of a demolished former small building or other structure. The platform is an asset of little or no heritage importance and of negligible sensitivity. The potential effect on the platform is likely to be of high magnitude, as track widening

work could substantially alter its character; the resultant effect would be **minor** and **not significant**.

- The remains of a possible building or turf cutting (**36**) lie close to the proposed hardstanding for turbine T7. The possible building or turf cutting is considered to be of little heritage importance and of negligible sensitivity. The potential effect on the platform is likely to be of high magnitude, as construction of the hard standing could substantially alter its character; the resultant effect would be **minor** and **not significant**.

7.4.3 The remains of a building (39) and other structure (40), recorded by Mercer in 1980, are recorded in the HER as lying close to the access track and hardstanding at turbine T2. However, field survey for this assessment has established that this asset is incorrectly recorded by Mercer and that the remains corresponding to Mercer's description (33) actually lie some distance to the northwest and well away from the proposed turbine location.

7.4.4 Taking into account the limited footprint of the proposed development within the site and the moderate level of probability for hitherto unidentified archaeological remains to be present within the site, it is assessed that there is low potential for direct effects on buried archaeological remains that are likely to be significant in EIA terms.

Potential Operational Effects

Direct Effects

7.4.5 There are no identified assets likely to receive a direct effect arising during operation of the proposed development assessed. This is due to the approach adopted in formulating the design and layout of the proposed development, i.e. avoidance, and because any maintenance works on site would be managed to recognise the presence of heritage assets and to avoid them.

Setting Effects

7.4.6 The proposed development could result in adverse effects on the setting of cultural heritage assets in both the Inner Study Area and the Outer Study Area. Beyond 10 km, the proposed development would not be a dominant feature in the landscape and the effect on the settings of heritage assets would not be significant. No assets beyond 10 km have been identified by HES or HET as requiring consideration for potential effects on their settings. Technical Appendices 7.2 and 7.3 contain summary assessments of the predicted effects on designated heritage assets in the Outer Study Area.

7.4.7 The assessment of operational effects on the settings of heritage assets has been carried out with reference to the layout of the proposed development and locations of the cultural heritage assets shown on Figures 7.2. The criteria detailed in Tables 7.2 to 7.4 have been used to assess the nature and magnitude of the effects which are set out in summary in Technical Appendices 7.2 and 7.3.

7.4.8 The following discussion addresses those assets identified by HES or HET as requiring assessment even where the significance of the predicted effect is assessed as being not significant in EIA terms. The assessments are supported with visualisations (Figures 7.4 – 7.13). All the assets, including those identified by HES and HET as requiring detailed assessment, are included in the tabulated assessment in Technical Appendices 7.2 and 7.3.

THING'S VA BROCH, 1000 M E OF BLACKHEATH, SCRABSTER (SM587) FIGURE 7.4

7.4.9 The remains of this broch survive as a low grass covered mound in a rural farmland setting in rough pasture on an east facing slope, with the open aspect directing views towards Thurso and the coast. Rising ground to the west of the broch obscures visibility in that direction. The broch remains are visible as a low mound within a rough pasture field when viewed from the minor road that runs to the east, but it is not a prominent or widely visible monument in the landscape. There is no direct intervisibility with the Scrabster Mains broch (SM579) to the northeast on the opposite side of the A836. The broch is a Scheduled Monument, of national importance and high sensitivity.

7.4.10 Figure 7.4 shows that all eight turbines (hubs and tips) would be visible in the view to the west from the broch, the remains of which are visible in the foreground in the photomontage. The closest turbine (T8) would be 1100 m from the broch and the proposed development would also be visible behind the broch when viewed from the minor road that runs to the east. The proposed development infrastructure (tracks, buildings, compounds, etc.) however would be screened from view from the broch and from the minor road, beyond the rising intervening ground.

7.4.11 Figure 7.4 shows that the ground visible from the broch in all directions, including that towards the proposed development, would preserve its current moorland/rough pasture quality. From the broch, the open aspect views towards the coast at Thurso Bay would be unaffected and it would remain possible for any visitor to appreciate and understand the landscape context of the siting of the broch overlooking the broad valley of the River Thurso to the east. The introduction of the proposed development would result in a noticeable change in the surroundings of the broch, particularly in the view to the west and in the view of the broch when approached from the east resulting in a medium magnitude of change. However, the key visual links from the broch (towards the east and Thurso Bay and towards Scrabster broch to the northeast) and its relationship with its surroundings would be unaffected.

7.4.12 Overall, it is assessed that, as a result of the change in its surroundings, the proposed development would result in an impact of moderate significance on the setting of Thing's Va broch; significant in EIA terms. However, the effect would not appreciably diminish the cultural significance of the monument or its amenity value as a relic of the later prehistoric occupation of the landscape and it will remain possible to understand and appreciate the broch and its setting. Its contribution to the local landscape character would be retained.

SCRABSTER MAINS BROCH 1000 M W OF (SM579) FIGURE 7.5

7.4.13 The remains of this broch survive as a low grass covered mound in a rural coastal farmland setting in rough pasture on a southeast facing slope, with open aspect directing views towards Thurso and the coast. Rising ground to northwest obscures visibility in that direction. The broch remains are visible as a low mound when viewed from A836, but it is not a prominent or widely visible monument in the landscape. There is no direct intervisibility with Thing's Va broch (SM587) to the southwest on the opposite side of the A836. The broch is a Scheduled Monument, of national importance and high sensitivity.

7.4.14 Figure 7.5 shows that eight turbine tips (five hubs) would be visible from the broch, the remains of which are visible in the foreground in the photomontage. The closest turbine (T8) would be 2 km from the broch. The proposed development would not be visible in combination with the broch when viewed from the A836 road that passes to the south of the broch and from where the remains can be readily seen and appreciated. Furthermore, the proposed development infrastructure (tracks, buildings, compounds, etc) would be screened from view from the broch, beyond the rising intervening ground.

7.4.15 Figure 7.5 shows that the ground visible from the broch in all directions including views towards the proposed development. The view towards the proposed development is open and over rough pasture. From the broch, the open aspect views towards the coast at Thurso Bay would be unaffected and it would remain possible for any visitor to appreciate and understand the landscape context of the siting of the broch, overlooking Thurso Bay and the mouth of the River Thurso. The introduction of the proposed development would result in a noticeable change in the surroundings of the broch, particularly in the view to the southwest and in the view of the broch when approached from the northeast resulting in a medium magnitude of change. However, the key visual links from the broch to the coast and across the Thurso valley and its relationship with its surroundings would be unaffected.

7.4.16 Overall, it is assessed that, as a result of the change in its surroundings, the proposed development would result in an impact of moderate significance on the setting of Scrabster Mains broch; significant in EIA terms. However, the effect would not appreciably diminish the cultural significance of the monument or its amenity value as a relic of the later prehistoric occupation of the landscape and it will remain possible to understand and appreciate the broch and its setting. Its contribution to the local landscape character would be retained.

CNOC FREICEADEAN, LONG CAIRNS (SM90078) FIGURE 7.6

7.4.17 These two long cairns lie at right angles to each other in a prominent hilltop location from which there are extensive and wide-ranging views in all directions. Baillie Wind Farm lies close by to the southeast (600 m to the nearest turbine) and is a prominent feature of the local landscape. The Dounreay Nuclear facility is visible on the coast to the north, 2.8 km distant. The cairns each comprise a long, low mound and are visible features in the local landscape. The cairns are a Scheduled Monument, of national importance and high sensitivity.

7.4.18 Figure 7.6 shows that all eight turbines (hubs and tips) would be visible in the view to the northeast from the cairns, the remains of which are visible in the foreground in the photomontage. The closest turbine (T1) would be 5 km from the cairns and the proposed development would be seen in the same view as, and in the background to, the intervening Baillie Wind Farm. Views from the cairns in all other directions would be unaffected and views of the cairns in their hilltop setting from the wider landscape would be unaffected.

7.4.19 The introduction of the proposed development would result in a noticeable change in the surroundings of the broch, particularly in the view to the northeast (being visible on the skyline behind and in the same context as Baillie Wind Farm) but it would have no impact on the views of the cairns when they are approached from the visitor car park which lies to the southeast of the cairns. The key visual links from the Cnoc Freiceadain long cairns and their relationship with their surroundings would be unaffected and the introduction of the proposed development would result in a low magnitude of change to the setting.

7.4.20 Overall, it is assessed that, as a result of the change in its surroundings, the proposed development would result in an impact of minor significance on the setting of Cnoc Freiceadain long cairns; not significant in EIA terms. The proposed development would not result in any appreciable diminishment of the cultural significance of the monument or its amenity value as funerary relict of the prehistoric landscape and it will remain possible to understand and appreciate the cairns and their setting. Their contribution to the local landscape character would be retained.

KNOCKGLASS, BROCH 300 M SSW OF MILL OF KNOCKGLASS (SM562) FIGURE 7.7

7.4.21 The remains of this broch survive as a low grass covered mound in a rural farmland setting in rough pasture/heather moorland on the north bank of the Forss Water, and it is one of a group of monuments, together with a group of three burial cairns (SM469, SM470 & SM471), in a riverside setting at Westfield village. The broch is not a visually prominent or widely visible monument in the landscape, and it is best appreciated at close quarters as part of a collective group of multi period monuments in its riverside setting. The broch is a Scheduled Monument, of national importance and high sensitivity.

7.4.22 Figure 7.7 shows that eight turbine tips and hubs would be visible from the broch; the closest turbine (T1) being 4.1 km from the broch. However, the proposed development infrastructure (tracks, buildings, compounds, etc.) would be screened from view from the broch, by the rising intervening ground, and the proposed development would be seen behind, and in the same view as, a line of pylons in the middle distance, and modern settlement and overhead power lines in the foreground. The proposed development would not adversely affect the close relationship between the broch and the other prehistoric remains at Westfield and it would not affect the view of the broch from the road that passes through Westfield, from where the mound is plainly visible.

7.4.23 Figure 7.7 shows that, although there would be some change in its surroundings, the improved pasture character of the landscape surrounding the broch in all directions including in views towards the proposed development would be preserved. From the broch, the open aspect views eastwards along the Forss Water valley would be unaffected and it would remain possible for any visitor to appreciate and understand the landscape context of the siting of the broch and its association with the other prehistoric monuments that lie in close proximity. The introduction of the proposed development would result in a noticeable change in the surroundings of the broch, particularly in the view to the northeast but would result in only a low magnitude of change; the key visual links from the broch and its relationship with its surroundings would be unaffected.

7.4.24 Overall, it is assessed that, as a result of the change in its surroundings, the proposed development would result in an impact of minor significance on the setting of Knockglass, broch; not significant in EIA terms. The effect would not appreciably diminish the cultural significance of the monument or its amenity value as a relic of the later prehistoric occupation of the landscape and it will remain possible to understand and appreciate the broch and its setting. Its contribution to the local landscape character would be retained.

MILL OF KNOCKGLASS, LONG CAIRN 100 M SSE OF, BRIDGE OF WESTFIELD (SM469) FIGURE 7.8

7.4.25 This long cairn lies in a rural farmland location in rough pasture/heather moorland on the north bank of the Forss Water. The cairn is aligned northwest to southeast, with its broad end at the southeast. It is one of a group of monuments, together with two other burial cairns (SM470 & SM471) and an Iron Age broch (SM562), in a riverside setting at Westfield village. The long cairn is not a visually prominent or widely visible monument in the landscape, and it is best appreciated at close quarters as part of a collective group of multi period monuments in its riverside setting. The long cairn is a Scheduled Monument, of national importance and high sensitivity.

7.4.26 Figure 7.8 shows that eight turbine tips and hubs would be visible from the cairn; the closest turbine (T1) being 3.8 km from the cairn. However, the proposed development infrastructure (tracks, buildings, compounds, etc.) would be screened from view from the cairn, beyond the rising intervening ground. The photomontage view from the broch at Westfield (Figure 7.7) also shows that the proposed development would be seen behind and in the same view as a line of pylons in the middle distance and modern settlement and overhead power lines in the foreground. The proposed development would not adversely affect the close group association between the cairn and the other prehistoric remains at Westfield.

7.4.27 From the cairn, the open aspect views south east wards across the Forss Water valley would be unaffected and it would remain possible for any visitor to appreciate and understand the landscape context of the siting of the cairn and its association with the other prehistoric monuments that lie in close proximity. The introduction of the proposed development would result in a noticeable change in the surroundings of the cairn, particularly in the view to the northeast but would result in only a low magnitude of change; the key visual links from the cairn, especially that to the southeast, and its relationship with its surroundings would be unaffected.

7.4.28 Overall, it is assessed that, as a result of the change in its surroundings, the proposed development would result in an impact of minor significance on the setting of Mill of Knockglass, long cairn; not significant in EIA terms. The effect would not appreciably diminish the cultural significance of the monument or its amenity value as a relic of the prehistoric occupation of the landscape and it will remain possible to understand and appreciate the long cairn and its setting. Its contribution to the local landscape character would be retained.

MILL OF KNOCKGLASS, CAIRN 220M S OF, BRIDGE OF WESTFIELD (SM470) & MILL OF KNOCKGLASS, CHAMBERED CAIRN 320M SSE OF, BRIDGE OF WESTFIELD (SM471) FIGURES 7.7 & 7.8

7.4.29 These two cairns, of probable Neolithic date, lie approximately 100 m apart on the south bank of the Forss Water, south of Bridge of Westfield. Both are grass-covered round cairns approximately 11 m in diameter and 1.5 m high. They lie south of and close to the long cairn (SM469), which lies on the north side of the watercourse. They are part of a group of monuments, together with the long cairn (SM469) and an Iron Age broch (SM562), in a riverside setting at Westfield village. The cairns are not visually prominent or widely visible monuments in the landscape, being set low down and close to the watercourse, and they are best appreciated at close quarters as part of a collective group of multi period monuments in a riverside setting. The cairns are both Scheduled Monuments, of national importance and high sensitivity.

7.4.30 Figures 7.7 and 7.8 provide visualisations (Photomontage in Figure 7.7 and wireline in 7.8) that show views from nearby to the two cairns and are typical, and representative, of the views from this low-lying local group on monuments. The ZTVs predict visibility of eight turbine tips and hubs from each of the two cairns; the closest turbine (T1) being around 4 km distant in each case. The proposed development infrastructure (tracks, buildings, compounds, etc.) would be screened from view from the cairn, hidden beyond the rising intervening ground. The photomontage view from the broch at Westfield (Figure 7.7) also shows that the proposed development would be seen behind and in the same view as a line of pylons in the middle distance and modern settlement and overhead power lines in the foreground. The proposed development would not adversely affect the close group association between the cairns and the other prehistoric remains at Westfield.

7.4.31 From the cairns, the open aspect views southeastwards across the Forss Water valley would be unaffected and it would remain possible for any visitor to appreciate and understand the landscape context of the siting of the cairns and their association with the other prehistoric monuments that lie in close proximity. The introduction of the proposed development would result in a noticeable change in the surroundings of the cairns, particularly in the view to the northeast but would result in only a low magnitude of change; the key visual links from the cairns, especially their relationships with the Forss Water and the other monuments nearby would be unaffected.

7.4.32 Overall, it is assessed that, as a result of the change in its surroundings, the proposed development would result in an impact of minor significance on the setting of the two cairns; not significant in EIA terms. The effect would not appreciably diminish the cultural significance of the monuments or their amenity value as relics of the prehistoric occupation of the landscape and it will remain possible to understand and appreciate the cairns and their setting. Their contribution to the local landscape character would be retained.

BRIMS CASTLE (SM5510) FIGURE 7.9

7.4.33 The standing remains of this former tower house stand in a coastal location within the farmyard setting of a later, post-medieval farmstead, with more recent farm buildings immediately to the northwest. The castle now has a relatively localised setting dominated by the later farmstead; although it is still possible to see and appreciate its close association with the seascape to the north. The castle is a Scheduled Monument, of national importance and high sensitivity.

7.4.34 Figure 7.9 shows that eight turbine tips and hubs would be visible from Brims Castle; the closest turbine (T6) being 3 km away. However, the proposed development infrastructure (tracks, buildings, compounds, etc) would be screened from view from the castle, beyond the distant rising intervening ground. The proposed development would not adversely affect the close group association between the castle and the present-day farm buildings, including the post-medieval farmstead, that lie immediately to the west or the coastal outlook from the castle.

7.4.35 The open, rural farmland setting would be unaffected, and it would remain possible for any visitor to appreciate and understand the landscape context of the siting of the castle; in particular, its association with the rural farmland and the coast. The introduction of the proposed development would result in a slight change in the wider surroundings of the Castle but this would result in only a low magnitude of change to its current setting; the key visual links from the castle, especially that to the coast to the north, and its relationship with its farmland surroundings would be unaffected.

7.4.36 Overall, it is assessed that, as a result of the change in its surroundings, the proposed development would result in an impact of minor significance on the setting of Brims Castle; not significant in EIA terms. The effect would not appreciably diminish the cultural significance of the monument or its amenity value as a relic of the historic occupation of the landscape and it will remain possible to understand and appreciate the remains of Brims Castle and its setting. Its contribution to the local landscape character would be retained.

SCRABSTER CASTLE (SM2630) FIGURE 7.10

7.4.37 The rather poorly preserved earthwork remains of the castle lie at the edge of the shore to the east side of the A9 road to Scrabster harbour. Modern housing lies immediately adjacent to the south, and similar modern housing across the A9 to the west obscures inland views. The main views from the castle remains, which are difficult to make out, are focussed northeast over the sea view of Thurso Bay. The castle is a Scheduled Monument, of national importance and high sensitivity.

7.4.38 Figure 7.10 shows that eight turbine tips and hubs would be visible from Scrabster Castle; the closest turbine (T8) being 3.7 km away. However, the proposed development infrastructure (tracks, buildings, compounds, etc.) would be screened from view from the castle remains, beyond the rising intervening ground and the modern housing beyond the A9. The proposed development would not adversely affect the castle's coastal outlook over Thurso Bay and the proposed development would not detract from the ability of any visitor to appreciate and understand the landscape context of the siting of the castle.

7.4.39 The introduction of the proposed development would result in a barely noticeable change in the surroundings of the castle, surrounded as it is by modern development, and would result in only a negligible magnitude of change; the key visual links from the castle, especially that over Thurso Bay to the northeast, would be unaffected.

7.4.40 Overall, it is assessed that, as a result of the change in its surroundings, the proposed development would result in an impact of minor significance on the setting of Scabster Castle; not significant in EIA terms. The effect would not appreciably diminish the cultural significance of the monument or its amenity value as relict of the historic occupation of the landscape and it will remain possible to understand and appreciate the remains of Scrabster Castle and its setting. Its contribution to the local landscape character would be retained.

HOLBORN HEAD, FORT, SCRABSTER (SM559) FIGURE 7.11

7.4.41 The low relief earthwork remains of this promontory fort lie at the northeastern tip of Holborn Head at the northwest side of Thurso Bay. Reputedly the site of a Viking army occupation in the early 11th century, the fort occupies a defensible position commanding extensive views of the coastline and Thurso Bay. The fort is a Scheduled Monument, of national importance and high sensitivity.

7.4.42 The ZTV (Figure 7.2) and the wireline provided from the fort (Figure 7.11) show that there is no visibility of the proposed development from the headland, which lies 4.8 km from the nearest turbine (T8). However, LVIA VP 7, taken from the sea approach to Scrabster Harbour, shows that from the sea off the headland the proposed development would be visible beyond the skyline and behind the site of the fort, which lies on the headland at the left of the photomontage. From the viewpoint, the photomontage shows eight turbine tips (six hubs) visible; these being offset from the view of the fort at this point on the approach. No remains of the fort are visible in this view and so the proposed development would not be seen to be dominant in relationship to the scale of the fort. In the views of the fort from the sea, the proposed development would have a low magnitude impact on the fort's setting, being visible directly behind views of the fort for only a short section of the approach to Scrabster harbour, off Holborn Head. From the landward approach to the fort, the proposed development would have no impact on its setting.

7.4.43 Overall, it is assessed that, as a result of the change in its surroundings, the proposed development would result in an impact of minor significance on the setting of Holborn Head, fort; not significant in EIA terms, and the effect would not appreciably diminish the cultural significance of the monument or its amenity value as part of the historic landscape and it will remain possible to understand and appreciate the remains of the fort and its setting. Its contribution to the local landscape character would be retained.

HILL OF SHEBSTER CHAMBERED CAIRN (SM476) FIGURE 7.12

7.4.44 The remains of this cairn lie in a hilltop location on the north facing summit of Hill of Shebster. From the cairn, there are open aspect views to the northwest and to the sea. Slightly rising ground to the southeast of the cairn limits views in that direction, which is the direction of the proposed development; although Hill of Lieurary can be seen as a prominent feature beyond the near horizon of Hill of Shebster. Baillie Wind Farm lies close by to the east (910 m to the nearest turbine) and is a prominent feature of the local landscape, and the Dounreay Nuclear facility lies on the coast to the north. The chambered cairn is a Scheduled Monument, of national importance and high sensitivity.

7.4.45 Figure 7.12 shows that eight turbine tips and hubs would be visible from the cairn; the closest turbine (T1) being 5.5 km away and seen beyond Baillie Wind Farm. The proposed development infrastructure (tracks, buildings, compounds, etc.) would be screened from view from the cairn, and the cairn's setting is dominated by the turbines at Baillie. The proposed development would not adversely affect the cairn's rural moorland/rough pasture setting on Shebster Hill and the view to the coastline to the north would be unaffected. The proposed development would not affect the ability of any visitor to appreciate and understand the landscape context of the siting of the cairn.

7.4.46 The introduction of the proposed development would result in a barely noticeable change in the surroundings of the chambered cairn and would result in only a negligible magnitude of change. It is therefore assessed that the proposed development would result in an impact of minor significance on the setting of Hill of Shebster chambered cairn; not significant in EIA terms, and the effect would not appreciably diminish the cultural significance of the monument or its amenity value as a relic of the historic occupation of the landscape. It will remain possible to understand and appreciate the cairn and its setting. Its contribution to the local landscape character would be retained.

GREEN TULLOCHS, BROCH AND CAIRN 640 M NNW OF BORROWSTONE MAINS (SM554) FIGURE 7.13

7.4.47 These two monuments are prominent grassy mounds that stand on the low cliffs overlooking and visible from the coastal waters of the North Atlantic/Pentland Firth. They are set low down on the cliff edge and are not prominent features of the local landscape; being best appreciated at close quarters. They are not obviously visible from the A836 road, but they can be seen from places further afield, such as Cnoc Freiceadean to the south. Forss Wind Farm and the Forss Business and Technology Park lie directly to the east of the broch and cairn and dominate their setting. The broch is a Scheduled Monument, of national importance and high sensitivity.

7.4.48 Figure 7.13 shows that eight turbine tips (seven hubs) would be visible from the broch and cairn; the closest turbine (T2) being 4.5 km away. However, the proposed development infrastructure (tracks, buildings, compounds, etc.) would be screened from view from the Castle remains, beyond the rising intervening ground and Forss Wind Farm and the Business and Technology Park are prominent features in their immediate surroundings, 400 m to the southeast. The proposed development would not adversely affect the coastal outlook from the broch and cairn, and it would not detract from the ability of any visitor to appreciate and understand the landscape context of the siting of these two monuments.

7.4.49 The introduction of the proposed development would result in a barely noticeable change in the surroundings of the broch and cairn and would result in only a negligible magnitude of change; the key visual links from the monuments, especially those over the seascape to the north, would be unaffected.

7.4.50 Overall, it is assessed that, as a result of the change in its surroundings, the proposed development would result in an impact of minor significance on the setting of Green Tullochs broch and cairn; not significant in EIA terms, and the effect would not appreciably diminish the cultural significance of the monument or its amenity value as a relic of the prehistoric occupation of the landscape and it will remain possible to understand and appreciate the broch and cairn and their setting. Their contribution to the local landscape character would be retained.

CROSSKIRK, ST MARYS CHAPEL AND BROCH S OF CHAPEL POOL (SM90086) LVIA VP 4

7.4.51 The remains of this 12th century Chapel stand in rough grassland on the cliff top at Crosskirk Bay overlooking and visible from the coastal waters of the North Atlantic and Pentland Firth. It is probable that this location was deliberately chosen so that the Chapel was visible from the sea, perhaps as a symbol of spiritual comfort to seafarers. The broch, which was an earlier settlement on the headland and which formerly lay close to the Chapel, was destroyed following excavation in 1972 and no trace of either it or of the small settlement that was also discovered to the east of the broch is now visible. The Chapel remains stand within an enclosed churchyard and are surrounded by a cemetery that is still occasionally used. The Chapel is a Scheduled Monument and Guardianship Monument (Property in Care) and is a visitor attraction, signposted and provided with a visitor display panel.

7.4.52 LVIA VP 4 shows that the proposed development would be visible from the Chapel; the closest turbine (T2) being 3.6 km away. However, the proposed development infrastructure (tracks, buildings, compounds, etc.) would be screened from view, beyond the rising intervening ground and Forss Wind Farm and the Business and Technology Park are prominent features in the immediate surroundings, directly to the southwest of, and 200 m from, the Chapel. The proposed development would not adversely affect the coastal outlook from the Chapel and the proposed development would not detract from the ability for any visitor to appreciate and understand the landscape context of the siting of the Chapel and the broch.

7.4.53 The introduction of the proposed development would result in a noticeable change in the surroundings of the Chapel, particularly in the view to the southeast., and would result in a low magnitude of change to its current setting. The key visual links from the Chapel, to and from the sea, and its relationship with its coastal farmland surroundings would be unaffected.

7.4.54 Overall, it is assessed that, as a result of the change in its surroundings, the proposed development would result in an impact of minor significance on the setting of Crosskirk, St Marys Chapel and broch; not significant in EIA terms, and the effect would not appreciably diminish the cultural significance of the monument or its amenity value as a relic of the historic occupation of the landscape and it will remain possible to understand and appreciate the Chapel and its setting. Its contribution to the local landscape character would be retained.

Potential Decommissioning Effects

7.4.55 Any ground-breaking activities, or other activities, such as vehicle movements, soil and overburden storage and landscaping, associated with the decommissioning of the proposed development have the potential to cause direct, permanent and irreversible effects on the cultural heritage assets within the site. The likelihood of direct effects is similar to or less than that expected during construction, presuming that the built infrastructure is used to facilitate decommissioning and removal of the components of the proposed development from the site.

7.4.56 There are no assets within the Inner Study Area likely to receive a direct effect arising from decommissioning of the proposed development. This is due to the approach adopted in formulating the design and layout of the proposed development, i.e. avoidance, and because decommissioning works on site would be managed to recognise the presence of heritage assets and to avoid them.

Potential Cumulative Effects

7.4.57 The proposed development could, in combination with other wind farm developments in the area that are operational, consented but not yet built, or are the subject of valid planning applications, result in adverse cumulative effects on the setting of cultural heritage assets.

7.4.58 Based on the list of cumulative developments agreed with THC (Chapter 4: Landscape and Visual Amenity), those other developments most likely to give rise to cumulative effects in combination with the proposed development on heritage assets are:

- Baillie Wind Farm (21 turbines, 115 m to tip) – operational and part of the baseline
- Forss Wind Farm 1 (two turbines 76 m to tip) – operational and part of the baseline
- Forss Wind Farm 2 (four turbines 78 m to tip) – operational and part of the baseline
- Limekiln (21 turbines (six at 126 m to tip and 15 at 139 m to tip) as varied in October 2017) – consented 21 June 2019
- Limekiln Extension (5 turbines, 149.9 m to tip) – Application
- Drum Hollistan 2 (7 turbines, 125 m to tip) – Application
- Lybster Road Forss (single turbine 79m to tip) – consented (in combination with Forss Wind Farm (1 and 2)
- Hill of Lybster (single turbine 99.5 m to tip) – consented (in combination with Forss Wind Farm (1 and 2)

7.4.59 Figure 7.3 shows the proposed development, along with the locations of other operational/under construction and consented wind farms, and those at the application/appeal stage, together with those cultural heritage assets within the Outer Study Area (within the proposed development ZTV and considered in the assessment).

7.4.60 Three of the cumulative schemes shown on Figure 7.3 (Baillie, Forss I and Forss II) are operational while three others (Limekiln, Hill of Lybster and Lybster Road Forss) are consented developments. Limekiln Extension and Drum Hollistan 2 are at the application stage. Both Lybster Road Forss and Hill of Lybster are single turbine developments.

7.4.61 Based on professional judgement, those schemes most likely, in combination with the proposed development, to have a cumulative effect on heritage assets are the larger schemes; in particular, Baillie and Limekiln (together with the proposed Limekiln Extension). An additional cumulative impact would arise from Forss I and II in combination with the two single turbines at Lybster Road Forss and Hill of Lybster.

7.4.62 Cumulative wireline visualisations are provided to inform the assessment of impacts on the settings of heritage assets (Figures 7.4 to 7.13). These show the predicted theoretical visibility, assuming the absence of any screening provided by woodland or commercial forestry, of other wind farms in the wider landscape in combination with the proposed development. The windfarms shown on the wirelines include all of those agreed by consultees where they would be theoretically visible. One of the LVIA viewpoints (VP 4) shows cumulative impacts from Crosskirk Chapel (SM90086).

7.4.63 Figure 7.3 shows that cumulative impacts from the proposed development in combination with the wind farms listed above are most likely to affect heritage assets to the west and southwest of the proposed development.

7.4.64 A group of scheduled monuments and listed buildings around Reay and Sandside Bay, to the west of the proposed development, would have visibility at varying distances of the operational developments at Baillie Wind Farm and Forss I and II (in combination with the Lybster Road Forss and Hill of Lybster single turbines) and the consented Limekiln Application (see Figure 7.3). The proposed Limekiln Extension and Drum Hollistan 2 would also be visible from these assets (e.g. Figures 7.6 and 7.12). From these assets, the proposed development would be seen cumulatively beyond and in the same context as the operational Baillie Wind Farm, with the group at Forss also visible but visually distinct and separate. Limekiln and Limekiln Extension would be seen, as a separate group of turbines, to the southwest, and Drum Hollistan 2 would be seen to the west, in the same context as Strathy North. The cumulative impact of the proposed development in combination with all of these other developments would be of low magnitude and **minor** significance; **not significant** in EIA terms, and the effect would not appreciably diminish the cultural significance of the monuments or their amenity value. It will remain possible to understand and appreciate these assets, and their settings, and their contribution to the local landscape character would be retained.

7.4.65 A group of scheduled monuments around Broubster, to the southwest of the proposed development would have visibility at varying distances of the operational developments at Baillie Wind Farm and Forss I and II (in combination with the Lybster Road Forss and Hill of Lybster single turbines) and with the consented Limekiln and the proposed Limekiln Extension development (see Figure 7.3). From these assets, the proposed development would be seen cumulatively beyond and offset from the operational Baillie Wind Farm with the group at Forss also theoretically visible beyond and through Baillie Wind Farm. The consented Limekiln scheme (as amended) and the proposed Limekiln Extension developments would be visible to the northwest as a separate group of turbines (Figure 7.3). The cumulative impact of the proposed development in combination with these other developments would be of low magnitude and **minor** significance; **not significant** in EIA terms, and the effect would not appreciably diminish the cultural significance of the monuments or their amenity value and it will remain possible to understand and appreciate these assets, and their settings, and their contribution to the local landscape character would be retained.

7.4.66 For the two scheduled monuments identified as having significant effects as a result of the introduction of the proposed development (Thing's Va broch, 1000m E of Blackheath, Scrabster (SM587) (Figure 7.4) and Scrabster Mains broch 1000m W of (SM579)) (Figure 7.5) no cumulative impact is predicted as a result of the proposed development in combination with other developments. From Thing's Va, the consented Limekiln scheme (together with the proposed Limekiln Extension) would be barely (if at all) visible, more than 10 km distant and beyond the operational Baillie Wind Farm. Forss I and II, together with Lybster Road Forss and Hill of Lybster single turbines would not be visible from Thing's Va. From Scrabster Mains broch (Figure 7.5), none of the cumulative schemes to the west would be visible in combination with the proposed development and those to the east would, with the exception of the Weydale Farm single turbine, be more than 15 km distant. It will remain possible to understand and appreciate both Thing's Va broch and Scrabster Mains broch, and their settings, and their contribution to the local landscape character would be retained. Overall, there would be no additional adverse effect in combination with the other cumulative developments considered in the assessment.

7.4.67 Overall, the cumulative effect of the addition of the proposed development to a baseline including other operational, consented or proposed wind farm developments would be **not significant** in EIA terms.

7.5 Mitigation

7.5.1 Planning Advice Note 1/2013: Environmental Impact Assessment (PAN1/2013) describes mitigation as a hierarchy of measures: prevention, reduction, compensatory (offset) measures. Prevention and reduction measures can be achieved through design, whilst compensatory measures offset effects that have not been prevented or reduced.

7.5.2 The emphasis in Planning Advice Note (PAN) 2/2011: Planning and Archaeology (PAN2) is for the preservation of important remains in situ where practicable and by record where preservation is not possible. The mitigation measures presented below therefore take into account this planning guidance and provide various options for protection or recording and ensuring that, where practical, surviving assets are preserved intact to retain the present historic elements of the landscape.

7.5.3 Historic Environment Policy for Scotland 2019 (HEPS) also contains policies (notably HEP2 and HEP4) that are relevant for conservation and preservation of the historic environment. HEP requires that decisions affecting the historic environment should ensure that its understanding and enjoyment as well as its benefits are secured for present and future generations. HEP 4 requires that changes to specific assets and their context should be managed in a way that protects the historic environment. Opportunities for enhancement should be identified where appropriate. If detrimental impact on the historic environment is unavoidable, it should be minimised. Steps should be taken to demonstrate that alternatives have been explored, and mitigation measures should be put in place

7.5.4 All mitigation works presented in the following paragraphs take note of the advice in PAN2 and HEPS. The mitigation proposed would take place prior to, or, where appropriate, during, the construction of the proposed development. All works would be conducted by a professional archaeological organisation, and the scope of works would be detailed in one or more Written Scheme(s) of Investigation (WSI) developed in consultation with (and subject to the agreement of) HET, acting on behalf of THC.

Mitigation during Construction

Preservation in Situ

7.5.5 Most of the known heritage assets within the site (Figure 7.1) have been avoided. The main access track from the A836 would pass alongside a former mill lade (**6**) of local heritage importance and low sensitivity but would not directly affect it. The main access track would also pass by a possible building platform (**18**) of little or no heritage importance and negligible sensitivity but would not directly affect it. There is no requirement for any measures to ensure preservation in situ in respect of either of these assets.

7.5.6 The remains of a possible building or turf cutting (**36**) of little heritage importance and negligible sensitivity lie close to the proposed hardstanding for turbine T7 and construction works for the hardstanding could directly affect the asset. No mitigation is recommended in respect of this impact.

7.5.7 The surviving remains of a former small croft (**1**) would be marked out, using high visibility marker posts that would be retained for the duration of the construction works phase. Markers placed 5 m from the outermost edge of the surviving remains of the enclosure would ensure that these remains are avoided and preserved in situ.

7.5.8 There are no requirements for any measures to ensure preservation in situ of any of the other identified heritage assets within the site.

Watching Brief(s)

7.5.9 If required under the terms of a planning condition, the scope of any required archaeological watching brief(s) would be agreed through consultation with HET in advance of development works commencing and would be set out in the Written Scheme of Investigation (WSI).

7.5.10 Taking account of the avoidance through the design and the identified cultural heritage baseline, it is assessed that there are no particularly sensitive areas within the Inner Study Area where watching briefs would be expected to encounter any archaeological remains.

Post-excavation

7.5.11 If significant discoveries are made during archaeological monitoring, and it is not possible to preserve the discovered remains in situ, provision would be made for the excavation where necessary, of any archaeological deposits encountered. The provision would include the consequent production of written reports, on the findings, with post-excavation analysis and publication of the results of the works, where appropriate.

Construction Guidelines

7.5.12 Written guidelines would be issued for use by all construction contractors, outlining the need to avoid causing unnecessary damage to known heritage assets. The guidelines would set out arrangements for calling upon retained professional support in the event that buried archaeological remains of potential archaeological interest (such as building remains, human remains, artefacts, etc.) should be discovered in areas not subject to archaeological monitoring.

7.5.13 The guidelines would make clear the legal responsibilities placed upon those who disturb artefacts or human remains.

Heritage Enhancement

7.5.14 The old sheepfold (**8**) close to the proposed temporary construction compound near turbine T4 will be restored using traditional drystone wall techniques and reused to provide a viewpoint and information point. Information panels will be provided offering general information on the cultural heritage of the local area and pointing out specific cultural heritage features that may be of interest to tourists and walkers, who may wish to further acquaint themselves with the wider cultural heritage of Caithness. Sites that could be promoted might include:

- Crosskirk, St Marys Chapel and broch S of Chapel Pool (SM90086), a scheduled monument and Property in Care;
- Cnoc Freiceadain, long cairns (SM90078), a scheduled monument and Property in Care;
- Thurso, St Peter's Church and Burial Ground (SM618);
- Reay, burial ground, old church and cross slab 175 m E of Parish Church (SM615) and Reay parish Church (LB14992);
- Holborn Head, fort, Scrabster (SM559);

- Loch Calder (remains of long cairn, chambered cairns and prehistoric settlement in lochside setting);
- Further afield (Castle of Mey; Mey Battery, Battery 80 m NE of Braes of Harrow; St John's Point, Fort & Site of St John's Chapel; Camster Cairns; Loch of Yarrows; etc).

7.5.15 In addition to promoting the local cultural heritage, the site entrance bell-mouth will be dressed with traditional Caithness flagstone walling, where traditional stoneworkers and craftspeople will be encouraged to create a series of stone carving artwork panels portraying aspects of the local cultural heritage. Stone for this work could be taken from the former quarry at Hopefield (**25**), thereby re-using a traditionally exploited source of Caithness flagstone.

Mitigation during Operation

7.5.16 Mitigation measures to ensure the preservation in situ of any heritage assets in close proximity to the as built layout of the wind farm will be adopted for any future works required during the operational phase (maintenance/replacement works) to ensure that no damage occurs to any heritage assets. The mitigation will include marking out heritage assets within 30 m of any access track or crane hardstanding, using high visibility marker posts that would be retained for the duration of any replacement works.

7.5.17 The layout of the proposed development has been designed to avoid or reduce as far as possible adverse effects on the settings of heritage assets, by retaining a stand-off from important heritage assets such as Thing’s Va broch and using the topography to provide a degree of visual screening of the on-site infrastructure.

Mitigation during Decommissioning

7.5.18 Mitigation measures to ensure the preservation in situ of any heritage assets in close proximity to the as built layout of the proposed development will be adopted during any future decommissioning works to ensure that no damage occurs to any heritage assets. The mitigation will include marking out heritage assets within 30 m of any access track or crane hardstanding, using high visibility marker posts that would be retained for the duration of the decommissioning works.

7.6 Assessment of Residual Effects

Residual Construction Effects

7.6.1 Taking account of the mitigation proposals set out above, the following residual construction effects have been identified:

- Former small croft (1), which survives as grass-covered footings and which is an asset of local heritage importance and of low sensitivity would be avoided and preserved in situ. The residual effect on the building would be **negligible** and **not significant**.
- The former Mill Lade (**6**), which survives as a linear ditch (ca 0.7 m wide and ca 0.5 m deep) and which is an asset of local heritage importance and of low sensitivity would be avoided and preserved in situ. The residual effect on the lade would be **negligible** and **not significant**.
- A sub-rectangular grassy platform (**18**), of no heritage importance and negligible sensitivity, may be affected by track widening work. No mitigation is required in relation to this feature and the residual effect would be **minor** and **not significant**.

- The remains of a possible building or turf cutting (**36**), of little heritage importance and of negligible sensitivity, may be affected by construction of the hard standing for T7. No mitigation is required in relation to this feature and the residual effect would be **minor** and **not significant**.
- Any adverse effects on buried archaeological remains that may be encountered during the construction of the proposed development would be offset through a programme of investigation and recording approved by THC and implemented under the terms of a WSI submitted to and approved by THC in response to any applied planning condition. The residual effect on the potential buried archaeological remains would be **negligible** and **not significant**.

Residual Operational Effects

7.6.2 Taking the recommended mitigation into account, there would be no significant residual direct effects on any of the cultural heritage assets within the site.

7.6.3 The residual effect of the proposed development on the settings of designated heritage assets would be the same as the predicted operational effects described above. These effects would be removed following decommissioning.

Residual Decommissioning Effects

7.6.4 Taking the recommended mitigation into account, there would be no residual decommissioning effects on cultural heritage.

Residual Cumulative Effects

7.6.5 The assessment of potential cumulative effects has not identified any significant cumulative impact from the proposed development in combination with any other development that is either operational, consented or in planning. The residual effect of the addition of the proposed development to a baseline including other operational, consented or proposed wind farm developments would therefore be of no more than **low magnitude** and **minor significance**; **not significant** in EIA terms.

7.7 Summary

7.7.1 A desk-based assessment and walk-over field survey have been carried out to establish the archaeology and cultural heritage baseline within the site. The assessment has been informed by consultation with Historic Environment Scotland and The Highland Council.

7.7.2 Fifty-six heritage assets were identified within the Inner Study Area. The majority of these assets are related to post-medieval, pre-improvement period agricultural use of the landscape and include former crofts and farmsteads and other associated buildings and structures. There are also some probable prehistoric remains present within the site including a possible Bronze Age burial cairn assessed as being of regional importance and medium sensitivity. Seventeen of the assets identified are of low sensitivity and 36 are assessed as being of negligible sensitivity. Two of the recorded sites (which are both erroneously recorded locations for assets identified by Mercer that have been shown by field survey to lie at different locations) are assessed as being on no sensitivity.

7.7.3 An assessment of the known cultural heritage resource within and in the immediate vicinity of the Inner Study Area, and the current and past land-use, indicates that there is a moderate probability of hitherto unidentified archaeological remains being present within the site; especially for remains of prehistoric date.

7.7.4 The layout of the proposed development has been designed to avoid direct effects on the identified heritage assets within the site and to minimise the effect of the proposed development on the settings of designated heritage assets in the wider landscape (Outer Study Area).

7.7.5 Five heritage assets have been identified that could be affected by construction of the proposed development, but in each case the predicted effect would be minor and not significant. The potential for significant direct effects on buried archaeological remains is considered to be low. Mitigation is proposed that would avoid potential direct effects on three heritage assets that lie in close proximity to the proposed development infrastructure.

7.7.6 Moderately significant effects on the settings of two scheduled monuments are predicted. These predicted effects would arise as a result of the presence of the proposed development in the landscape surroundings of two brochs (Thing's Va broch (SM587) and Scrabster Mains broch (SM579)). The introduction of the proposed development would not however result in a change that would be so significant as to reduce the cultural significance or amenity value of the assets or to detract from the ability for any visitor to appreciate and understand the assets or their settings.

7.7.7 No significant cumulative impacts upon the settings of any designated cultural heritage assets are predicted.

Table 7.5: Summary of Potential Significant Effects of the Proposed Development

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Construction			
Potential impact on assets in close proximity to working areas (**1**, 6, 8, 18 and 36)	Marking out of former small croft (1) using high visibility markers to ensure that the remains are avoided and preserved in situ. Sheepfold (**8**) will be retained and restored for use as an information point There are no requirements for any measures to ensure preservation in situ of any of the other identified heritage assets.	Planning condition; CEMP	Not significant
Potential impact on any buried archaeological remains.	Watching brief if required in sensitive areas; at the discretion of THC.	Planning condition; CEMP	Not significant
Operation			
Potential impact on assets in close proximity to infrastructure (**1**, 6, 8, 18 and 36)	Marking out of former small croft (1) using high visibility markers to ensure that the remains are avoided and preserved in situ. Sheepfold (**8**) will be retained and restored for use as an information point There are no requirements for any measures to ensure	CEMP	Not significant

Table 7.5: Summary of Potential Significant Effects of the Proposed Development			
Likely Significant Effect	**Mitigation Proposed**	**Means of Implementation**	**Outcome/Residual Effect**
	preservation in situ of any of the other identified heritage assets.		
Impact on the setting of Thing's Va broch, 1000 m E of Blackheath, Scrabster (SM587)	None proposed	Not applicable	Significant
Impact on the setting of Scrabster Mains broch 1000 m W of (SM579)	None proposed	Not applicable	Significant
Decommissioning			
Potential impact on assets in close proximity to infrastructure (**1**, 6, 8, 18 and 36)	Marking out of former small croft (1) using high visibility markers to ensure that the remains are avoided and preserved in situ. Sheepfold (**8**) will be retained and restored for use as an information point There are no requirements for any measures to ensure preservation in situ of any of the other identified heritage assets.	Planning condition; CEMP	Not significant

7.8 Glossary and Abbreviations

Glossary

Term	Definition
Broch	An Iron Age round defended house, found mainly in the north and west of Scotland. Brochs have a tapering profile and thick, usually hollow dry-stone walls which contain galleries, cells and a stairway, with guard cells at the entrance.
Burnt Mound	A mound of fire-cracked stone, often set beside a stream and including a trough or pit which may have been lined with clay, wood or stone. Assumed to be a location where heated stones were used to boil water for cooking purposes.
Chambered Cairn	A Neolithic burial monument comprising a stone-built chamber within a mound of stones.
Cist	Generally rectangular structure normally used for burial purposes; formed from stone slabs set on edge and covered by one or more horizontal slabs or capstones. Cists may be built on the surface or sunk into the ground.
Croft	A small farm or holding.
Long cairn	A rectangular or trapezoidal non-megalithic stony mound of Neolithic date, with human remains in cists rather than a large chamber. Mound construction and associated features vary considerably in type and complexity.
Marker Cairn	A cairn of no great antiquity, erected to mark a particular spot in the landscape, often used as a marker or directional aid in upland areas.
Mill Lade	An artificial channel carrying water from a stream or river to a water mill.
Promontory fort	A defensive enclosure created by constructing one or more lines of ramparts across a neck of land, in order to defend, or restrict access to, a spur or

Term	Definition
	promontory, either inland or on the coast. Use for prehistoric and early historic sites.
Property in Care (PiC)	Properties in Care (PiCs) form a portfolio of sites cared for and managed by Historic Environment Scotland on behalf of Scottish Ministers. The PiCs are legally defined and protected, and they are accessible to the public.
Rig and Furrow	A series of ridges (rigs), separated by furrows, created by ploughing.

Abbreviations

Abbreviation	Expanded Term
CIfA	Chartered Institute for Archaeologists
EIA	Environmental Impact Assessment
GIS	Geographical Information Systems
GPS	Global Positioning System
HER	Highland Council Historic Environment Record
HES	Historic Environment Scotland
HET	Highland Council Historic Environment Team
HLAMap	Historic Land-Use Assessment Data for Scotland
HwLDP	Highland-wide Local Development Plan
NHRE	National Record of the Historic Environment
SNH	Scottish Natural Heritage
SPAD	Scottish Palaeoecological Archive Database
THC	Highland Council
WSI	Written Scheme of Investigation
ZTV	Zone of Theoretical Visibility

7.9 List of Figures and Technical Appendices

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8 Traffic and Transport

8.1 Introduction

8.1.1 This Chapter assesses transport and traffic impacts and effects resulting from the construction, operation and decommissioning of the proposed Cairnmore Hill Wind Farm as described in Chapter 2 of this ES ('the proposed development'). This Chapter primarily focuses on the traffic impact associated with the construction phase of the proposed development as it will generate the highest volume of traffic and therefore result in the greatest impact. The operational and decommissioning phases of the proposed development are also considered; however, the traffic impact during these phases would be limited in comparison to the construction phase.

8.1.2 The proposed development comprises eight wind turbines and associated infrastructure including a series of on-site access tracks, turning points and a temporary construction compound. The proposed development site ('the site') is located approximately 4.5 km northwest of Thurso, situated within the administrative boundary of the Highland Council ('THC'). Access to the site is proposed via a new priority junction with the A836 at a location approximately 5 km west of the A9 trunk road ('T'). A full description of the proposed development is included in Chapter 2: Development Description.

8.1.3 The traffic and transport receptors have been identified within a defined assessment area (the 'Study Area') which have the potential to be adversely or positively impacted by the construction, operation and decommissioning of the proposed development. These receptors have been assessed based on their determined sensitivity and the anticipated magnitude of change of traffic flows as a result of the proposed development. This chapter also identifies and details the various mitigation measures that will be implemented to prevent, reduce or offset potential adverse impacts or enhance potential beneficial effects; where possible.

8.1.4 The objectives of this Chapter are as follows:

- Outline the scope of the traffic impact assessment;
- Describe the overarching methodology and significance criteria used in the assessment;
- Identify relevant policies and guidance for consideration;
- Describe the baseline characteristics of the surrounding area;
- Describe the anticipated construction, operational and decommissioning characteristics of the Proposal and their likely effects;
- Describe the mitigation measures proposed to address any likely significant effects; and
- Assess any remaining residual effects.

8.1.5 This transport and traffic assessment has been carried out by AECOM and is supported by the following:

- Technical Appendix 8.1: Abnormal Indivisible Loads (AIL) Route Assessment;
- Technical Appendix 8.2: Anticipated Proposed Construction Traffic by Month;
- Figure 8.1: Study Area;
- Figure 8.2: Traffic Counter Locations;
- Figure 8.3: Accident Statistics and Locations; and

- Tables 8.1 – 8.12.

8.1.6 Figures and technical appendices are referenced in the text where relevant.

8.2 Assessment Methodology and Significance Criteria

National, Regional and Local Transport Planning Policy

Scottish Planning Policy

8.2.1 Scottish Planning Policy (SPP)[1] produced in 2014 sets out Scottish Ministers' priorities in terms of development planning and other important matters.

8.2.2 It is proposed that all major wind turbine components (i.e. Blades, Tower Sections and Nacelle) associated with the proposed development would be transported by sea arriving at Scrabster Harbour, approximately 4.5 km northeast of the site.

8.2.3 Paragraph 290 of SPP (2014) states that:

"Development proposals that have the potential to affect the performance of safety of the strategic transport network need to be fully assessed to determine their impact. Where existing infrastructure has the capacity to accommodate a development without adverse impacts on safety or unacceptable impacts on operational performance, further investment in the network is not likely to be required. Where such investment is required, the cost of the mitigation measures required to ensure the continued safe and effective operation of the network will have to be met by the developer".

8.2.4 Technical Appendix 8.1 includes an assessment of abnormal indivisible loads ('AIL') from Scrabster Harbour to the site identifying where mitigation would be necessary to facilitate access to the site.

8.2.5 Notwithstanding these transport specific aspects, policies concerning the delivery of renewable energy related developments are detailed within the 'A Low Carbon Place' section of SPP (2014). Paragraph 169 of this section identifies that proposed wind farm developments should consider a variety of multidisciplinary environmental aspects that are relative to the scale and location of the potential site. Amongst these considerations is the requirement to consider *"impacts on road traffic"* and *"impacts on adjacent trunk roads".* This Chapter assess the transport and traffic impacts on local and trunk roads within the Study Area.

PLANNING ADVICE NOTE 75 – PLANNING FOR TRANSPORT

8.2.6 SPP (2014) is supported by the document Planning Advice Note 75 (PAN 75) – Planning for Transport[2] produced by the Scottish Government in 2005.

PAN 75 (2005) states that:

"the early involvement of interested parties will positively inform transport planning by building consensus and minimising potential future areas of objection".

8.2.7 Engagement with THC and other stakeholders has been undertaken at an early stage by the Applicant through a scoping exercise. Relating to transport and traffic, cognisance will be taken of comments related by THC Transport Planning Team and Transport Scotland (TS) within this Chapter, where applicable.

[1] Scottish Government, Scottish Planning Policy, 2014

[2] Scottish Government, Planning Advice Note 75 – Planning for Transport, 2005

Regional and Local Transport Planning Policy

HIGHLAND WIDE LOCAL DEVELOPMENT PLAN

8.2.8 The Highland-wide Local Development Plan (HwLDP)[3], which was adopted by THC in 2012, provides an overview of the spatial planning policy for the local authority region.

8.2.9 Policy 36 states that:

"renewable energy development proposals will be assessed against the renewable Energy Policies, the non-statutory Highland Renewable Energy Strategy and where appropriate, Onshore Wind Energy: Supplementary Guidance".

8.2.10 In relation to transport, Policy 57 states that:

"Development proposals that involve travel generation must include sufficient information with the application to enable the Council to consider any likely on- and off-site transport implications of the Development".

8.2.11 Policy 67 states that THC will have regard to "*proposals able to demonstrate significant benefits including by making effective use of existing and proposed infrastructure facilities*".

8.2.12 This Chapter takes cognisance of the HwLDP by quantifying and assessing the anticipated impacts of the proposed development related traffic on the local and trunk road network.

Assessment Guidance

Onshore Wind Energy Interim Supplementary Guidance

8.2.13 This Guidance identifies the planning approval process for wind farm developments. Chapter 11 of the Guidance document identifies the requirements for traffic and transportation considerations.

8.2.14 Paragraph 2.62 specifies that:

"any proposal for a wind energy development must demonstrate that the development including its associated infrastructure will not have a significant adverse effect individually or cumulatively (with other built, permitted or lodged wind energy proposals) on the public road network."

8.2.15 Paragraph 2.64 goes on to state that:

"Developers should consider measures to reduce the impact of construction traffic on the road network such as the use of on-site borrow pits and on-site concrete batching."

8.2.16 This Chapter assesses cumulative transport and traffic impacts. The chapter and Technical Appendix 8.1 also illustrate measures proposed by the Applicant to mitigate transport and traffic impacts.

Guidelines for Traffic Impact Assessment

8.2.17 The Institution of Highways and Transportation (IHT), now the Chartered IHT (CIHT), publication Guidelines for Traffic Impact Assessment 1994[4] recommends that traffic and transport effects should be assessed in accordance with the IEMA Guidelines (1993)[5].

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[3] The Highland Council, The Highland-wide Local Development Plan, 2012

[4] Institution of Highways & Transportation. Guidelines for Traffic Impact Assessment. 1994.

[5] Institute of Environmental Assessment. Guidelines for the Environmental Assessment of Road Traffic. 1993.

Guidelines for the Environmental Assessment of Road Traffic

8.2.18 The IEMA Guidelines (1993) recommends that the following rules be considered when assessing the increase in traffic flow, associated with a proposal, on highway links and when identifying the area of influence for assessment purposes:

- Rule 1: Include highway links where traffic flows would increase by more than 30% (or the number of Heavy Goods Vehicles (HGVs) would increase by more than 30%); and
- Rule 2: Include any specifically sensitive areas where traffic flows would increase by 10% or more.

8.2.19 The IEMA Guidelines (1993) acknowledge that day-to-day variations of traffic on a road can frequently be at least + or – 10%. At a basic level, it should therefore be assumed that projected changes in traffic of less than 10% create no discernible environmental impact. Absolute changes (number of vehicles) are equally relevant since percentages alone could be misleading.

8.2.20 It is considered that the 30% threshold from the IEMA Guidelines (1993) is the appropriate rule to apply when assessing the impact of the proposed development on the local and trunk road network. This rule has been used to determine the extent of the Study Area and to identify the road links within the Study Area where a full assessment of environmental effects may be warranted.

Scope of Assessment

8.2.21 This traffic, transport and access chapter of the ES includes the following steps to ensure that the effects on road users due to traffic associated with the construction, operation and decommissioning of the proposed development establish:

- An assessment of the existing baseline conditions based on Department for Transport (DfT) traffic data;
- An assessment of the surrounding road network to determine its suitability to accommodate the anticipated volume of construction traffic e.g. HGVs; and
- An assessment of the increase in traffic compared to baseline traffic flows for the opening year of construction for the roads included in the Study Area.

8.2.22 For the construction, operation and decommissioning phases of the proposed development it considers the following potential impacts as listed within the IEMA (1993) Guidelines:

- Severance (for motorists or pedestrians);
- Increased journey times for non-construction traffic;
- Pedestrian delay, intimidation, loss of amenity;
- Road accidents and safety; and
- Dust and dirt.

Consultation

8.2.23 Table 8.1 summarises the consultation responses received regarding traffic and transport as relates to the proposed development and provides information on where and/or how they have been addressed in this assessment. The following organisations made comment on the proposed development:

- The Highland Council ('THC'); and

- Transport Scotland ('TS').

8.2.24 Full details on the consultation responses can be reviewed in Technical Appendix 1.1: Consultation Register.

Table 8.1 – Consultation Summary

Consultee and Date	Summary of Consultation	Comment / Action Taken
The Highland Council (pre-application meeting – 8th June 2016)	The Traffic, Transport and Access chapter of the EIA should include: ▪ A list of the public roads affected by construction traffic and their baseline traffic flows; ▪ Detail the number of LGVs, HGVs and AILs that are expected; ▪ Assess the impact of construction traffic on the carriageway, road users and nearby communities; ▪ Provide swept path analysis of AILs at the problem areas; ▪ Assess the cumulative impact of other developments that are under construction and are committed; ▪ Provide mitigation measures; and ▪ Include a framework Construction Traffic Management Plan (CTMP).	▪ correspondence list of possible construction traffic routes was identified and agreed with THC. ▪ Anticipated Proposal Construction Traffic has been calculated and assigned to proposed routes (in terms of both LGV and HGV, disaggregated by month of construction programme). ▪ Assessment of the construction traffic on the roads, its users and nearby communities has been undertaken following IEMA and DMRB guidelines. ▪ Swept path analysis has been undertaken for turbine components, and specifically blades along the route from port to site (included in Technical Appendix 8.1). ▪ Cumulative effects of other wind farm developments have been considered and assessed. Details of selection criteria has been provided. ▪ Mitigation measures have been proposed and discussed where necessary within Chapter 8 of the ES. ▪ An outline of a Framework Construction Traffic Management Plan (CTMP) has been prepared and included within this chapter.
The Highland Council (Re-scoping)	THC informed of the intention to use a temporary southern access route using the U2144 at Viewfield to permit early enablement works and access to potential borrow pits.	Scoping letter issued by AECOM on the 6th March 2019. Agreement in Principle (subject to the route being assessed and appropriate mitigation being put in place where required) response received from THC on 19th March 2019. Subsequently the use of U2144 for site access from the south has been ruled out for use. Original Scoping agreement still applies.
Transport Scotland	Although not a statutory consultee a scoping letter was issued as traffic associated with the proposed development would route to and from the site via the trunk road network (A9 (T)).	AECOM issued a scoping letter to TS on 26th August 2016 – correspondence has been considered in this chapter where applicable.

Potential Effects Scoped Out

8.2.25 On the basis of the desktop and video survey work undertaken by AECOM, the professional judgement of AECOM, experience from other relevant projects and policy guidance/standards and considering scoping with THC Transport Planning Team, the following has been scoped out of this transport and traffic chapter:

- The effect of vehicles associated with the proposed development on the road network, in respect of traffic flows, both in isolation and cumulatively, is considered unlikely to be significant in terms of congestion. Therefore, full detailed junction capacity assessments have not been undertaken and thus no Transport Assessment / Traffic Impact Assessment has been prepared to support the proposed development.

Method of Baseline Characterisation

Extent of the Study Area

8.2.26 The Study Area for the assessment of transport and traffic impacts and effects extends from the site to include:

- A836 between the proposed site access junction and the A9 (T);
- A9 (T) north between the A836 and Scrabster Harbour; and
- A9 (T) south from the A836 junction to Thurso town centre.

8.2.27 The extent of the Study Area has been agreed with THC Transport Planning Team and is shown in Figure 8.1 Study Area. More detail on the characteristics of the Study Area is included in the Baseline Characterisation section of this Chapter.

Desk Study

8.2.28 The Study Area has been identified using Institute of Environmental Assessment (IEA) now the Institute of Environmental Management and Assessment (IEMA) Guidelines[6] considering the anticipated routing of vehicles associated with the proposed development. More detail on the IEMA Guidelines (1993) and anticipated vehicle routing is included in this Chapter.

Field Survey

8.2.29 AECOM completed a Study Area site visit in August 2016 which included a video survey of the anticipated route of construction vehicles, particularly AILs from Scrabster harbour to the site. In addition to the video survey a desktop survey of the Study Area has also been undertaken.

Criteria for Assessing the Sensitivity of Receptors

8.2.30 In the case of the proposed development the receptors of sensitivity are defined as roads, communities and businesses within the Study Area, detailed further in the following section. Table 8.2: Receptor Sensitivity details the criteria used to determine receptor sensitivity.

Table 8.2: Receptor Sensitivity[6]

Sensitivity	Description
Very High	Roads which have not been constructed for regular use by road traffic and are limited in width and capacity e.g. private access roads or recreational routes.
High	Roads that have limited width and have not been constructed to accommodate a high volume of traffic or frequent use by HGVs e.g. single-track rural roads. Roads with traffic control signals, width and loading restrictions and traffic calming measures that restrict the flow of traffic.
Medium	Local roads that are capable of accommodating regular use by HGVs e.g. A or B class roads. Roads which pass through urban areas that have some form of traffic management measures.
Low	Trunk roads or A class road links that can accommodate a significant volume of HGVs per hour. Roads with limited or no traffic management measures.
Negligible	Modern strategic links such as trunk roads that have sufficient capacity to accommodate an increase in traffic with little

[6] Institute of Environmental Management & Assessment, Guidelines for the Environmental Assessment of Road Traffic, 1993

Table 8.2: Receptor Sensitivity[6]	
Sensitivity	**Description**
	perceivable impact. Roads with no frontage developments or adjacent settlements.

Criteria for Assessing the Magnitude of Change

8.2.31 In terms of the magnitude of change, the IEMA Guidelines (1993) point to changes in traffic in excess of 30%, 60% and 90% as being representative of "slight", "moderate" and "substantial" impacts respectively. Table 8.3: Magnitude of Traffic Change reflects the IEMA Guidelines (1993) and has been used to quantify the magnitude of change associated with traffic associated with the proposed development. As indicated previously, the IEMA Guidelines (1993) relate to the operational impacts of development only. Application of the IEMA Guidelines (1993) to temporary construction traffic is therefore considered a robust and conservative approach.

Table 8.3: Magnitude of Change	
Magnitude	**Description**
High	Substantial or total loss of capability for movement along and across transport corridors, loss of access to key facilities, loss of safety and severe delays to road users. (+ 90% increase in traffic)
Medium	Moderate loss of capability for movement along and across transport corridors, some measurable loss of access to key facilities, loss of safety and severe delays to road users. (60 - 90% increase in traffic).
Low	Some measurable loss of capability for movement along and across transport corridors, some measurable loss of access to key facilities, loss of safety and some measurable increase in delays to road users. (30 – 60% increase in traffic)
Negligible	Very minor loss of capability for movement along and across transport corridors, very minor loss of access to key facilities, very minor loss of safety and increase in delays to road users. (10 – 30% increase in traffic)
No change	No loss or alteration of characteristics, features or elements. No observable impact in either direction. (0 – 10% increase in traffic)

8.2.32 Where the predicted increase in traffic volume (general traffic or HGV only) is lower than IEMA Guidance (1993) Rule 1 (30%), the significance of the effects can be stated to be Not Significant meaning that further detailed assessments are not warranted.

8.2.33 In order to determine the magnitude of change associated with traffic impacts, table 8.3: Magnitude of Change has been utilised in tandem with due professional judgement.

8.2.34 The magnitude of change is a function of the existing traffic volumes, the percentage increase and change due to a proposed development, the changes in type of traffic, and the temporal distribution of traffic (day of week, time of day). The determination of magnitude has been undertaken by reviewing the characteristics of the proposed development, establishing the parameters of roads within the Study Area that may be affected and quantifying impacts.

8.2.35 Consideration has been given to the composition of the traffic on the road network, under both existing and proposed conditions. For example; Light Goods vehicles (LGV's) have less impact on traffic and the road system than HGVs. Similarly, HGV's can have less impact than AIL vehicles, depending on the frequency of deliveries.

Criteria for Assessing Cumulative Effects

8.2.36 The cumulative assessment of traffic, transport and access effects only considers wind farms that are approved, approved but not yet under construction, submitted but pending decision or at appeal as only these schemes may be under construction concurrently with the proposed development and therefore have potential for significant cumulative construction effects. The timescale for delivery of proposals currently in scoping to successfully securing planning consent is considered to be of a duration by which it is unlikely that cumulative construction would occur. There is no potential for significant cumulative effects to occur from those wind farms which are operational due to the minimal vehicle trips attributed to the operational phase of a development.

8.2.37 Secondly, cumulative effects are only considered for wind farm proposals which meet the former criteria, and where they use any of the road network utilised by traffic associated with the construction, operation and decommissioning phases of the proposed development.

Criteria for Assessing Significance

Assessment of Significance

8.2.38 As per IEMA Guidance (1993) the magnitude is defined as the "level of change" and whether the effect is significant or not will largely depend on the number of people affected. With regards to significance the IEMA Guidelines (1993) state that:

"for many effects there are no simple rules or formulae which define the thresholds of significance and there is, therefore, a need for interpretation and judgement on the part of the assessor, backed-up by data or quantified information wherever possible. Such judgements will include the assessment of the numbers of people experiencing a change in environmental impact as well as the assessment of the damage to various natural resources."

8.2.39 As a guide to inform the assessment, but not as a substitute for professional judgement, criteria for determining the significance of traffic and transport related effects are set out in Table 8.4: Significance of Effects. This is based on combining the magnitude of the effect with the receptor sensitivity.

Table 8.4: Significance of Effects

Magnitude of Change	**Receptor Sensitivity**				
	Very High	High	Medium	Low	Negligible
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Minor	Negligible	Negligible	Negligible
No Change	Negligible	Negligible	Negligible	Negligible	Negligible

8.2.40 Significance is categorised as major, moderate, minor or negligible. Effects judged to be of major or moderate significance are considered to be Significant in accordance with the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011

('EIA Regulations (2011)'). Effects judged to be of minor or negligible significance are considered Not Significant.

Limitations and Assumptions

8.2.41 Large road networks provide the opportunity for route choice for vehicles using them, and consequently the impact of additional traffic on the road network can become diluted. In this instance in order to provide a robust assessment of the environmental impact of a proposed development in terms of traffic and transport, the methodology used would assume that 100% of the construction traffic predicted to be generated would be loaded onto each road link in turn. This methodology automatically applies in the case of the proposed development, as route choice for construction vehicles associated with the proposed development is limited to the A9(T) and A836 as noted previously in this chapter.

8.3 Baseline Conditions

Current Baseline

8.3.1 In order to determine the baseline characteristics of the Study Area the following sources have been utilised:

- Desktop review of the Study Area;
- Video survey of the road network between Scrabster Harbour and the site;
- Scotland's Census 2011;
- National Road Traffic Forecast '97 (NRTF) annual traffic growth factors;
- Publically available accidents statistics form www.crashmap.co.uk;
- Publically available traffic flow data from the Department for Transport (DfT) (www.dft.gov.uk/traffic-counts) for roads within the Study Area;
- Supplementary Automatic Traffic Count (ATC) survey carried out in March 2019 in order to inform the existing DfT data with Average and Percentile Speeds recorded; and
- Theoretical carrying capacities of road links as identified in the DMRB (2002).

Road Network

AIL Routing

8.3.2 It is anticipated that Queen Elizabeth pier at Scrabster Harbour will be used for the delivery of blades and the Jubilee Quay will be used for the delivery of the Nacelle and tower sections.

8.3.3 All options utilise the existing road network, firstly joining the A9 out of the harbour and connecting onto the A836 via the Pennylands Junction.

8.3.4 After travelling approximately 5.6 km along the A836 to Forss, the AILs will access and enter the site via a new construction access junction and internal site track(s).

A836

8.3.5 Within the Study Area (Figure 8.1), the A836 connects Scrabster to the site. The A836, although not a trunk road, provides a strategic connection for communities in the Highlands.

8.3.6 Within the vicinity of the site the A836 is a two-way single carriageway and is approximately 7 m wide and subject to the National Speed Limit. There are no footways or street lighting along this section of the A836 and the road has an undulating carriageway in keeping with the rural characteristics of the area. A number of residential and business holdings (farms) have direct frontage access or are accessed form the A836 via minor roads / tracks within the Study Area.

8.3.7 As the A836 passes through the boundary of Thurso town at Burnside, the characteristics of the road change. Footways are provided as is street lighting and the speed limit is 40 mph. the approximate carriageway width remains 7 m. Along this section of the A836 there are no direct frontage accesses to residential properties instead access via Upper Burnside Drive. There are however two direct frontage accesses at the A836 / A9 (T) junction for access to a former car garage which is now used for car parking and for access to the Weigh Inn Hotel. Within the Study Area, a bus stop is provided at the A836 for westbound travel only. This bus stop takes the form of a shelter with seating.

8.3.8 At the junction of the A836 / A9 (T) the A836 is subject to road name change to the A9 (T).

8.3.9 Businesses and residential properties which have frontage to or are accessed from the A836, within the Study Area, are considered to be ‘medium’ sensitivity receptors. The A836 within the Study Area is also considered to be a ‘medium’ sensitivity receptor.

8.3.10 During the video survey no traffic congestion was noted along the A836.

8.3.11 A836 forms a part of the North Coast 500 (NC500) route that runs 516 miles to and from Inverness, forming a loop around the northern Highlands. Specially commissioned traffic surveys conducted for this assessment as well as count data gathered by Transport Scotland (publically disseminated by the DfT) at their automated counter sites includes both local vehicle movements and longer distance using the NC 500.

A836 / A9 (T) Junction

8.3.12 At the priority junction of the A836 / A9 (T) localised improvements have been provided to facilitate turning movements associated with AIL vehicles. These improvements take the form of a hardstanding run-off area and a lay-by to facilitate a right turn movement from the A9 (T) north (Scrabster Harbour) to the A836 for westbound travel towards the site.

A9 (T)

8.3.13 The A9 (T) is a strategic trunk road and connects Scrabster Harbour to Perth via Inverness. Within the Study Area the A9 (T) links the site to Scrabster Harbour and Thurso town centre and is also a bus route. The Study Area video survey illustrates that localised peak period congestion is noted along the A9 (T) particularly within Thurso town centre.

8.3.14 The A9 (T) within the study area is a two-way single carriageway.

8.3.15 Within the village of Scrabster the A9 (T) is subject to a 30 mph speed limit, is approximately 7.5 m wide and is well lit. There are intermittent footways provided. A number of residential properties and businesses have direct frontage to the A9 (T) within Scrabster village. The population of Scrabster village is 191 individuals per Census (2011) data.

8.3.16 Scrabster Harbour is a strategic facility and caters for the renewable energy industries. The Harbour has previously facilitated AIL deliveries, more detail on the route to the site is included in Technical Appendix 8.1. Additionally, it is an established gateway to the North of Scotland, a recognised cruise port with a modern ferry terminal designed to handle both domestic and international traffic.

8.3.17 Heading south of Scrabster the A9 (T) is subject to a 40 mph speed limit and is approximately 7.5 m wide. A continuous footway is provided as is street lighting. A number of residential and business properties front or are accessed from the A9 (T) south of Scrabster.

8.3.18 Bus stops along the A9 (T) north take form of a bus shelter or bus flag poles.

8.3.19 The A9 (T) south (from A836 to Thurso town centre) is a two-way single carriageway (approximately 7.5 m wide) subject to a 30 mph speed limit. Footways and street lighting is provided as are bus shelters / bus flag poles.

8.3.20 A number of residential properties, businesses, recreational and leisure land uses front or are accessed from the A9 (T) south within the Study Area. The population of Thurso is 7,933 individuals (Census, 2011).

8.3.21 Within the Study Area a short section of the A9 (T) forms a part of National Cycle Route (NCR) 1. NCR 1 within Thurso is an on-road route with wayfinding.

8.3.22 Businesses and residential properties which have frontage to or are accessed from the A9 (T), within the Study Area, are considered to be 'low' sensitivity receptors due to current and historic volume of traffic that uses the A9 (T) each day. The A9 (T) is also considered to have a 'low' sensitivity.

Traffic Flows

8.3.23 Table 8.5: 2017 and 2019 Study Area Traffic Flows illustrates the most recent Average Annual Daily Flows (AADF) for roads within the Study Area based on the recently undertaken traffic surveys as well as AADF for roads within the Study Area based on publicly available traffic flow data. The traffic counter locations are presented in Figure 8.2: Counter Locations.

Table 8.5: 2017 and 2019 Study Area Traffic Flows

Counter Number / Location	Road	2017 DfT AADF two-way and 2019 Survey based AADF						
		Pedal Cycles	**Motorcycles**	**Cars/ Taxis**	**Buses/ Coaches**	**LGV's**	**HGV's**	**Total Two-way Motor Vehicles**
10934	A 836	6	39	1,908	94	345	65	2,451
20801	A9 (T)	15	9	2,644	25	367	92	3,137
40800	A9 (T)	9	6	2,452	72	503	146	3,179
40956	A9 (T)	48	90	11,600	132	1,706	266	13,794
Survey 1	A 836	1	2	720	10	1,290	91	2,111

8.3.24 As illustrated in Table 8.5 the DfT data shows AADF by vehicle type, as percentage of total vehicles, HGV traffic accounts for between 2% - 5%.

Accidents

8.3.25 Within the Study Area there have been 11 recorded road accidents between 2014 and 2018 (www.crashmap.com). The approximate location of recorded accidents is shown in Figure 8.3: Accident Statistics and Locations. Of the recorded accidents, 1 was reported as Fatal (involved 2 vehicles), 1 Serious (involved 2 vehicles) and all other accidents were reported as 'Slight'.

Future Baseline

8.3.26 As the most recent data available is from 2018 and 2019 it is necessary to factor this data to anticipated 2020 levels using the NRTF annual growth factors. Low Growth has been utilised as this represents the most robust test when considering the impact of the proposed development in respect of a percentage increase in traffic and lack of consistent observed growth. The NRTF Low Growth factor is 1.024 (for 2018 obtained data) and 1.008 (for the 2019 obtained data).

Table 8.6: 2020 Traffic Flows

Counter Number / Location	Road	2018 DfT AADF two-way and 2019 Survey-based AADF						
		Pedal Cycles	Motorcycles	Cars/Taxis	Buses/ Coaches	LGV's	HGV No. / HGVs as % of Total Traffic	Total Two-way Motor Vehicles
10934	A836	6	40	1954	96	353	67/3%	2510
20801	A9 (T)	15	9	2707	26	376	94/3%	3212
40800	A9 (T)	9	6	2511	74	515	150/5%	3255
40956	A9 (T)	48	92	11878	135	1747	272/2%	14125
Survey 1	A836	1	2	726	10	1300	92/4%	2130

Theoretical Road Carrying Capacity

8.3.27 The DMRB (2002) identifies the typical theoretical carrying capacity of roads based on their characteristics, under favourable road and traffic conditions. Within the DMRB (2002) the capacity is defined as the maximum sustainable flow of traffic passing in one hour.

8.3.28 Utilising the DMRB Volume 5, Section 1 (Part 3) (1997)[7] and Volume 15, Section 1 (Part 5) (2013)[8] it is considered that for the A9 (T) and A836 within the Study Area the theoretical traffic carrying capacity is 1,200 vehicles per hour in one direction or 2,400 vehicles per hour in both directions.

8.3.29 The traffic flows included in Table 8.6 demonstrate that the flows are in keeping with the theoretical carrying capacity of the road network and that it is noted that in terms of DMRB, road links within the Study Area have residual capacity. It is however recognised that capacities can vary depending on local conditions.

Summary of Sensitive Receptors

8.3.30 Based on a review of the Study Area characteristics, Table 8.7: Summary of Receptor Sensitivity has been created.

Table 8.7: Summary of Receptor Sensitivity

Receptor	Sensitivity	Justification
Private Residential dwellings with direct frontage to or accessed from the A836.	Medium	Current and historic volume of traffic that uses the A836 each day is less than that relative to the A9(T).
Businesses including farms	Medium	Current and historic volume of traffic

[7] Department for Transport, Design Manual for Roads and Bridges, Volume 5, Section 1, Part 3, 1997

[8] Department for transport, Design Manual for Roads and Bridges, Volume 15, Section 1, Part 5 (2013)

Table 8.7: Summary of Receptor Sensitivity		
Receptor	**Sensitivity**	**Justification**
with direct frontage to or accessed from the A836.		that uses the A836 each day is less than that relative to the A9(T).
Retail, businesses and residential premises with direct frontage on to or accessed from the A9(T).	Low	Current and historic volume of traffic that uses the A9 (T) each day are already relatively high.
A9 (T)	Low	Strategic Route designed and maintained to appropriate standard.
A836	Low	Strategic Route designed and maintained to appropriate standard.

8.4 Assessment of Likely Effects

Potential Construction Effects

8.4.1 The construction traffic associated with the proposed development would comprise of HGVs and LGVs carrying construction materials and plant. There would also be AIL vehicles carrying the main wind turbine components and private cars / vans associated with construction workers and general deliveries. Details of each construction process, construction plant equipment utilised, and the associated traffic movements are included in Technical Appendix 8.1.

8.4.2 There is expected to be an average of 50 construction personnel working on-site at any one time. It is important to note that the number of personnel on-site would vary during the construction process.

8.4.3 Construction work hours are expected to be between 7am to 7pm on Mondays to Saturdays (although it may occasionally be necessary to extend beyond this, for example due to incremental weather). This means that staff would generally arrive and depart outside the peak hours associated with the surrounding road network (typically 8am to 9am and 5pm to 6pm).

8.4.4 The construction period is anticipated to last for 12 months.

8.4.5 Estimates of traffic generation associated with the construction phase of the proposed development have been calculated and include, but are not limited to, the following activities:

- Delivery and removal of plant / materials in relation to site mobilisation and set up of site compound;
- Delivery of aggregates and geotextile materials to construct site access roads;
- Delivery of roadstone wearing course for access roads and hardstanding areas at the site;
- Delivery of steel reinforcement;
- Delivery of base rings for turbines;
- Delivery of transformers and switchroom equipment;
- Delivery of sand bedding for cabling;
- Delivery of cabling for turbines;

- Delivery of turbine components (including AILs);
- Delivery and removal of cranes for turbine erection;
- Miscellaneous deliveries; and
- Construction worker trips.

8.4.6 Table 8.8: Anticipated Proposal Construction Traffic details vehicle movements by type.

Table 8.8: Anticipated Proposed Development Construction Traffic

Vehicle Type	**Anticipated Number of Vehicles during Proposal Construction**
Low loaders	86
Tippers	4463
Mixers	556
Flat-beds	40
Backhoe loaders	4
30t to 50t cranes	1
Clamp-lift trailers	24
Extendible trailers	24
1000t to 1200t crane	2
150t to 200t crane	2
Tele-handlers	2
Skip lorries	104
Small tankers	104
TOTAL HGVs	5,412
TOTAL TWO-WAY HGVs	10,824
Cars, Vans & LGVs	7,540
TOTAL VEHICLES	12,952
TOTAL TWO-WAY VEHICLE MOVEMENTS	25,904

8.4.7 Table 8.8 demonstrates that the proposed development is anticipated to generate a total of 25,904 two-way vehicle movements over the 12-month construction period. It is important to note that traffic movements associated with construction are temporary in nature. Of the 25,904 two-way movements, 10,824 are HGVs.

8.4.8 In addition to the vehicles detailed in Table 8.8 there are anticipated to be 48 one-way AIL vehicle movements associated with the Proposed Development. AIL vehicles can retract once components have been off-loaded and thus the outbound movement is akin to a HGV. The impacts of AIL vehicles are detailed in Technical Appendix 8.1.

8.4.9 Table 8.9: Anticipated Proposal Construction Traffic by Month, provides a breakdown of deliveries by vehicle type by month.

Table 8.9: Anticipated Proposal Construction Traffic by Month

Vehicle	**Month**											
	1	2	3	4	5	6	7	8	9	10	11	12
Low Loader	15	5	2		5	2			45			12
Tipper	710	710	709	709	716	118	5	5	6	6	384	385

Table 8.9: Anticipated Proposal Construction Traffic by Month

Vehicle	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Mixer Truck			160	160	160	74	1	1				
Flat Bed			5	6	13	8		8				
Backhoe Loader			2									2
Clamp Lift Trailer									24			
Extendible Trailer									24			
30t - 50t Crane					1							
150t - 200t crane									2			
1000t - 1200t crane									2			
Tele Handler						2						
Skip Lorry	9	9	9	8	8	8	8	9	9	9	9	9
Small Tanker	9	9	9	8	8	8	8	9	9	9	9	9
Delivery Vans	87	87	87	87	86	86	86	86	87	87	87	87
Staff Vehicles	542	542	542	542	541	541	541	541	542	542	542	542
TOTAL	1372	1362	1525	1520	1538	847	649	659	750	653	1031	1046
	12,952											

8.4.10 Construction vehicles would generally be arriving and departing the site at regular intervals during expected site working hours.

8.4.11 Table 8.9 illustrates that Month 5 of the construction period is anticipated to be the busiest month in terms of the number of construction vehicle movements, with 3,076 two-way movements anticipated (1,538 deliveries). Hence, Month 5 is used to determine the impact and any resultant effects of the proposed development by determining the anticipated average number of daily vehicle movements which would be added to the baseline AADF illustrated in Table 8.6.

8.4.12 For the purposes of this assessment the following assumptions have been used to determine average daily two-way vehicle movements during Month 5:

- Robust case monthly two-way vehicle movements 3,076 (based on 1,538 deliveries);
- Weekly two-way vehicle movements 769 (assume 4 weeks per month);
- Daily two-way vehicle movements 154 (assume 5 day working week); and
- Hourly two-way vehicle movements 13 (assume 12-hour working day).

8.4.13 Thus, as a robust case, it is anticipated that the peak average number of construction vehicle movements on a daily basis would amount to 154 two-way movements. This equates to approximately 13 two-way vehicle movements per hour.

Vehicle Routing and Access

8.4.14 Technical Appendix 8.1 contains the route assessment of AIL vehicles from Scrabster Harbour to the site including detailed Swept Path Analysis ('SPA'). The single access point for the AIL vehicles is outlined in the SPA and detailed in Technical Appendix 8.1.

8.4.15 The AIL vehicle route can be summarised as follows:

- from Scrabster Harbour heading south along the A9 (T);
- right turn from the A9 (T) to the A836; and
- westbound travel along the A836 for approximately 5 km prior to taking a left turn into the site.

8.4.16 All other construction traffic is anticipated to access the site via the A9 (T) from Thurso. This has been agreed with THC Transport Planning Team. Thus, for the purposes of the traffic and transport assessment it is assumed that 100% of construction traffic (as shown in Table 8.9) would pass counter locations: 10934, 40800 and 40956 as shown in Figure 8.2. A review of quarries in the area has been used to confirm the assumptions relating to vehicle routing. To represent a robust case, it is also assumed that 100% of construction traffic would pass counter 20801 when in reality only AIL vehicles are likely to utilise the A9 (T) north.

8.4.17 Within the site, existing tracks would be utilised where practicable. New and upgraded access tracks would be provided, typically 5.5 m in width with passing places as required.

Impact of Construction Vehicles

8.4.18 Table 8.10: Impact of Construction Vehicles details the anticipated impact of proposed construction vehicles within the Study Area based on robust assumptions relating to: the use of Month 5 traffic movements and the assumption that all construction traffic would use each link in the Study Area.

8.4.19 The full table of proposed development flows is included in the Technical Appendix 8.2: Anticipated Proposed Construction Traffic by Month.

Table 8.10: Impact of Construction Vehicles

Counter	Road	2020 Baseline AADF		Proposed development Vehicles Peak Daily Flow		% Impact of Proposed development Vehicles	
		HGVs Two-Way Vehicles	Total Two-Way Vehicles	HGVs Two-Way Vehicles	Total Two-Way Vehicles	HGVs	Total Vehicles
10934	A836	67	2,510	92	154	137%	6%
20801	A9(T)	94	3,212	92	154	98%	5%
40800	A9(T)	150	3,255	92	154	61%	5%
40956	A9(T)	272	14,125	92	154	34%	1%
A836	A836	92	2,130	92	154	100%	7%

*Note: To ensure a robust evaluation of Construction traffic a 5-day working week has been assumed. As stipulated in Section 8.4.3 Saturday working is used for activities such as turbine lifts and not the main construction activities.

8.4.20 Table 8.10 demonstrates that in respect of total vehicle movements, the maximum daily percentage increase in traffic is 7% at the surveyed location on the A836. As per the IEMA

Guidelines (1993), the increase in traffic does not exceed the threshold whereby an assessment of effects is warranted.

8.4.21 It is however recognised that the impact of construction vehicles exceeds the 30% threshold when considering HGVs only at several points in the Study Area, thus an assessment of environmental effects has been undertaken, detailed in the following section.

8.4.22 The daily percentage increase in HGV traffic is anticipated to be between 34% and 137%. It is important to recognise the existing low baseline level of HGVs when assessing any environmental effects and the robust nature of the volume of construction traffic anticipated.

8.4.23 Construction traffic volumes are anticipated to equate to an average of 13 two-way vehicles per hour assuming a 12-hour working day. Considering that the theoretical carrying capacity of roads within the Study Area is in the region of 2,400 two-way vehicles, an additional 13 two-way vehicles per hour is not anticipated to affect the carrying capacity of road links. As demonstrated in Table 8.6 and in respect of DMRB theoretical carrying capacities, it is recognised that road links within the Study Area have residual capacity.

Study Area Traffic Impact Assessment

8.4.24 The following paragraphs detail the magnitude of impact and effects associated with construction traffic on the road network within the Study Area.

A836

8.4.25 The proposed development is expected to increase the total daily traffic flow on the A836 by a maximum of 7%. The carrying capacity of the A836, as identified by DMRB (2002) is 1,200 vehicles per hour in either direction. It is anticipated that an additional 13 vehicles per hour is not expected to significantly affect the operation of the A836.

8.4.26 As per Table 8.3, the magnitude of the change of the construction vehicles associated with the proposed development on the A836 is classed as 'no change', with a maximum increase of 7%.

8.4.27 The daily increase in HGVs is a maximum of 137%. Whilst this equates to a 'High' Magnitude of Change, it is important to note that the existing HGV traffic flows are low (67 two-way vehicle movements) and any increase in traffic has a more pronounced percentage impact. Table 8.3 stipulates in the description for a 'High' Magnitude of Change that the result would be a substantial or total loss of capability for movement along and across transport corridors, loss of access to key facilities, loss of safety and severe delays to road users. It is not considered that this would be the case on the A836 in relation to HGV impact of the proposed development. Table 8.3 details the Magnitude of Change descriptors associated with percentage traffic impacts. It is important to note that the impact on the A836 would not match the descriptor for a High Magnitude of Change. As per Section 8.2.31, the approach used is considered fully robust given the temporary nature of construction traffic.

8.4.28 The sensitivity of the A836 has been determined to be 'low' in terms of the criteria set out within Table 8.2. When the magnitude is combined with the sensitivity of the receptor (Table 8.4), the overall significance of effect is considered to be **Negligible** and is **Not Significant**.

A9 (T)

8.4.29 The proposed development is expected to increase the daily traffic flow on the A9 (T) by between 1% and 5%. The carrying capacity of the A9 (T), as identified by DMRB is approximately 1,200 vehicles per hour in each direction. It is anticipated that an additional 13 vehicles per hour is not expected to noticeably affect the operation of the A9 (T).

8.4.30 The magnitude of change can be classed as 'no change' when compared with the criteria set out in Table 8.3. The sensitivity of the receptors can be defined as 'low' in terms of the criteria set out within Table 8.2. When the magnitude is combined with the sensitivity of the receptor, the overall significance of effect is considered to be **Minor** and is **Not Significant**.

8.4.31 The daily increase in HGVs is between 34% and 98%. Similar to the A836, this results in a 'High' Magnitude of Change. However, due to the low baseline of HGV traffic, it is not considered that the traffic impact of HGV delivery for the proposed development would match the descriptor of a 'High' Magnitude of Change as shown in Table 8.3.

Severance

8.4.32 The IEMA Guidelines (1993) advise that "severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery".

8.4.33 The potential for traffic associated with the proposed development to cause severance is assessed on a case-by-case basis using professional judgement. As detailed in this Chapter communities exist within the Study Area, principally the settlements of Thurso and Scrabster. There are also a small number of isolated residential and business properties located along the A9 (T) and the A836. On the A9(T) these are identified as being of low sensitivity in Table 8.7. On the A836 businesses and private residential properties are identified as medium sensitivity.

8.4.34 The greatest anticipated traffic volume increase as a result of the construction of the proposed development is on A836 with a 7% overall increase in traffic and 137% increase in HGVs. However, as discussed in Paragraph 8.4.27, the percentage increases do not reflect the overall increase in vehicles due the low baseline traffic volume. With an increase of 13 vehicles per hour in each direction or three every 15 minutes, there is not expected to be any perceivable level of severance.

8.4.35 On the A9 (T), it is expected that only residents of Thurso and Burnside would be likely to experience any severance as these settlements are bisected by the A9 (T). However as discussed, the increase in traffic relating to construction vehicles is not expected to result in any perceivable severance occurring.

8.4.36 Combining the low to medium sensitivity of the receptors with the small magnitude of the effect, it is considered that in respect of severance, the proposed development would have a **Negligible to Minor** effect and is therefore **Not Significant** on all links in the Study Area.

Driver Delay

8.4.37 Some driver delay may be experienced when construction traffic is accessing the site. The IEMA Guidelines (1993) advise "delays are only likely to be significant when the traffic on the network surrounding the development is already at, or close to, the capacity of the system".

8.4.38 It is noted that existing traffic flows on local routes within the vicinity of the proposed development are low and there are no locations of significant congestion. Whilst the existing flows are higher on the A9 (T), there are also no significant periods of prolonged congestion. This is demonstrated by existing traffic flows being substantially lower than the theoretical capacity of links in the Study Area. The sensitivity of these routes is considered to be medium when compared with the criteria set out in Table 8.2.

8.4.39 It is noted that construction traffic associated with the proposed development amounts to 154 two-way vehicles per day in the robust traffic impact assessment. This volume would only occur during Month 5 of the construction programme and equates to 13 two-way trips per hour. This volume of traffic is considered to be negligible in magnitude when compared to the baseline traffic volume of each link.

8.4.40 When this 'low' magnitude of the change is combined with the 'medium' sensitivity of the receptors, it is considered that the expected volume of construction traffic would have a **Minor** effect on the Study Area in terms of driver delay and consequently the effect is deemed to be **Not Significant** for all links.

8.4.41 It is noted that the transportation of AILs is likely to cause minor delays to road users due to the need to travel at low speeds and under escort. However, the transportation of AILs to site would be infrequent and is expected to only occur in month 9 of construction therefore the magnitude of any change would be small. When combined with the medium sensitivity of the receptors, the significance of any driver delay is considered to be **Minor** and therefore **Not Significant**.

Pedestrian Delay and Loss of Amenity

8.4.42 An increase in construction traffic can make it more difficult for pedestrians to cross a road. Pedestrians can also experience intimidation and the degree to which this is true is affected by the volume of traffic, the proportion of HGV traffic and its proximity to pedestrians and cyclists.

8.4.43 Construction traffic will travel to site through rural areas where there is limited existing pedestrian and cycle infrastructure and therefore activity is expected to be low throughout the Study Area. Given the nature of Scrabster and Thurso, there is anticipated to be a volume of pedestrians akin to the scale and size of these settlements. Along the A836, pedestrian movements are likely to be nominal.

8.4.44 As shown in Table 8.6, there is a negligible volume of cyclists on the Study Area on a daily basis. In 2020, there is expected to be 48 cyclists per day on the A9 (T) through Thurso, 15 on the A9 (T) near Burnside and 6 on the A836. It is noted that a short section of the A9 (T) in Thurso forms part of National Cycle Route (NCR) 1; however, there are segregated footways and signalised crossings in this area which would prevent any loss of amenity for cyclists of pedestrians following the route.

8.4.45 The number of pedestrians or cyclists that are likely to be impacted by construction traffic is negligible and the magnitude of the effect is considered to low; therefore, the effect is considered **Negligible** and **Not Significant**.

Accidents and Safety

8.4.46 It is estimated that 12,952 vehicles would access the site during the construction phase (12-month period). An approximate calculation has been undertaken to quantify the level of accident risk that could be expected due to construction traffic.

8.4.47 Receptors of accidents are considered to be of high sensitivity, and any accident directly attributable to the proposed development is considered to be significant in terms of EIA Regulations (2011).

8.4.48 The likelihood of an accident occurring is commonly expressed in accidents per million vehicle-km. Accidents that are appraised in relation to transport are predominantly those in which Personal Injury Accidents (PIAs) occur.

8.4.49 Whilst it is acknowledged that there are varying road characteristics along the length of the links within the Study Area, for the purpose of this calculation it has been assumed that the length of road is approximately 7.1 km (from the site access point on the A836 to Thurso town centre) and can be classified as rural good single carriageway.

8.4.50 Accident rates for this category (rural good single carriageway) of road are:

0.190 PIAs per million veh-km.

8.4.51 Assuming a two-way trip on the 7.1 km route for each of the 12,952 vehicles, a total distance travelled of 172,814 km is obtained. Based on the rate above this suggests that 0.033 PIAs would occur during the construction phase.

8.4.52 It is considered that the magnitude of this effect is negligible and when combined with the 'low' sensitivity of the receptors (existing users of the roads within the Study Area) the overall effect is classed as **Negligible** and therefore **Not Significant** for all links in the Study Area.

Dust and Dirt

8.4.53 IEMA Guidelines (1993) acknowledge that it is not practical to quantify the level of dust and dirt that can be expected from construction traffic associated with a development. Therefore, a quantitative description of the effect on dust and dirt from construction traffic is not provided here.

8.4.54 It is acknowledged that HGVs would have the potential to collect debris on their tyres when accessing the site. This could be transferred to the road surface when vehicles travel away from the site and can be deposited on the road in the form of either dust or dirt depending on weather conditions.

8.4.55 Under the current site access arrangements, it is expected that the A836 would be the most affected by any accumulation of dust or dirt as construction traffic will be entering and exiting the site from this road. As the A836 is a strategically important road for the north of Scotland and is expected to carry approximately 2,500 vehicles in total (two-way) each day in 2020, its sensitivity with respect to dust and dirt has been determined to be 'low.

8.4.56 As discussed, the volume of construction traffic included in the robust traffic impact assessment amounts to an average of 13 two-way vehicles movements each hour. The magnitude of the effect of dust and dirt is considered to be 'low'.

8.4.57 When the 'low' magnitude of the effect is combined with the 'low' sensitivity of the link, and in the absence of mitigation, it is considered that the effect of dust and dirt study is **Negligible** and therefore **Not Significant**.

Potential Operational Effects

8.4.58 Once the proposed development is operational, the volume of traffic associated with the operations would be minimal, relating to maintenance of wind turbines only. Vehicles used for maintenance are likely to be road-going 4x4s. There may, on rare occasions, be the need for HGV access to the wind turbines. The effect of operational traffic on the road network is therefore considered to be **Minor** and therefore **Not Significant**.

8.4.59 The effect of operational traffic impacts in respect of: severance, driver delay, pedestrian delay and amenity, accidents and safety and dust and dirt is considered to be **Not Significant** given that the volume of traffic associated with operational phase is likely to be significantly less than during construction.

Potential Decommissioning Effects

8.4.60 Planning permission for the proposed development is sought for a 35-year period, after which the proposed development may be decommissioned, or a further application submitted to repower the site. Traffic associated with the decommissioning of the proposed development would include HGVs, LGVs, AILs and private cars. The number of vehicle trips associated with decommissioning is be anticipated to be significantly less than those associated with construction as it is likely that elements of infrastructure such as access tracks and electrical connections would be left in place and components could be broken up on-site to allow transport by reduced numbers of vehicles. As decommissioning traffic volumes are less than construction volumes, assuming the baseline has not substantially changed, the significance of any effects would not be greater, with the effect on the road network considered to be **Not Significant**. It can therefore be assumed that the assessment of the construction phase covers the worst-case scenario.

8.4.61 The effect of decommissioning traffic impacts in respect of: severance, driver delay, pedestrian delay and amenity, accidents and safety and dust and dirt is considered to be **Not Significant** given that the anticipated volume of traffic is significantly less than during construction.

Potential Cumulative Effects

Traffic Impact

8.4.62 The cumulative developments that have been reviewed and their relative characteristics are as follows:

- Achlan – Access Route from Wick – Not Considered;
- Achlan 2 - Access Route from Wick – Not Considered;
- Berriedale and Dunbeath - Access Route from Wick – Not Considered;
- Cogle Moss - Access Route from Wick – Not Considered;
- Golticlay - Access Route from Wick – Not Considered;
- Halsary - Access Route from Wick – Not Considered;
- Hill of Lybster – 1 Turbine – Not Considered;
- Rumster Community - Access Route from Wick – Not Considered;
- Limekiln Resubmission (Planning Reference 16/02752/S36) located to the west of the site and is anticipated to generate an average of 61 two-way HGV movements per day and 111 total vehicle two-way movements;
- Strathy Wood Wind Farm (Planning Reference 13/04469/S36) located to the west of the site is anticipated to generate an average of 8 two-way HGV movements per day and 20 total vehicle two-way movements;

- Strathy South Wind Farm (Planning Reference 07/00263/S36SU) also located to the west of the site is anticipated to generate an average of 11 two-way HGV movements per day and 33 total vehicle two-way movements per day; and
- Drum Hollistan Wind Farm (Planning Reference 16/04987/S36) – Refused – Not Included.

8.4.63 Thus, the combined average per day associated with cumulative developments is 80 two-way HGV movements and 164 total vehicle two-way movements.

8.4.64 For the purposes of this transport and traffic assessment, as per the main assessment methodology, 100% of the HGV movements associated with the cumulative developments has been applied to each link in the Study Area in order to provide a robust assessment. Furthermore, it should be recognised that the cumulative impacts represent a robust case as the Strathy Wood Wind Farm has not been granted planning consent and are at present, still in the planning process.

8.4.65 The resultant cumulative impact of the proposed development and potential cumulative developments is included in Table 8.11: Cumulative Traffic Impact.

Table 8.11: Cumulative Traffic Impact

Counter	Road	2020 Baseline AADF		Proposal Vehicles + Cumulative Developments		% Impact	
		HGVs Two-Way Vehicles	Total Two-Way Vehicles	HGVs Two-Way Vehicles	Total Two-Way Vehicles	HGVs	Total Vehicles
10934	A836	67	2,510	172	318	257%	13%
20801	A9(T)	94	3,212	172	318	183%	10%
40800	A9(T)	150	3,255	172	318	115%	10%
40956	A9(T)	272	14,125	172	318	63%	2%
A836	A836	92	2,130	172	318	187%	15%

8.4.66 The cumulative impact equates to 318 two-way vehicles per day or 27 two-way vehicles per hour assuming a 12-hour working day.

Likely Cumulative Effects and their Significance

Road Network

8.4.67 The magnitude of change associated with the proposed development and cumulative traffic (combined total of 318 two-way vehicles) is considered to be low. The sensitivity of receptors is considered to be medium on all roads within the study area. The significance is classed as **Minor** and thus **Not Significant.**

8.4.68 Whilst the percentage increase in HGV's seems high, this is due to the very low level of existing HGV traffic and the fact that the A836 and A9(T) have been shown to have substantial residual capacity to cope with an increase.

Severance

8.4.69 The sensitivity of the receptors is considered to be low. It is considered that the volume of cumulative traffic (318 two-way vehicles per day) would have a small effect on the local road network in terms of severance and consequently the effect is deemed to be **Negligible** and thus **Not Significant**.

Driver Delay

8.4.70 When the magnitude of the effect (small) is combined with the sensitivity of the receptors (medium), it is considered that in respect of driver delay the effect is of **Minor** significance and thus deemed **Not Significant** for all the routes within the study area.

Pedestrian Delay and Amenity

8.4.71 It is considered that the receptor sensitivity to this effect is low while magnitude of this effect is considered to be negligible thus the effect can be considered as **Not Significant** on all routes within the study area.

Accidents and Safety

8.4.72 An estimated 76,320 vehicles are associated with the cumulative developments over the 12 month construction programme, based on a robust calculation of assuming the total proposed two-way vehicle trips vehicles (318) would be subject to the same working patterns as the proposed development i.e a 5 day week for calculation purposes (318 x 5 days x 4 weeks x 12 months = 76,320). Using the same study route length of 7.1 km (paragraph 8.4.53) and an accident rate of 0.190 PIAs per million vehicle-kilometres, the likelihood of an accident is 0.103. Given that the increased traffic levels are temporary the magnitude of the accidents and safety effects has been determined as being low and **Not Significant**.

Dust and Dirt

8.4.73 When the magnitude of the change is combined with the receptor sensitivity, it is considered that the effect of dust and dirt on all routes within the study area is **Not Significant**.

8.5 Mitigation

8.5.1 The assessment does not predict any significant effects. As a result, no mitigation is required to address predicted effects associated with traffic and transport. Notwithstanding this, the following measures are proposed as 'good practice' to ensure the any effects are minimised as far as possible within the Study Area and it is assumed will be a condition to any consent for the proposed development. The Applicant proposes to offer mitigation by way of CTMP. The purpose of the CTMP is to reduce the traffic impacts and effects associated with the proposed development. The CTMP would include (where applicable) the following indicative measures:

- Minimise the volume of imported and exported material;
- Delivery control;
- Implementation of sustainability policies;
- Designated construction route to the site (preferred routes have already been identified);
- Implementation of contractor' speed limit;
- Use of warning and information signs;
- Restriction on construction site operating hours;
- Management of construction vehicle routing;
- Wheel washing at site accesses;
- Use of road sweeper to keep A836 clear of dust and dirt;

- Workforce parking arrangements; and
- Staff induction to educate site staff on traffic management arrangements.

Mitigation during Construction

8.5.2 A Liaison Officer would be appointed by the Applicant with responsibility for the CTMP. The Liaison Officer would be responsible for the implementation of the mitigation measures and would be a key point of contact with the local community and other stakeholders. The Liaison Officer would be responsible for ensuring the Principal Contractor for the proposed development adheres to the CTMP.

8.5.3 With regards to the movement of AIL, the following mitigation measures would be put in place:

- All AIL vehicles would be restricted out-with the peak hours when existing traffic flows along the route would be lower;
- Information on the movement of AIL would be provided to the local press to help inform the public and those directly affected by the proposed development;
- An escort would accompany all AIL vehicles; and
- Appropriate warning and information signs would be provided along the AIL delivery route.

8.5.4 The Liaison Officer appointed by the Applicant would as part of the CTMP consult and work with other developers of wind farm proposals to mitigate impacts and effects through the appropriate scheduling and control vehicle access, where appropriate. It is important to recognise that the peak periods associated with wind farm developments are not likely to overlap due to the output capacities of quarries. Scheduling of AIL deliveries would also be discussed with the Scrabster Harbour Master to mitigate impacts, where appropriate.

Mitigation during Operation

8.5.5 There are no relevant mitigation measures.

Mitigation during Decommissioning

8.5.6 There are no relevant mitigation measures.

8.6 Assessment of Residual Effects

8.6.1 There would be no significant Residual Effects.

8.7 Summary

8.7.1 Table 8.12: Summary of Potential Significant Effects of the Proposed Development, summarises the significance of transport and traffic effects during the construction, operation and decommissioning of the proposed development. There would be no Residual Effects.

Table 8.12: Summary of Potential Significant Effects of the Proposed Development

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Construction			
Severance	▪ Use of warning and information signs.	CTMP	Not Significant

Table 8.12: Summary of Potential Significant Effects of the Proposed Development			
Likely Significant Effect	**Mitigation Proposed**	**Means of Implementation**	**Outcome/Residual Effect**
	▪ Delivery control.		
Driver Delay	▪ Designated construction Route. ▪ Restriction on construction site operating hours.	CTMP	Not Significant
Pedestrian Delay and Amenity	▪ Use of contractor's speed limits. ▪ Management of construction vehicle routing.	CTMP	Not Significant
Accidents and Safety	▪ Use of warning and information signs. ▪ Use of contractor's speed limits.	CTMP	Not Significant
Dust and Dirt	▪ Wheel Washing at site access. ▪ Use of Road Sweeper.	CTMP	Not Significant
Cumulative			
Severance	▪ Use of warning and information signs. ▪ Delivery control.	CTMP	Not Significant
Driver Delay	▪ Designated construction Route. ▪ Restriction on construction site operating hours.	CTMP	Not Significant
Pedestrian Delay and Amenity	▪ Use of contractor's speed limits. ▪ Management of construction vehicle routing.	CTMP	Not Significant
Accidents and Safety	▪ Use of warning and information signs. ▪ Use of contractor's speed limits.	CTMP	Not Significant
Dust and Dirt	▪ Wheel Washing at site access. ▪ Use of Road Sweeper.	CTMP	Not Significant
Operation			
Severance	Not Applicable	Not Applicable	Not Significant
Driver Delay	Not Applicable	Not Applicable	Not Significant
Pedestrian Delay and Amenity	Not Applicable	Not Applicable	Not Significant
Accidents and Safety	Not Applicable	Not Applicable	Not Significant
Dust and Dirt	Not Applicable	Not Applicable	Not Significant
Decommissioning			
Severance	Not Applicable	Not Applicable	Not Significant
Driver Delay	Not Applicable	Not Applicable	Not Significant
Pedestrian Delay and Amenity	Not Applicable	Not Applicable	Not Significant
Accidents and Safety	Not Applicable	Not Applicable	Not Significant
Dust and Dirt	Not Applicable	Not Applicable	Not Significant

8.7.2 The Applicant proposes to mitigate the transport and traffic impact and effects of the proposed development during construction through CTMP.

8.8 Glossary and Abbreviations

8.8.1 Table below shows the list of terms used within this chapter with brief definition.

Term	**Definition**
Study Area	Defined Assessment Area
proposed development	Cairnmore Hill Wind Farm
the site	The project site, the site, development area, red line boundary

8.8.2 Table below shows the list of abbreviations used within the chapter and its expansion. All the abbreviations were fully expanded on first reference within the chapter with the abbreviation in brackets immediately after.

Abbreviation	**Expanded Term**
AADF	Average Annual Daily Flows
AIL	Abnormal Indivisible Loads
ATC	Automatic Traffic Counter
CIHT	Chartered Institution of Highways and Transportation
CTMP	Construction Traffic Management Plan
DfT	The Department for Transport
DMRB	The Design Manual for Roads and Bridges
EIA	Environmental Impact Assessment
HGV	Heavy Goods Vehicle
HwLDP	Highland wide Local Development Plan
IEA	Institute of Environmental Assessment
IEMA	Institute of Environmental Management and Assessment – formerly the IEA
IHT	The Institution of Highways and Transportation
IEA	Institute of Environmental Assessment
LGV	Light Goods Vehicle
NRTF	National Road Traffic Forecasts
PAN 75	Planning Advice Note 75
SPP	Scottish Planning Policy
THC	The Highland Council
TS	Transport Scotland

9 Noise

9.1 Introduction

9.1.1 This chapter considers the likely significant effects of noise associated with the construction, operation and decommissioning of the proposed development. The specific objectives of the chapter are to:

- describe the noise baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

9.1.2 The assessment has been carried out by Andrew Birchby of RES, a Member of the Institute of Acoustics with over ten years of experience in wind farm noise assessment. Further detail of RES' experience is provided in Technical Appendix 9.1.

9.1.3 This chapter is supported by the following figures and technical appendices:

- Figure 9.1 – Predicted Noise Footprint due to Proposed Development;
- Figure 9.2 – Predicted Cumulative Noise Footprint;
- Technical Appendix 9.1 – Statement of Authority;
- Technical Appendix 9.2 - Assessment of Battery Energy Storage Facility;
- Technical Appendix 9.3 – Scope of Assessment;
- Technical Appendix 9.4 – Calculating Standardised Wind Speed;
- Technical Appendix 9.5 – Propagation Height & Valley Effect;
- Technical Appendix 9.6 – Background Noise Survey Photos;
- Technical Appendix 9.7 – Instrumentation Records;
- Technical Appendix 9.8 – Charts; and
- Technical Appendix 9.9 – Suggested Planning Conditions: Noise.

9.1.4 Figures and technical appendices are referenced in the text where relevant.

9.2 Assessment Methodology and Significance Criteria

Scope of Assessment

9.2.1 Noise can have an effect on the environment and on the quality of life enjoyed by individuals and communities. The effect of noise, both in the construction and operational phase, is therefore a material consideration in the determination of planning applications.

Construction Noise

9.2.2 The sources of construction noise, which are temporary, would vary both in location and duration as the different elements of the wind farm are constructed and would arise primarily through the operation of large items of plant.

9.2.3 Noise would also arise due to the temporary increase in construction traffic near the site. This level would also depend on the particular construction phase of the proposed development.

9.2.4 The acoustic impact assessment of construction noise from the proposed development presented in this chapter is based on RES's experience of constructing wind farms and calculated for the operation of the primary large items of construction equipment. Additionally, consideration is given to the increased noise levels due to increased traffic flows during the construction phase to and from the site.

9.2.5 Noise would also arise during decommissioning of the proposed development (through turbine deconstruction and breaking of the exposed part of the concrete bases) although resultant noise levels are expected to be lower than those associated with construction activity.

Operational Noise

9.2.6 In the context of other sources of environmental noise, the noise levels produced by wind turbines are generally low and have greater dependence upon wind speed. The combination of these two factors implies that a degree of masking would often be provided by background noise.

9.2.7 As described by Scottish Government Planning Advice for Onshore Wind Turbines[1]:

"Technically, there are two quite distinct types of noise sources within a wind turbine - the mechanical noise produced by the gearbox, generator and other parts of the drive train; and the aerodynamic noise produced by the passage of the blades through the air. There has been significant reduction in the mechanical noise generated by wind turbines through improved turbine design".

9.2.8 The main focus of the assessment of operational noise presented in this chapter is based on the most relevant type of noise emission for modern wind turbines: aerodynamic noise, which is broadband in nature. Mechanical noise, which can be tonal in nature, is also considered albeit less relevant to modern wind turbines. Implicitly incorporated within this assessment is the normal character of the noise associated with wind turbines (commonly referred to as 'blade swish') and consideration of a range of noise frequencies, including low frequencies.

9.2.9 An acoustic assessment considering the operation of the proposed battery energy storage facility can be found in Technical Appendix 9.2.

Consultation

9.2.10 Details of the consultation undertaken are outlined in Table 9.1.

Table 9.1: Acoustic Assessment Consultation

Consultee	Date of Consultation	Issue Raised	Response / Action Taken
The Highland Council	29/08/2014	Report "Planned Acoustic Assessment at the Proposed Hill of Forss Wind Farm" (ref. 03022-000409) sent to Environmental Health Officer (EHO).	Response from EHO received 29/08/2014 detailed below
The Highland Council	29/08/2014	Email from EHO following receipt of planned acoustic assessment details confirming that ETSU-R-97 and the Institute of Acoustics Good Practice Guide should be used. EHO proposes visiting site to get a better idea of the proposed survey locations. EHO notes that noise from existing wind farms will need to be excluded from the	ETSU-R-97 and the Institute of Acoustics Good Practice Guide have been used. Measures to exclude the influence of existing wind farms have been taken. Conditioned levels have been used for any consented/existing projects

[1] 'Onshore wind turbines', The Scottish Government, 2013, www.scotland.gov.uk

Table 9.1: Acoustic Assessment Consultation			
Consultee	**Date of Consultation**	**Issue Raised**	**Response / Action Taken**
		measurements, consented levels rather than predicted levels should be used and that there are other projects other than Forss and Baillie in the vicinity. The EHO also raises the issue of respite/exposure.	in the cumulative assessment. Eight single turbine sites are included in the cumulative assessment alongside Forss & Baillie. An assessment of respite/exposure is included.
The Highland Council	29/09/2014	Phone call made to EHO to confirm receipt of "Planned Acoustic Assessment at the Proposed Hill of Forss Wind Farm" report. EHO was invited to attend the initial setup and confirmed their attendance on 6th October 2014. EHO to confirm his acceptance of the survey locations by 3rd October 2014.	Response from EHO received 03/10/2014 detailed below
The Highland Council	03/10/2014	Email from EHO saying they hadn't been able to visit site and attaching a map with the five broad areas for monitoring and advising that survey locations within these areas should be conservative e.g. sheltered, set back from the road and away from agricultural activity.	The four survey locations are within the four areas identified by the EHO that are closest to the proposed development. The selected monitoring locations were chosen to be conservative as far as possible with the EHO present at the installation.
The Highland Council	28/10/2014	Report "Noise Survey Locations for the Acoustic Assessment at the Proposed Hill of Forss Wind Farm" (ref. 03022-000436), containing details of installed survey locations, sent to EHO via email.	Response from EHO received 18/11/2014 detailed below
The Highland Council	18/11/2014	Email response received from EHO providing planning officer contact details regarding obtaining a copy of the Baillie Environmental Impact Assessment.	Baillie Environmental Impact Assessment obtained.
The Highland Council	25/08/2017	Email to EHO informing of name change to Cairnmore Hill and request to discuss assessment in advance of submission.	Response from EHO received 29/08/2017 detailed below
The Highland Council	29/08/2017	Response from EHO requesting summary and mapping in advance to inform any discussion.	Information requested provided 15/03/19 as detailed below
The Highland Council	15/03/2019	Email to EHO outlining points for discussion and providing requested background information.	Response from EHO received 02/04/2019 detailed below
The Highland Council	02/04/2019	On determining background noise level from existing wind farms EHO notes that old data can be used, directional filtering might be appropriate in this case and that the properties to the east are probably far enough away from Baillie and Forss. Where significant headroom exists between the predicted noise levels and consented limits adding 3dB to the predictions is generally appropriate.	Directional filtering is used to account for the presence of existing wind farms at the two survey locations to the west. The resulting background noise levels are compared to old data for reference. 3dB is added to the predicted noise levels where significant headroom exists.

Table 9.1: Acoustic Assessment Consultation			
Consultee	**Date of Consultation**	**Issue Raised**	**Response / Action Taken**
The Highland Council	08/04/2019	Email to EHO requesting further opinion on methods for excluding influence of existing sites, sites for inclusion in cumulative assessment, cumulative exposure assessment method, significant headroom definition and appropriate lower limits.	Response from EHO received 11/04/2019 detailed below
The Highland Council	11/04/2019	EHO looking for evidence that background figures are representative. Suggested cumulative exposure assessment methods, e.g. calculating % time a property would be downwind, ok. Night time lower limit of 38dB(A) advised although Baillie consented to 43dB(A).	The background noise levels are compared to old data for reference. Exposure assessed using one of the suggested methods (% time downwind). Night time lower limit of 38dB(A) adopted.

Potential Effects Scoped Out

9.2.11 Low frequency content of the noise from wind farms is considered through the use of octave band specific noise emission and propagation modelling; however, it is considered that a specific and targeted assessment on low frequency noise from the proposed development is unjustified.

9.2.12 Detailed reasoning for scoping out low frequency noise, infrasound, sleep disturbance, vibration, amplitude modulation and wind turbine syndrome is presented in Technical Appendix 9.3. A summary of the findings of a comprehensive study into wind turbine noise and health effects can also be found in this appendix.

9.2.13 Based on the acoustic assessment presented in Technical Appendix 9.2, operational and construction effects associated with the proposed battery energy storage facility have been 'scoped out' of further consideration.

Method of Baseline Characterisation

9.2.14 The baseline is determined following the methodology described in the Department of Trade and Industry's 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97)[2] and the Institute of Acoustics' Good Practice Guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise (IoA GPG)[3].

9.2.15 Similar to other assessments of noise impacts (most notably BS 4142[4] which ETSU-R-97 identifies as forming the basis of its recommendations), the ETSU-R-97 methodology requires the comparison of predicted noise levels due to turbine emissions (which vary with hub height wind speed) with noise limits based upon the noise levels already existing under those same conditions (i.e. the baseline conditions).

9.2.16 Since background noise levels depend upon wind speed, as indeed do wind turbine noise emissions, it is important when making reference measurements to put them in that context.

[2] 'The Assessment and Rating of Noise from Wind Farms', The Working Group on Noise from Wind Turbines, ETSU Report for the DTI, ETSU-R-97

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

[4] 'Method for Rating Industrial Noise affecting Mixed Residential and Industrial Areas', British Standards Institution, 1997

Thus, the assessment of background noise levels at potentially sensitive residential properties requires the measurement of not only noise levels, but concurrent wind conditions, covering a representative range of wind speeds. These wind measurements are made at the wind turbine site rather than at the residential properties, since it is this wind speed that would subsequently govern the wind farm's noise generation. Often the residential properties themselves will be sheltered from the wind and may consequently have relatively low background noise levels.

9.2.17 To establish the baseline conditions, sound level meters and associated apparatus are set-up to record the required acoustic information at a selection of the most noise sensitive residential properties geographically spread around the proposed wind farm site and which are likely to be representative of other residential properties in the locale.

9.2.18 Wind speed and direction are recorded as 10 minute averages for the same period as for the noise measurements, and are synchronised with the acoustic data to allow correlations to be established. The wind speed that is adopted for use is the same wind speed as that which drives the turbine noise levels.

9.2.19 The adoption of this wind speed was recommended by the IoA GPG. The methodology used to calculate standardised 10 m wind speed is described in Technical Appendix 9.4.

9.2.20 Prior to establishing the baseline conditions the acoustic data is filtered as follows:

- For each background noise measurement location, the measured noise data is divided into two sets, as specified by ETSU-R-97 and shown in Table 9.2:

Table 9.2: Definition of Time of Day Periods

Time of Day	**Definition**
Quiet daytime	18:00 - 23:00 every day 13:00 - 18:00 Saturday 07:00 - 18:00 Sunday
Night-time	23:00 - 07:00 every day

- Rainfall affected data is systematically removed from the acoustic data set. To facilitate this, a rain gauge is deployed at the site to record 10 minute rainfall data and identify potentially affected noise data. Both the 10 minute period containing the bucket tip and the preceding 10 minute period are removed from the dataset as recommended by the IoA GPG to account for the time it takes for the rain gauge tipping bucket to fill;
- Periods of measured background noise data thought to be affected by extraneous, i.e. non-typical, noise sources are identified and removed from the data set. Whilst some 'extraneous' data may actually be real, it tends to bias any trend lines upwards so its removal is adopted as a conservative measure.
- In practice this means close inspection of the measured background noise levels, comparison with concurrent data measured at nearby locations and consideration of both directional and temporal variation.

Criteria for the Assessment of Effects

Construction Noise

9.2.21 In the web based Scottish Government technical advice on construction noise assessment in 'Appendix 1: Legislative Background, Technical Standards and Codes of Practice'[5] it is stated that:

"However, under Environmental Impact Assessments and for planning purposes i.e. not in regard to the Control of Pollution Act 1974, the 2009 version of BS 5228 is applicable."

9.2.22 Given that BS 5228-1:2009 'Code of practice for noise and vibration control on construction and open sites - Part 1: Noise'[6] is identified as being the appropriate source of guidance on methods for minimising noise from construction activities, it is adopted herein.

9.2.23 The Control of Pollution Act 1974 provides information on the need for ensuring that the best practicable means are employed to minimise noise[7].

9.2.24 To ensure adequate assessment of the potential impacts of the construction noise from the proposed development the following steps have been taken:

- Baseline noise criteria are established from the appropriate guidance BS 5228-1:2009;
- Noise levels due to on-site construction activities are predicted at the most sensitive residential properties in accordance with the BS 5228-1:2009 standard;
- Predicted noise levels due to construction traffic at the same residential properties are made using the BS 5228-1:2009 standard; and
- The combined effect of on-site construction activities with construction traffic is compared with the target level specified by BS 5228-1:2009.

Operational Noise

9.2.25 Within Scotland, noise is defined within the planning context by 'Planning Advice Note 1/2011: Planning and Noise'[8]. This Planning Advice Note provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. The Planning Advice Note 1/2011 states that:

"Good acoustical design and siting of turbines is essential to minimise the potential to generate noise."

9.2.26 Planning Advice Note 1/2011 refers to the use of the Department of Trade and Industry's 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97), noting that further guidance is provided in the web based planning advice on renewable technologies for onshore wind turbines[1]. In relation to noise from wind farms the web-based renewables advice states:

"The Report, 'The Assessment and Rating of Noise from Wind Farms' describes a framework for the measurement of wind farm noise, which should be followed by applicants and consultees, and used by planning authorities to assess and rate noise from wind energy developments, until such time as an update is available."

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[5] 'Appendix 1: Legislative Background, Technical Standards and Codes of Practice', Scottish Government, 2011, www.scotland.gov.uk

[6] 'Code of Practice for Noise and vibration control on construction and open sites - Part 1: Noise', British Standards Institution, BS 5228-1:2009

[7] 'Control of Pollution Act', Control of Pollution Act, published by Her Majesty's Stationary Office, 1974

[8] 'Planning Advice Note 1/2011: Planning and Noise', Scottish Government policy, March 2011

9.2.27 It is therefore considered that the use of ETSU-R-97, as criteria for assessment of wind farm noise, fulfils the requirements of Planning Advice Note 1/2011.

9.2.28 The methodology described in ETSU-R-97 was developed by a working group comprising a cross-section of interested persons including, amongst others, environmental health officers, wind farm operators and independent acoustic experts.

9.2.29 The guidance makes it clear from the outset that any noise restrictions placed on a wind farm must balance the environmental impact of the wind farm against the national and global benefits that arise through the development of renewable energy resources. The principle of balancing development needs against protection of amenity may be considered common to any type of noise control guidance.

9.2.30 The basic aim of ETSU-R-97, in arriving at the recommendations contained within the report, is the intention to provide:

"Indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or local authorities."

9.2.31 An article published in the Institute of Acoustics Bulletin (IoA Bulletin) Vol. 34 No. 2, March/April 2009[9] , recommends a methodology for addressing issues not made explicit by, or outside the scope of, ETSU-R-97, such as in relation to wind shear or noise propagation modelling. Whilst this article does not represent formal legislation or guidance it was authored by a group of independent acousticians experienced in wind farm noise issues who have undertaken work on behalf of wind farm developers, local planning authorities and third parties and as such is a good indicator of best practice techniques. The assessment presented herein adopts the recommendations made within this article.

9.2.32 The IoA GPG, issued by the Institute of Acoustics in May 2013 and endorsed by the Department of Energy and Climate Change (DECC), Northern Ireland Executive, Scottish Government and the Welsh Assembly, provides guidance on all aspects of the use of ETSU-R-97 and reaffirms the recommendations of the IoA Bulletin with regard to propagation modelling and wind shear. The assessment presented herein adopts the recommendations of the IoA GPG.

9.2.33 Supplementary guidance notes were published by the Institute of Acoustics in July and September 2014, and these provide further details on specific areas of the IoA GPG[10] . The assessment presented in this chapter adopts the recommendations made within these supplementary guidance notes.

9.2.34 ETSU-R-97 has been applied at the vast majority of wind farms currently operating in the UK and provides a robust basis for assessing the noise impact of a wind farm when used in accordance with the IoA GPG. It is the only relevant guidance referenced in Scottish planning policy for rating and assessing operational wind farm noise. Based on planning policy and guidance, as outlined above, a wind farm which can operate within noise limits derived according to ETSU-R-97 shall be considered acceptable. This approach has been agreed with the Highland Council (THC) (see Table 9.1)

[9] 'Prediction and Assessment of Wind Turbine Noise', Bowdler et al, Acoustics Bulletin Vol 34 No 2 March/April 2009

[10] 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise - Supplementary Guidance Notes', Institute of Acoustics, July & September 2014

9.2.35 To ensure adequate assessment of the potential impacts of the operational noise from the proposed development the following steps have been taken, in accordance with relevant guidance detailed above:

- The baseline noise conditions at a representative sample of the nearest residential properties are established by a background noise survey;
- The noise levels at the nearest residential properties, from the operation of the proposed development, are predicted using a sound propagation model considering:
  - the locations of the wind turbines;
  - the locations of the properties;
  - the intervening terrain; and
  - the likely noise emission characteristics of the wind turbines;
- With due regard to relevant guidance or regulations the acoustic assessment criteria are derived; and
- The evaluation of the acoustic impact is undertaken by comparing the predicted noise levels with the assessment criteria.

MODELLING NOISE PROPAGATION

9.2.36 Whilst there are several sound propagation models available, the ISO 9613 Part 2 model has been used[11], this being identified as the most appropriate for use in such rural sites[12]. The specific interpretation of the ISO 9613 Part 2 propagation methodology recommended in the aforementioned IoA Bulletin and the subsequent IoA GPG has been employed.

9.2.37 To make noise predictions it is assumed that:

- the turbines radiate noise at the power specified in this report;
- each turbine can be modelled as a point source at hub-height; and
- each residential property is assigned a reference height to simulate the presence of an observer.

9.2.38 The sound propagation model takes account of attenuation due to geometric spreading and atmospheric absorption. The assumed temperature and relative humidity are 10°C and 70% respectively, as recommended in the IoA Bulletin and IoA GPG. Ground effects are also taken into account by the propagation model with a ground factor of 0.5 and a receiver height of 4 m used, as recommended in the IoA Bulletin and IoA GPG.

9.2.39 The barrier attenuations predicted by ISO 9613 Part 2 have been shown to be significantly greater than those measured in practice under downwind conditions. Therefore, barrier attenuation according to the ISO 9613 Part 2 method has been discounted. In lieu of this, where there is no direct line of sight between the residential property in question and any part of the wind turbine, 2 dB attenuation has been assumed, as recommended in the IoA Bulletin and the IoA GPG.

9.2.40 Additionally, verification studies have also shown that ISO 9613 Part 2 tends to slightly underestimate noise levels at nearby dwellings in certain exceptional cases, notably in a valley type environment where the ground drops off between source and receiver. In these instances, an addition of 3 dB(A) has been applied to the resulting overall A-weighted noise level, as recommended by the IoA GPG. Further detail is provided in Technical Appendix 9.5.

[11] 'Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation', International Organisation for Standardisation, ISO 9613-2:1996

[12] 'A Critical Appraisal of Wind Farm Noise Propagation', ETSU Report W/13/00385/REP, 2000

9.2.41 To generate the ground cross sections between each turbine and each dwelling necessary for reliable propagation modelling, ground contours at 5 m intervals for the area of interest have been generated from 50 m grid resolution digital terrain data.

9.2.42 The predicted noise levels are calculated as L_{Aeq} noise levels and changed to the L_{A90} descriptor (to allow comparisons to be made) by subtraction of -2 dB, as specified by ETSU-R-97.

9.2.43 It has been shown, by measurement-based verification studies, that the ISO 9613 Part 2 model tends to slightly overestimate noise levels at nearby dwellings[12]. Examples of additional conservative assumptions modelled are:

- properties are assumed to be downwind of all noise sources simultaneously and at all times. In reality, this is not the case and additional attenuation would be expected when a property is upwind or crosswind of the proposed wind turbines;
- although, in reality, the ground is predominantly porous (acoustically absorptive) it has been modelled as 'mixed', i.e. a combination of hard and porous, corresponding to a ground absorption coefficient of 0.5 as recommended by the IoA Bulletin and IoA GPG;
- receiver heights are modelled at 4 m above local ground level, which equates roughly to first floor window level, as recommended by the IoA Bulletin and IoA GPG. This results in a predicted noise level anything up to 2 dB(A) higher than at the typical human ear height of 1.2 - 1.8 m;
- trees and other non-terrain shielding effects have not been considered;
- an allowance for measurement uncertainty has been included in the sound power levels for the presented turbine.

CRITERIA FOR ASSESSING SIGNIFICANCE

9.2.44 Noise is measured in decibels (dB) which is a measure of the sound pressure level, i.e. the magnitude of the pressure variations in the air. Measurements of environmental noise are usually made in dB(A) which includes a correction for the sensitivity of the human ear.

9.2.45 ETSU-R-97 seeks to protect the internal and external amenity of wind farm neighbours by defining acceptable limits for operational noise from wind turbines. The test applied to operational noise is whether or not the noise levels produced by the combined operation of the wind turbines lie below noise limits derived in accordance with ETSU-R-97 at nearby residential properties.

9.2.46 Whilst ETSU-R-97 presents a comprehensive and detailed assessment methodology for wind farm noise, it also provides a simplified methodology:

"if the noise is limited to an $L_{A90,10min}$ of 35dB(A) up to wind speeds of 10 m/s at 10 m height, then these conditions alone would offer sufficient protection of amenity, and background noise surveys would be unnecessary".

9.2.47 In the detailed methodology, ETSU-R-97 states that different limits should be applied during daytime and night-time periods. The daytime limits, derived from the background noise levels measured during quiet daytime periods, are intended to preserve outdoor amenity, while the night-time limits are intended to prevent sleep disturbance. The general principle is that the noise limits should be based on existing background noise levels, except for very low background noise levels, in which case a fixed limit may be applied. The suggested limits are given in Table 9.3 below, where L_B is the background noise level in $L_{A90,10min}$ and is a function of wind speed. During daytime periods and at low background noise levels, a lower fixed limit of 35–40 dB(A) is applicable. The exact value is dependent upon a number of factors: the number of nearby dwellings, the effect of the noise limits on energy produced, and the duration and level of exposure.

Table 9.3: Permissible Noise Level Criteria	
Time of Day	**Permissible Noise Level**
Day	35-40 dB(A) for L_B less than 30-35 dB(A) L_B + 5 dB, for L_B greater than 30-35 dB(A)
Night	43 dB(A) for L_B less than 38 dB(A) L_B + 5 dB, for L_B greater than 38 dB(A)

9.2.48 Note that a higher noise level is permissible during the night than during the day as it is assumed that residents would be indoors. The night-time criterion is derived from sleep disturbance criterion referred to in ETSU-R-97, with an allowance of 10 dB for attenuation through an open window.

9.2.49 The wind speeds at which the acoustic impact is considered are less than or equal to 12 ms^{-1} at a height of 10 m and are likely to be the acoustically critical wind speeds. Above these wind speeds, as stated in ETSU-R-97, reliable measurements of background and turbine noise are difficult to make. However, if a wind farm meets the noise criteria at the wind speeds presented, it is most unlikely that it would cause any greater loss of amenity at higher wind speeds due to increasing background noise levels masking wind farm generated noise.

9.2.50 It is important to note that, since reactions to noise are subjective, it is not possible to guarantee that a given development would not result in any adverse comment with regard to noise as the response to any given noise will vary from person to person. Consequently, standards and guidance that relate to environmental noise are typically presented in terms of criteria that would be expected to be considered acceptable by the majority of the population.

9.3 Baseline Conditions

Current Baseline

Construction Noise

9.3.1 For the on-site construction noise assessment, Annex E of BS 5228-1:2009 provides guidance on setting environmental noise targets. Several methods of assessing the significance of noise levels are presented in Annex E and the most applicable to the construction of the proposed wind farm development is the ABC method. The ABC method sets threshold noise levels for specific periods based on the ambient noise levels.

Operational Noise

9.3.2 The proposed development is located approximately 4.5 km northwest of Thurso. The surrounding area is predominantly rural in nature although an A-class road runs to the north of the site and the Atlantic Ocean is approximately 2 km to the north. The general noise character is typical of a rural environment with some traffic noise from the A road.

9.3.3 Background noise measurements were undertaken at four residential property locations in accordance with ETSU-R-97 as detailed in Table 9.4.

Table 9.4: Background Noise Survey Details				
House Name	**House ID**	**Start**	**End**	**Duration**
Braighmor	H39	08/10/2014	24/11/2014	48

Table 9.4: Background Noise Survey Details				
House Name	**House ID**	**Start**	**End**	**Duration**
Dunhobby	H75	08/10/2014	24/11/2014	48
Hopefield	H34	08/10/2014	24/11/2014	48
Taldale	H69	08/10/2014	24/11/2014	48

9.3.4 The background noise monitoring equipment was housed in weather-proof enclosures and powered by lead-acid batteries. The microphones were placed at a height of approximately 1.2 m above ground and equipped with all-weather wind shields which also provide an element of water resistance.

9.3.5 The proprietary wind shields used are designed to reduce the effects of wind-generated noise at the microphone and accord with the recommendations of the IoA GPG in that they are the appropriate size and, in combination with the microphone, are certified by the manufacturer as meeting Type 1 / Class 1 precision standards.

9.3.6 Noise levels are monitored continuously, and summary statistics stored every 10 minutes in the internal memory of each meter. The relevant statistic measured is the $L_{A90,10min}$ (The A-weighted sound pressure level exceeded for 90 % of the 10 minute interval).

9.3.7 The sound level meters were placed away from reflecting walls and vegetation. Photos of the equipment, in situ, may be seen in Technical Appendix 9.6. The apparatus were calibrated before and after the survey period and the maximum drift detected was 0.5 dB, which is within the required range outlined in the IoA GPG. All instrumentation has been subject to laboratory calibration traceable to national standards within the last 24 months, as recommended in the IoA GPG. Detailed instrumentation records are provided in Technical Appendix 9.7.

9.3.8 Chart 1 (see Technical Appendix 9.8 for all charts) shows the measured wind rose recorded over the background noise survey period, as measured by a SoDAR located on site.

9.3.9 A SODAR instrument is a remote sensing device that measures conditions in the atmosphere by using sound waves to detect the movement of air in the atmospheric boundary layer to measure wind speed and direction. For a SoDAR remote sensing device, sound pulses are reflected by temperature gradients in the atmosphere. SODAR provides measurements at several heights, and this enables wind speed data to be obtained that describe the wind profile across a range of heights.

9.3.10 The Triton SODAR employed has been successfully tested, by independent third parties using suitable test sites, against conventional anemometry[13,14]. From the technical reports, these tests have demonstrated that, over a range of relevant heights, the accuracy of the Triton SODAR is comparable to that of the conventional anemometry. The results of these validation campaigns provide confidence that the Triton SODAR can reproduce traditional wind speed measurements within the approximate uncertainty limits expected for cup anemometer measurements

9.3.11 For illustrative purposes, Chart 2 shows the measured wind rose over an extended period (16/02/05 – 01/03/06) at a meteorological mast located 5 km from the proposed site. As

[13] Verhoef, H Van der Werff, A Oostrum, H (2009), 'Comparative Measurements Between a Triton SODAR and Meteo Measurements at the EWTW, The Netherlands', ECN report ECN-X--09-104 (rev.b), dated September 2009

[14] Scott, G Elliott, D Schwartz, M (2010), 'Comparison of Second Wind TritonTM Data with Meteorological Tower Measurements', National Renewable Energy Laboratory Technical Report NREL/ TP-550-47429, dated January 2010.

previously discussed, the noise prediction model employed is likely to overestimate the real noise immission levels for locations not downwind of the turbines. Chart 2 therefore may aid the reader as to the likelihood of over-estimation due to this factor.

9.3.12 The noise data has been cross-referenced with rainfall data measured at the SoDAR using a rain gauge. Any noise data identified as having been affected by rainfall has been removed from the analysis as shown in Charts 3 to 10.

9.3.13 Short-term periods of increased noise levels considered to be atypical have been removed from the dataset. The excluded data is shown in Charts 3 to 10.

9.3.14 An analysis of the impact of noise from existing wind turbines on the datasets has also been performed. Predicted noise levels due to the existing wind turbines were calculated at each of the survey locations so that they could be subtracted from the measured noise levels to calculate the background noise level. The noise levels were calculated by direction and weighted by the survey wind rose to account for the reductions in noise that would occur when the measurement location is not downwind of the turbines.

9.3.15 The predicted noise levels due to the existing turbines are greater than the measured noise levels at three of the four measurement locations demonstrating that the prediction methodology is conservative. This remains true when noise levels from the existing wind turbines are not scaled to their conditioned limits, indicating that conservatism exists in either the acoustic emission data adopted or the propagation model itself.

9.3.16 Given the conservatism of the predicted noise levels the influence of the existing turbines was instead accounted for by directional filtering. Data recorded when the measurement location was downwind of either the existing Baillie or Forss wind farms has been filtered out as the noise levels from these sites would be expected to be greatest from these wind directions. In order to further focus the assessment, additional filtering was performed so that only data for the wind directions when properties are downwind of the proposed development was included.

9.3.17 For Taldale data recorded between wind directions of 210-90 degrees has not been considered in the assessment. At Braighmor data recorded for wind directions of 135-360 degrees has not been considered. No directional filtering was done at Dunhobby or Hopefield as these locations are to the east of the proposed development and further from the existing Baillie and Forss wind farms.

9.3.18 Charts 3 to 6 show $L_{A90,10min}$ correlated against wind speed for quiet daytime periods at each survey location. In each case, a 'best fit' line has been fitted to the data and the derived daytime noise limits added. The equation of the regression polynomial has been provided in the charts.

9.3.19 Charts 7 to 10 show $L_{A90,10min}$ correlated against the wind speed for night-time periods at each survey location. In each case, a 'best fit' line has been fitted to the data and the derived night-time noise limits added. The equation of the regression polynomial has been provided in the charts.

9.3.20 Tables 9.5 and 9.6 detail the $L_{A90,10min}$ background noise levels calculated from the derived 'best fit' lines, as described above.

Table 9.5 – Quiet Daytime Background Noise Levels (dB(A) re 20 μPa)												
House Name	**Standardised 10 m Wind Speed (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Braighmor	24.2	24.2	24.2	24.2	24.3	25.4	27.4	30.0	32.8	35.7	38.3	40.4
Dunhobby	25.5	25.5	25.5	26.0	27.0	28.6	30.7	33.3	36.3	39.7	43.4	47.5
Hopefield	22.2	22.2	22.3	22.7	23.6	24.9	26.6	28.8	31.6	34.9	38.7	43.2
Taldale	30.3	30.5	30.7	31.0	31.5	32.1	33.0	34.1	35.5	37.3	39.4	41.9

Table 9.6 – Night-time Background Noise Levels (dB(A) re 20 μPa)												
House Name	**Standardised 10 m Wind Speed (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Braighmor	25.4	25.4	25.4	25.4	25.4	25.6	26.6	28.2	30.4	33.2	36.5	40.3
Dunhobby	23.8	23.8	24.0	24.6	25.6	27.1	29.2	31.7	34.7	38.3	42.5	47.2
Hopefield	21.3	21.5	21.7	22.0	22.5	23.3	24.5	26.3	28.8	32.0	36.2	41.3
Taldale	29.4	29.4	29.4	29.4	29.4	29.5	30.2	31.4	33.1	35.4	38.3	41.8

9.3.21 A comparison of the background noise levels detailed in Tables 9.5 and 9.6 with the background noise levels recorded in noise surveys carried out to inform the acoustic assessments of other sites in the vicinity has been made, the results of which can be viewed in Charts 11 and 12.

9.3.22 The charts show that the background noise levels for use in the assessment of the proposed development are lower than almost all of the comparison locations:

- Borrowston Mains which was surveyed as part of the Forss assessment;
- Achiebraeskiall, Bardnaheigh, Hillcrest, Skiall and Stemster which were surveyed as part of the Baillie assessment; and
- Achins, Borlum House, Milton and Loanscorribest which were surveyed as part of the Limekiln[15] assessment.

9.3.23 The assessment in this Chapter is therefore more conservative than if background noise data from previous surveys had been used as lower background noise levels result in lower noise limits which the proposed development is required to meet.

Future Baseline

9.3.24 The baseline conditions would not be expected to change under the "do nothing" scenario i.e. in the event that the proposed development does not go ahead.

[15] The Scottish Government, Energy and Climate Change Directorate, Decision Notice for Limekiln wind farm, dated June 2019, Highland Council planning reference 16/02752/S36

9.4 Assessment of Likely Effects

Potential Construction Effects

Construction Noise Assessment

9.4.1 Primary activities creating noise during the construction period include the construction of the turbine bases; the erection of the turbines; the excavation of trenches for cables; and the construction of associated hard standings, access tracks and construction compound. Noise from vehicles on local roads and access tracks would also arise due to the delivery of turbine components and construction materials, notably aggregates, concrete and steel reinforcement.

9.4.2 It should be noted that the exact methodology and timing of construction activities cannot be predicted at this time, this assessment is therefore based on assumptions representing a worst-case approach.

Construction Noise Predictions

9.4.3 The plant assumed for each construction activity is shown in Table 9.7. The number of items indicates how many of each plant are required for the specified activity, and the duration of activity is a percentage of a given 12 hour day period needed for that plant to operate. Overall sound power levels are based upon the data in Annex C of BS 5228-1:2009.

Table 9.7: Construction Phases and Sound Power Levels

Activities	Plant	Sound Power (L_{WA})	No. Items	Activity Duration (%)	Effective Sound Power (L_{WA})
Upgrade Site Tracks	Tracked excavator	113	2	100	120
	Dump truck	113	2	100	
	Tipper lorry	107	4	50	
	Dozer	109	2	75	
	Vibratory roller	102	1	75	
Construct Temporary site compounds	Tracked excavator	113	2	100	119
	Dump truck	113	2	100	
	Tipper lorry	107	2	50	
	Vibratory roller	102	1	75	
	Lorry	108	1	75	
Construct Site Tracks	Tracked excavator	113	3	100	122
	Dump truck	113	2	75	
	Tipper lorry	107	4	50	
	Dozer	109	1	100	
	Vibratory roller	102	1	75	
	Excavator mounted rock breaker	121	1	50	
Construct Substations	Tracked excavator	113	1	100	117
	Concrete mixer truck	108	2	50	

Table 9.7: Construction Phases and Sound Power Levels					
Activities	**Plant**	**Sound Power (L_{WA})**	**No. Items**	**Activity Duration (%)**	**Effective Sound Power (L_{WA})**
	Lorry	108	1	50	
	Telescopic Handler	99	1	100	
	Piling rig	117	1	50	
Construct Crane Hardstandings	Tracked excavator	113	3	100	120
	Dump truck	113	2	100	
	Tipper lorry	107	4	50	
	Vibratory roller	102	1	50	
Construct Turbine Foundations	Tracked excavator	113	2	75	123
	Dump truck	113	2	75	
	Concrete mixer truck	108	4	50	
	Mobile telescopic	110	1	50	
	Concrete pump	106	2	50	
	Water pump	93	1	100	
	Hand-held pneumatic breaker	111	1	75	
	Compressor	103	3	50	
	Piling rig	117	1	100	
	Poker vibrator	106	3	50	
	Excavator mounted rock breaker	121	1	50	
Excavate and Lay Site Cables	Tracked excavator	113	2	100	122
	Dump truck	113	2	75	
	Tractor (towing equipment)	108	1	75	
	Tractor (towing trailer)	107	1	75	
	Vibratory plate	108	1	50	
	Excavator mounted rock breaker	121	1	50	
Erect Turbine	Mobile telescopic	110	2	75	119
	Lorry	108	1	75	
	Diesel generator	102	1	100	
	Torque guns	111	4	100	
Reinstate Crane Bases	Tracked excavator	113	1	75	115
	Dump truck	113	1	75	
Lay Cable to Substations	Wheeled loader	108	1	100	117
	Saw	114	1	50	

Table 9.7: Construction Phases and Sound Power Levels					
Activities	**Plant**	**Sound Power (L_{WA})**	**No. Items**	**Activity Duration (%)**	**Effective Sound Power (L_{WA})**
	Hand-held pneumatic breaker	111	1	50	
	Dump truck	113	1	75	
	Tipper lorry	107	1	50	
	Vibratory plate	108	1	75	
	Tandem roller	102	1	75	
	Tractor (towing trailer)	107	1	50	
	Lorry	108	1	75	
Construct New Water Crossing	Tracked Excavator	113	1	100	120
	Dump Truck	113	1	100	
	Tipper lorry	107	4	50	
	Dozer	109	1	75	
	Vibratory Roller	102	1	75	
	Telescopic Handler	99	1	100	
	Piling rig	117	1	50	
	Concrete pump	106	1	50	
	Concrete mixer truck	108	3	50	
	Poker vibrator	106	2	50	
	Water pump	93	2	100	
Construct Enabling Works Compound	Tracked excavator	113	2	100	119
	Dump truck	113	2	100	
	Tipper lorry	107	2	50	
	Vibratory roller	102	1	75	
	Lorry	108	1	75	

9.4.4 Predictions of construction noise levels have been carried out using the methods prescribed in Annex F of BS 5228-1:2009[16] . The worst-case scenario, where each construction activity takes place at the nearest proposed location to the residential property being assessed, is considered. The locations of the construction activities are taken from the site layout drawing (Figure 2.1). The results of these predictions, made at four representative residential properties are shown in Table 9.8 (see Table 9.12 for further detail of receptor locations). The significance of these predicted noise levels is discussed in paragraphs 9.4.12 to 9.4.16.

9.4.5 In all cases, average noise levels over the construction period would be lower as the worst case is presented for when the activities are closest to the residential property.

[16] A 50% mixed ground attenuation has been used throughout to conservatively account for the nature of ground conditions at the site.

Table 9.8 - Predicted Sound Pressure Level due to Construction Noise (dB L_{Aeq})				
Activity	**H34**	**H39**	**H69**	**H75**
Upgrade Site Tracks	49.2	45.4	70.5	44.7
Construct Site Compounds	44.3	43.7	48.1	43.2
Construct Site Tracks	51.5	51.3	72.8	51.3
Construct Substations	44.5	40.4	43.7	42.0
Construct Crane Hard-standings	49.5	49.3	49.8	49.3
Construct Turbine Foundations	52.4	52.2	52.7	52.2
Excavate and Lay Site Cables	51.2	51.0	51.5	51.0
Erect Turbine	48.2	48.0	48.5	48.0
Reinstate Crane Bases	44.2	44.0	44.5	44.0
Lay Cable to Substations	46.6	46.4	46.9	46.4
Construct New Water Crossing	47.2	44.9	68.9	48.0
Construct Enabling Works Compound	43.9	43.3	47.7	42.8

Construction Traffic

9.4.6 Due to the delivery of construction material and wind farm components, vehicle movements either into or away from the site would increase levels of traffic flow on public roads in the area. It is estimated that a maximum of 154 vehicle movements per day, or 13 per hour (modelled as 5 dump trucks, 5 concrete mixer trucks and 3 lorries) would be required during the most intense period of construction activity which is anticipated to occur in month 5 of the 12 month construction programme as explained in Chapter 8: Traffic and Transport.

9.4.7 Construction traffic noise has been quantified using the method described in BS 5228-1:2009. Using the distances from the considered residential properties to the centre of the relevant carriageway where site traffic would be, the noise levels predicted are presented in Table 9.9. The maximum sound pressure level due to traffic flows during the most intensive period of activity at the properties considered is predicted to be 59.5 dB L_{Aeq} at H75 which is adjacent to the proposed delivery route and thus corresponds to the worst case.

Table 9.9: Traffic Noise Predictions (dB L_{Aeq})				
House ID	**Dump Truck**	**Lorry**	**Concrete Mixer**	**Total**
H34	37.8	31.0	33.2	39.7
H39	38.6	31.7	33.9	40.5
H69	51.1	44.2	46.4	53.0
H75	57.6	50.7	53.0	59.5

9.4.8 The increase in noise level due to the presence of construction traffic on nearby roads has been quantified using the methodology set out in CRTN[17]. The maximum predicted increase in daytime average traffic noise level, during the most intense period of construction, is 1.2 dB(A) on the A836 based on the data provided in Table 8.10. Given that a 3 dB(A) change is commonly regarded as the smallest subjectively perceptible difference in noise level, the predicted short-term change in traffic noise levels is not considered to be significant.

[17] HMSO Department of Transport (1988) Calculation of Road Traffic Noise (CRTN)

General Construction Noise in Conjunction with Traffic Noise

9.4.9 Worst case construction noise levels may arise when the following simultaneous activities occur:

- the construction of the substation;
- the excavation and laying of cables;
- the construction of turbine foundations and associated hard standings; and
- construction of site tracks.

9.4.10 Cumulative predicted noise levels due to these construction activities and the additional contribution from construction traffic have been calculated and are shown in Table 9.10.

9.4.11 It should be noted that the predictions exclude the screening effects of local topography therefore actual levels of noise experienced at nearby residential properties could be lower.

Table 9.10: Predicted Noise due to Combined Traffic Noise and Turbine Construction (dB L_{Aeq})

House ID	Construction Plant Noise	Traffic Noise	Combined Noise
H34	57.5	39.7	57.5
H39	57.2	40.5	57.2
H69	72.9	53.0	72.9
H75	57.2	59.5	61.5

Assessment of Construction Noise

9.4.12 In accordance with the ABC method of Annex E of BS 5228-1:2009, due to the relatively low levels of ambient noise at the site, a Category A assessment is appropriate. This category sets threshold L_{Aeq} criteria of: 65 dB(A) during weekdays (0700-1900) and Saturdays (0700-1300); below 55 dB(A) for evenings (1900-2300 weekdays) and weekends (Saturdays 1300-2300 and Sundays 0700-2300); and below 45 dB(A) for night-time (2300-0700) periods.

9.4.13 Table 9.10 shows that predicted noise levels from the combined effect of increased traffic flows and activities associated with the peak of construction activities are below the 65 dB(A) daytime target level specified by BS 5228-1:2009 at three of the assessed residential properties. At H69, which is adjacent to the site entrance, the 65 dB(A) criteria is predicted to be exceeded during the construction/upgrade of site tracks and construction of the nearest water crossing.

9.4.14 Peak construction noise levels are predicted to exceed the 55 dB(A) target level for evenings and weekends at the four assessed properties.

9.4.15 An assessment against the night-time target level has not been undertaken as construction work is not scheduled to take place during the night.

9.4.16 The predictions made represent the worst-case combination of most intensive traffic activity with simultaneous construction activity at the nearest possible location to each residential property.

Potential Operational Effects

Noise Propagation Modelling

9.4.17 The locations of the proposed turbines are provided in Table 9.11 and shown in Figure 9.1.

Table 9.11: Location of Proposed Turbines		
Turbine	Co-ordinates	
	X (m)	Y (m)
T1	305838	967654
T2	305658	968216
T3	306169	967828
T4	306001	968398
T5	306509	968101
T6	306302	968713
T7	306702	968395
T8	306979	968632

9.4.18 The locations of the nearest residential properties to the turbines have been determined by inspection of relevant maps and through site visits. More residential properties may have been identified but have not been considered in this acoustic assessment e.g. due to their distance from the proposed development, them being adequately represented by another location or them being unoccupied for the lifetime of the wind farm. The locations considered are listed in Table 9.12 and are also shown in Figure 9.1.

9.4.19 The distances from each residential property to the nearest turbine are given in Table 9.12. It can be seen that the minimum house–to–turbine separation is 854 m.

Table 9.12: Location of Residential Properties and Distances to Nearest Proposed Turbine					
House Name	House ID	Co-ordinates		Distance (m)	Nearest Turbine
		X (m)	Y (m)		
1 Oust Farm	H1	306329	965584	2127	T1
Oust Farm	H2	306354	965589	2128	T1
2 Oust Farm Cottages	H3	306297	965606	2099	T1
3 Oust Farm Cottages	H4	306290	965609	2094	T1
New House	H5	306258	965628	2069	T1
Bardnaclavan	H6	307682	965855	2486	T3
Srathbofey	H7	305580	965936	1737	T1
5 Stempster Holding	H8	304485	966012	2128	T1
Tobarvale	H9	304599	966170	1933	T1
1 Lythmore Farm Cottage	H10	305393	966229	1493	T1
3 Lythmore Farm Cottage	H11	305387	966245	1479	T1
Lythmore Farm House	H12	305315	966421	1339	T1
South Waass	H13	307770	966440	2085	T5
6 Stempster Holding	H14	304479	966472	1801	T1
River Cottage	H15	304453	966608	1736	T1
Waas Farm	H16	308147	966850	2061	T5
Achnamara	H17	307554	967104	1444	T5

Table 9.12: Location of Residential Properties and Distances to Nearest Proposed Turbine

House Name	House ID	Co-ordinates		Distance (m)	Nearest Turbine
		X (m)	Y (m)		
Fairview	H18	307420	967153	1315	T5
Smith House	H19	307617	967158	1455	T5
Viewfield	H20	307395	967182	1277	T5
Langlands House	H21	307678	967183	1486	T5
Eibihlin	H22	307610	967219	1411	T5
Daibhidh	H23	307596	967243	1385	T5
Strathmore House	H24	304958	967245	970	T1
Glenburnie	H25	307371	967293	1181	T5
Quarry View	H26	307733	967310	1457	T5
Bramwyn	H27	307522	967372	1248	T5
Oaklands	H28	307609	967390	1310	T5
Amberbanks	H29	307973	967408	1577	T8
Murrayfield	H30	307802	967424	1460	T5
Carron	H31	307964	967444	1543	T8
Kidagach	H32	307969	967501	1503	T8
Burnside	H33	308653	967531	2004	T8
Hopefield	H34	307200	967551	883	T5
Sharone	H35	307909	967574	1409	T8
Eriador	H36	308232	967589	1630	T8
Caol Argaibh	H37	308596	967610	1913	T8
Briga View	H38	307892	967614	1367	T8
Braighmor	H39	304931	967630	907	T1
Ornum Cottage	H40	307892	967669	1327	T8
Seaview	H41	308456	967677	1759	T8
Hill Of Forss	H42	308323	967685	1644	T8
Seaview Cottage	H43	308610	967687	1885	T8
Bernessie	H44	308040	967706	1408	T8
Caiplie	H45	308409	967770	1670	T8
The Shiean	H46	308529	967790	1764	T8
Fullerton	H47	308566	967878	1757	T8
8 Holding	H48	304671	968045	1002	T2
7 Holding	H49	304371	968318	1291	T2
Lochroy	H50	304302	968336	1361	T2
6 Holding	H52	304403	968499	1287	T2
Beechwood	H53	304381	968522	1313	T2
9 Holding	H54	304318	968629	1402	T2
10 Holding	H55	304474	968886	1360	T2
Cairnmore	H56	304638	968940	1251	T2

Table 9.12: Location of Residential Properties and Distances to Nearest Proposed Turbine

House Name	House ID	Co-ordinates		Distance (m)	Nearest Turbine
		X (m)	Y (m)		
Rosedean	H57	304674	968949	1227	T2
1 School Place	H58	304612	968970	1289	T2
2 School Place	H59	304614	968973	1290	T2
3 School Place	H60	304622	968975	1284	T2
4 School Place	H61	304633	968977	1277	T2
Schoolhouse	H62	304655	968980	1261	T2
5 School Place	H63	304633	968996	1288	T2
6 School Place	H64	304638	968998	1285	T2
7 School Place	H65	304643	969000	1283	T2
8 School Place	H66	304649	969003	1280	T2
"Fairview, Roadside"	H67	304716	969008	1231	T2
Atlantic View	H68	305422	969089	902	T4
Taldale	H69	305576	969163	854	T6
Burn Of Brims	H70	305283	969188	1042	T2
Torigill	H71	304573	969218	1477	T2
Scrabster Lodge	H72	308827	969313	1969	T8
Brims House	H73	305644	969424	969	T6
Annfield	H74	305696	969446	951	T6
Dunhobby	H75	307282	969480	901	T8
2 Brims Cottages	H76	305677	969515	1017	T6
1 Brims Cottages	H77	305684	969516	1013	T6
Thorvik Brims	H78	307012	969550	919	T8
Windrift	H79	306607	969561	901	T6
Thusater Farm	H80	306899	969729	1100	T8
Brimmisa House	H81	306286	969729	1016	T6
Thusater Cottage	H82	306875	969794	1167	T8
Thusater	H83	306875	969794	1167	T8
Middleton Of Brims	H84	305919	969903	1250	T6
Fuaran	H85	305367	970009	1598	T6
East Brims	H86	305308	970030	1650	T6
Melgedwynell	H87	305416	970067	1618	T6
Ornum Farm House 2	H88	307898	967773	1258	T8
Ornum Farm House 1	H89	307865	967917	1139	T8

9.4.20 Although not finalised, the candidate turbine type for the noise assessment is the Vestas V117 4.2 MW turbine. This report uses the acoustic data from the manufacturer's performance specification for all analysis[18]. The manufacturer has identified these values as warranted

[18] 'Performance Specification V117 - 4.0/4.2 MW, Vestas Document ID: 0067 7063 V03, 2017-11-29

although no independent test reports are available to indicate whether any margin has been incorporated; therefore, 2 dB has been added to the warranted levels as a conservative measure as recommended by the IoA GPG. Details used in this analysis are as follows:

- a hub height of 80 m;
- a rotor diameter of 117 m;
- sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}) as shown in Table 9.13;
- octave band sound power level data, at the wind speeds where it is available, as shown in Table 9.14;
- tonal emission characteristics such that no clearly audible tones are present at any wind speed.

Table 9.13 – A-Weighted Sound Power Levels (dB(A) re 1 pW) for the Vestas V117 4.2 MW Wind Turbine

Standardised 10 m Height Wind Speed, v_{10} (ms^{-1})	Warranted	Plus Uncertainty
1	93.1	95.1
2	93.1	95.1
3	93.1	95.1
4	95.8	97.8
5	99.8	101.8
6	103.6	105.6
7	105.7	107.7
8	106.0	108.0
9	106.0	108.0
10	106.0	108.0
11	106.0	108.0
12	106.0	108.0

Table 9.14 - Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at 8 ms^{-1} for the Wind Turbine

Octave Band (Hz)	Sound Power Level, dB(A)
63	88.4
125	95.5
250	100.2
500	102.5
1000	102.4
2000	99.8
4000	94.8
8000	87.3
OVERALL	108.0

Predictions of Noise Levels at Residential Properties

9.4.21 Table 9.15 shows the predicted noise immission levels at the nearest residential properties, at each wind speed considered, due to the operation of the proposed development. The property with the highest predicted noise immission level of 40.8 dB(A) is Taldale (H69).

9.4.22 Figure 9.1 shows an isobel (i.e. noise contour) plot for the site at a 10 m height wind speed of 8 ms^{-1}. Such plots are useful for evaluating the noise 'footprint' of a given development

Table 9.15: Predicted Noise Levels at nearby Residential Properties, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H1	17.2	17.2	17.2	19.9	23.9	27.7	29.8	30.1	30.1	30.1	30.1	30.1
H2	17.2	17.2	17.2	19.9	23.9	27.7	29.8	30.1	30.1	30.1	30.1	30.1
H3	17.3	17.3	17.3	20.0	24.1	27.8	29.9	30.2	30.2	30.2	30.2	30.2
H4	17.4	17.4	17.4	20.0	24.1	27.8	29.9	30.2	30.3	30.3	30.3	30.3
H5	17.5	17.5	17.5	20.2	24.2	28.0	30.0	30.3	30.4	30.4	30.4	30.4
H6	17.3	17.3	17.3	20.0	24.0	27.8	29.8	30.2	30.2	30.2	30.2	30.2
H7	19.6	19.6	19.6	22.3	26.3	30.1	32.2	32.5	32.5	32.5	32.5	32.5
H8	17.5	17.5	17.5	20.2	24.2	28.0	30.0	30.4	30.4	30.4	30.4	30.4
H9	18.4	18.4	18.4	21.1	25.1	28.9	31.0	31.3	31.3	31.3	31.3	31.3
H10	20.9	20.9	20.9	23.6	27.7	31.4	33.5	33.8	33.8	33.8	33.8	33.8
H11	21.0	21.0	21.0	23.7	27.7	31.5	33.6	33.9	33.9	33.9	33.9	33.9
H12	21.9	21.9	21.9	24.6	28.6	32.4	34.5	34.8	34.8	34.8	34.8	34.8
H13	19.3	19.3	19.3	22.0	26.0	29.8	31.9	32.2	32.2	32.2	32.2	32.2
H14	19.2	19.2	19.2	21.9	25.9	29.7	31.8	32.1	32.1	32.1	32.1	32.1
H15	19.5	19.5	19.5	22.2	26.2	30.0	32.1	32.4	32.4	32.4	32.4	32.4
H16	19.4	19.4	19.4	22.1	26.1	29.9	32.0	32.3	32.3	32.3	32.3	32.3
H17	23.1	23.1	23.1	25.8	29.8	33.6	35.7	36.0	36.0	36.0	36.0	36.0
H18	24.0	24.0	24.0	26.7	30.8	34.5	36.6	36.9	36.9	36.9	36.9	36.9
H19	23.0	23.0	23.0	25.7	29.8	33.5	35.6	35.9	35.9	35.9	35.9	35.9
H20	24.3	24.3	24.3	27.0	31.0	34.8	36.9	37.2	37.2	37.2	37.2	37.2
H21	22.8	22.8	22.8	25.5	29.6	33.3	35.4	35.7	35.7	35.7	35.7	35.7
H22	23.4	23.4	23.4	26.1	30.1	33.9	35.9	36.2	36.3	36.3	36.3	36.3

Table 9.15: Predicted Noise Levels at nearby Residential Properties, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H23	23.5	23.5	23.5	26.2	30.3	34.0	36.1	36.4	36.4	36.4	36.4	36.4
H24	24.8	24.8	24.8	27.5	31.5	35.3	37.4	37.7	37.7	37.7	37.7	37.7
H25	25.0	25.0	25.0	27.7	31.8	35.5	37.6	37.9	37.9	37.9	37.9	37.9
H26	23.1	23.1	23.1	25.8	29.8	33.6	35.7	36.0	36.0	36.0	36.0	36.0
H27	24.6	24.6	24.6	27.3	31.3	35.1	37.1	37.5	37.5	37.5	37.5	37.5
H28	24.1	24.1	24.1	26.8	30.9	34.6	36.7	37.0	37.0	37.0	37.0	37.0
H29	22.1	22.1	22.1	24.8	28.9	32.6	34.7	35.0	35.0	35.0	35.0	35.0
H30	23.2	23.2	23.2	25.9	29.9	33.7	35.7	36.0	36.1	36.1	36.1	36.1
H31	22.3	22.3	22.3	25.0	29.0	32.8	34.9	35.2	35.2	35.2	35.2	35.2
H32	22.5	22.5	22.5	25.2	29.2	33.0	35.0	35.3	35.4	35.4	35.4	35.4
H33	18.9	18.9	18.9	21.6	25.6	29.4	31.5	31.8	31.8	31.8	31.8	31.8
H34	27.6	27.6	27.6	30.3	34.4	38.1	40.2	40.5	40.5	40.5	40.5	40.5
H35	23.1	23.1	23.1	25.8	29.8	33.6	35.6	36.0	36.0	36.0	36.0	36.0
H36	21.2	21.2	21.2	23.9	27.9	31.7	33.8	34.1	34.1	34.1	34.1	34.1
H37	19.3	19.3	19.3	22.0	26.0	29.8	31.9	32.2	32.2	32.2	32.2	32.2
H38	23.3	23.3	23.3	26.0	30.0	33.8	35.9	36.2	36.2	36.2	36.2	36.2
H39	26.5	26.5	26.5	29.2	33.3	37.0	39.1	39.4	39.4	39.4	39.4	39.4
H40	23.5	23.5	23.5	26.2	30.2	34.0	36.1	36.4	36.4	36.4	36.4	36.4
H41	20.2	20.2	20.2	22.9	26.9	30.7	32.7	33.1	33.1	33.1	33.1	33.1
H42	20.9	20.9	20.9	23.6	27.6	31.4	33.5	33.8	33.8	33.8	33.8	33.8
H43	19.4	19.4	19.4	22.1	26.1	29.9	31.9	32.3	32.3	32.3	32.3	32.3

Table 9.15: Predicted Noise Levels at nearby Residential Properties, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H44	22.7	22.7	22.7	25.4	29.4	33.2	35.2	35.5	35.6	35.6	35.6	35.6
H45	20.6	20.6	20.6	23.3	27.3	31.1	33.2	33.5	33.5	33.5	33.5	33.5
H46	20.0	20.0	20.0	22.7	26.7	30.5	32.5	32.9	32.9	32.9	32.9	32.9
H47	19.9	19.9	19.9	22.6	26.6	30.4	32.5	32.8	32.8	32.8	32.8	32.8
H48	25.0	25.0	25.0	27.7	31.7	35.5	37.6	37.9	37.9	37.9	37.9	37.9
H49	22.6	22.6	22.6	25.3	29.4	33.1	35.2	35.5	35.5	35.5	35.5	35.5
H50	22.1	22.1	22.1	24.8	28.9	32.6	34.7	35.0	35.0	35.0	35.0	35.0
H52	22.7	22.7	22.7	25.4	29.4	33.2	35.2	35.5	35.6	35.6	35.6	35.6
H53	22.5	22.5	22.5	25.2	29.2	33.0	35.0	35.4	35.4	35.4	35.4	35.4
H54	21.9	21.9	21.9	24.6	28.6	32.4	34.5	34.8	34.8	34.8	34.8	34.8
H55	22.3	22.3	22.3	25.0	29.0	32.8	34.9	35.2	35.2	35.2	35.2	35.2
H56	23.2	23.2	23.2	25.9	29.9	33.7	35.7	36.1	36.1	36.1	36.1	36.1
H57	23.4	23.4	23.4	26.1	30.1	33.9	35.9	36.3	36.3	36.3	36.3	36.3
H58	22.9	22.9	22.9	25.6	29.6	33.4	35.5	35.8	35.8	35.8	35.8	35.8
H59	22.9	22.9	22.9	25.6	29.6	33.4	35.5	35.8	35.8	35.8	35.8	35.8
H60	23.0	23.0	23.0	25.7	29.7	33.5	35.5	35.8	35.9	35.9	35.9	35.9
H61	23.0	23.0	23.0	25.7	29.7	33.5	35.6	35.9	35.9	35.9	35.9	35.9
H62	23.2	23.2	23.2	25.8	29.9	33.6	35.7	36.0	36.1	36.1	36.1	36.1
H63	23.0	23.0	23.0	25.6	29.7	33.4	35.5	35.8	35.9	35.9	35.9	35.9
H64	23.0	23.0	23.0	25.7	29.7	33.5	35.5	35.9	35.9	35.9	35.9	35.9
H65	23.0	23.0	23.0	25.7	29.7	33.5	35.6	35.9	35.9	35.9	35.9	35.9
H66	23.0	23.0	23.0	25.7	29.8	33.5	35.6	35.9	35.9	35.9	35.9	35.9

Table 9.15: Predicted Noise Levels at nearby Residential Properties, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H67	23.4	23.4	23.4	26.1	30.2	33.9	36.0	36.3	36.3	36.3	36.3	36.3
H68	27.6	27.6	27.6	30.3	34.3	38.1	40.1	40.4	40.5	40.5	40.5	40.5
H69	27.9	27.9	27.9	30.6	34.6	38.4	40.5	40.8	40.8	40.8	40.8	40.8
H70	26.0	26.0	26.0	28.7	32.8	36.5	38.6	38.9	38.9	38.9	38.9	38.9
H71	21.8	21.8	21.8	24.5	28.6	32.3	34.4	34.7	34.7	34.7	34.7	34.7
H72	17.9	17.9	17.9	20.6	24.6	28.4	30.4	30.8	30.8	30.8	30.8	30.8
H73	26.2	26.2	26.2	28.9	32.9	36.7	38.8	39.1	39.1	39.1	39.1	39.1
H74	26.3	26.3	26.3	28.9	33.0	36.7	38.8	39.1	39.2	39.2	39.2	39.2
H75	25.6	25.6	25.6	28.3	32.3	36.1	38.2	38.5	38.5	38.5	38.5	38.5
H76	25.6	25.6	25.6	28.3	32.4	36.1	38.2	38.5	38.5	38.5	38.5	38.5
H77	25.7	25.7	25.7	28.4	32.4	36.2	38.2	38.5	38.6	38.6	38.6	38.6
H78	26.0	26.0	26.0	28.7	32.8	36.5	38.6	38.9	38.9	38.9	38.9	38.9
H79	26.7	26.7	26.7	29.4	33.5	37.2	39.3	39.6	39.6	39.6	39.6	39.6
H80	24.8	24.8	24.8	27.5	31.5	35.3	37.4	37.7	37.7	37.7	37.7	37.7
H81	25.3	25.3	25.3	28.0	32.0	35.8	37.8	38.2	38.2	38.2	38.2	38.2
H82	24.4	24.4	24.4	27.1	31.1	34.9	36.9	37.2	37.3	37.3	37.3	37.3
H83	24.4	24.4	24.4	27.1	31.1	34.9	36.9	37.2	37.3	37.3	37.3	37.3
H84	23.5	23.5	23.5	26.2	30.2	34.0	36.0	36.3	36.4	36.4	36.4	36.4
H85	21.4	21.4	21.4	24.1	28.2	31.9	34.0	34.3	34.3	34.3	34.3	34.3
H86	21.2	21.2	21.2	23.9	27.9	31.7	33.7	34.0	34.1	34.1	34.1	34.1
H87	21.3	21.3	21.3	24.0	28.0	31.8	33.8	34.1	34.2	34.2	34.2	34.2

Table 9.15: Predicted Noise Levels at nearby Residential Properties, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H88	23.8	23.8	23.8	26.5	30.5	34.3	36.3	36.7	36.7	36.7	36.7	36.7
H89	24.5	24.5	24.5	27.1	31.2	34.9	37.0	37.3	37.4	37.4	37.4	37.4

9.4.23 Noise levels at 31 of the 88 nearest residential properties are below 35 dB(A) level, indicating that the noise immission levels would be regarded as acceptable and the residents amenity as receiving 'sufficient protection' without further assessment requiring to be undertaken.

Acoustic Acceptance Criteria

9.4.24 As stated previously, during daytime periods and at low background noise levels, a lower fixed limit of 35-40 dB(A) is applicable with the exact value dependent upon a number of factors: the number of noise affected residential properties; the potential impact on the power output of the wind farm and the likely duration and level of exposure.

9.4.25 Considering each of the factors recommended by ETSU-R-97 and the guidance provided by the IoA GPG in more detail:

- Number of noise affected residential properties: There are 57 residential properties with maximum predicted noise levels of greater than 35 dB(A) although not all of these are predominantly downwind of the proposed development and this should be considered in the context of the significant social, economic and environmental benefits generated by the proposed development;
- Potential impact on the power output of the wind farm: The proposed development can be considered a medium scale development as it has an indicative rated power output of 33.6 MW should the turbine type considered in the acoustic assessment be installed. A daytime lower limit at the lower end of the range would reduce the amount of energy that could be generated by such a scheme;
- The likely duration and level of exposure: The amount of the time that noise levels of greater than 35 dB(A) are predicted is limited to periods of sufficiently high wind speed. Noise levels would also be reduced when properties are not located downwind of the proposed development.

9.4.26 Despite the explanations presented above indicating that a daytime lower limit towards the middle of the range would potentially be justifiable, RES has adopted a daytime lower limit of 35 dB(A) for the assessment of the proposed development as a conservative measure in consultation with the EHO.

9.4.27 Despite ETSU-R-97 recommending a night-time lower limit of 43 dB(A), a 38 dB(A) lower limit has been adopted for the purposes of this assessment in consultation with the EHO. The resulting criteria are shown in Table 9.16.

Table 9.16: Permissible Noise Level Criteria for Assessment

Time of Day	**Permissible Noise Level**
Day	35 dB(A) for L_B less than 30 dB(A) L_B + 5 dB, for L_B greater than 30 dB(A)
Night	38 dB(A) for L_B less than 33 dB(A) L_B + 5 dB, for L_B greater than 33 dB(A)

9.4.28 The 'best-fit' lines of Charts 3-10 have been used to calculate the acceptable noise limits at the background noise measurement locations. Table 9.17 shows the daytime noise limits and Table 9.18 the night time noise limits.

Table 9.17 – Daytime Noise Limits (dB(A) re 20 μPa)												
House Name	**Standardised 10 m Wind Speed (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Braighmor	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	37.8	40.7	43.3	45.4
Dunhobby	35.0	35.0	35.0	35.0	35.0	35.0	35.7	38.3	41.3	44.7	48.4	52.5
Hopefield	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	36.6	39.9	43.7	48.2
Taldale	35.3	35.5	35.7	36.0	36.5	37.1	38.0	39.1	40.5	42.3	44.4	46.9

Table 9.18 – Night-time Noise Limits (dB(A) re 20 μPa)												
House Name	**Standardised 10 m Wind Speed (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Braighmor	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.2	41.5	45.3
Dunhobby	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	39.7	43.3	47.5	52.2
Hopefield	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	41.2	46.3
Taldale	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.1	40.4	43.3	46.8

9.4.29 The recommendations of ETSU-R-97 state that where there are groups of properties that are likely to have a similar background noise environment, it is appropriate to use data from one representative location as the basis for assessment at the other properties. The survey results inferred to be representative for each property is shown in Table 9.19. The specific choice of noise survey chosen has been made considering the distance to the nearest survey location and the likelihood of experiencing a broadly similar exposure as the survey.

Table 9.19 – Assumed Representative Background Noise Survey Locations		
House ID	**House Name**	**Survey Location**
H1	1 Oust Farm	Hopefield
H2	Oust Farm	Hopefield
H3	2 Oust Farm Cottages	Hopefield
H4	3 Oust Farm Cottages	Hopefield
H5	New House	Hopefield
H6	Bardnaclavan	Hopefield
H7	Srathbofey	Braighmor
H8	5 Stempster Holding	Braighmor
H9	Tobarvale	Braighmor
H10	1 Lythmore Farm Cottage	Braighmor
H11	3 Lythmore Farm Cottage	Braighmor
H12	Lythmore Farm House	Braighmor
H13	South Waass	Hopefield
H14	6 Stempster Holding	Braighmor
H15	River Cottage	Braighmor
H16	Waas Farm	Hopefield
H17	Achnamara	Hopefield

Table 9.19 – Assumed Representative Background Noise Survey Locations		
House ID	**House Name**	**Survey Location**
H18	Fairview	Hopefield
H19	Smith House	Hopefield
H20	Viewfield	Hopefield
H21	Langlands House	Hopefield
H22	Eibihlin	Hopefield
H23	Daibhidh	Hopefield
H24	Strathmore House	Braighmor
H25	Glenburnie	Hopefield
H26	Quarry View	Hopefield
H27	Bramwyn	Hopefield
H28	Oaklands	Hopefield
H29	Amberbanks	Hopefield
H30	Murrayfield	Hopefield
H31	Carron	Hopefield
H32	Kidagach	Hopefield
H33	Burnside	Hopefield
H34	Hopefield	Hopefield
H35	Sharone	Hopefield
H36	Eriador	Hopefield
H37	Caol Argaibh	Hopefield
H38	Briga View	Hopefield
H39	Braighmor	Braighmor
H40	Ornum Cottage	Hopefield
H41	Seaview	Hopefield
H42	Hill Of Forss	Hopefield
H43	Seaview Cottage	Hopefield
H44	Bernessie	Hopefield
H45	Caiplie	Hopefield
H46	The Shiean	Hopefield
H47	Fullerton	Dunhobby
H48	8 Holding	Braighmor
H49	7 Holding	Braighmor
H50	Lochroy	Braighmor
H52	6 Holding	Braighmor
H53	Beechwood	Braighmor
H54	9 Holding	Braighmor
H55	10 Holding	Taldale
H56	Cairnmore	Taldale
H57	Rosedean	Taldale

Table 9.19 – Assumed Representative Background Noise Survey Locations		
House ID	**House Name**	**Survey Location**
H58	1 School Place	Taldale
H59	2 School Place	Taldale
H60	3 School Place	Taldale
H61	4 School Place	Taldale
H62	Schoolhouse	Taldale
H63	5 School Place	Taldale
H64	6 School Place	Taldale
H65	7 School Place	Taldale
H66	8 School Place	Taldale
H67	"Fairview, Roadside"	Taldale
H68	Atlantic View	Taldale
H69	Taldale	Taldale
H70	Burn Of Brims	Taldale
H71	Torigill	Taldale
H72	Scrabster Lodge	Dunhobby
H73	Brims House	Taldale
H74	Annfield	Taldale
H75	Dunhobby	Dunhobby
H76	2 Brims Cottages	Taldale
H77	1 Brims Cottages	Taldale
H78	Thorvik Brims	Dunhobby
H79	Windrift	Taldale
H80	Thusater Farm	Dunhobby
H81	Brimmisa House	Taldale
H82	Thusater Cottage	Dunhobby
H83	Thusater	Dunhobby
H84	Middleton Of Brims	Taldale
H85	Fuaran	Taldale
H86	East Brims	Taldale
H87	Melgedwynell	Taldale
H88	Ornum Farm House 2	Hopefield
H89	Ornum Farm House 1	Hopefield

9.4.30 As recommended in ETSU-R-97, the absolute lower noise limits may be increased up to 45 dB(A) if the occupant of a property has a financial involvement in the wind farm. As such, at H12, H34 and H69 the absolute lower limit has been increased to 45 dB(A).

Acoustic Assessment

9.4.31 An assessment of the proposed development alone has not been undertaken as there are other wind turbines in the vicinity that are already in existence and it is necessary for the criteria to be met cumulatively. An acoustic assessment considering the proposed development along with nearby consented and existing sites is provided in the Potential Cumulative Effects section of this Chapter.

Potential Decommissioning Effects

9.4.32 The noise levels associated with decommissioning are not expected to exceed those predicted due to construction and the same criteria would apply such that no significant effects are anticipated.

Potential Cumulative Effects

Cumulative Construction Noise

9.4.33 Any noise due to the construction of the other sites considered in the cumulative operational noise assessment, the majority of which have already been built, is unlikely to be ongoing at the same time as the construction of the proposed development. In the event that this scenario did occur, the activities associated with single turbine sites would be relatively limited and far enough away so as not to have a cumulative impact.

Cumulative Operational Noise

9.4.34 An assessment of the cumulative acoustic impact of the proposed development in conjunction with the existing Baillie and Forss Wind Farms, along with eight single turbine schemes, has been undertaken in accordance with the guidance on wind farm noise assessment; ETSU-R-97 and the IoA GPG.

9.4.35 ETSU-R-97 states:

"It is clearly unreasonable to suggest that, because a wind farm has been constructed in the vicinity in the past which resulted in increased noise levels at some properties, the residents of those properties are now able to tolerate higher noise levels still. The existing wind farm should not be considered as part of the prevailing background noise."

9.4.36 The locations of the turbines that make up the proposed development, along with the other turbines considered in the cumulative assessment, are shown in Figure 9.2. The planning references for the single turbine schemes are as detailed in Table 9.20.

Table 9.20: Single Turbine Planning Details

Turbine ID	Planning Reference	Status
L1	17/04934/FUL	Consented
A1	17/01450/FUL	Consented
C1	12/01053/FUL	Existing
D1	12/00224/FUL	Existing
E1	11/04131/FUL	Existing
G1	11/03913/FUL	Existing
J1	10/03869/FUL	Existing
I1	10/00012/FULCA	Existing

9.4.37 The residential properties considered in the cumulative assessment are as per those detailed in Table 9.12. The distances to the nearest turbine included in the cumulative assessment are given in Table 9.21.

Table 9.21: Distances from Residential Properties to Nearest Cumulative Turbine

House ID	Distance to nearest Turbine (m)	Nearest Turbine
H1	2127	T1
H2	2128	T1
H3	2099	T1
H4	2094	T1
H5	2069	T1
H6	2486	T3
H7	1737	T1
H8	1270	B21
H9	1401	B15
H10	1493	T1
H11	1479	T1
H12	1339	T1
H13	2085	T5
H14	1137	D1
H15	1049	D1
H16	2061	T5
H17	1444	T5
H18	1315	T5
H19	1455	T5
H20	1277	T5
H21	1486	T5
H22	1411	T5
H23	1385	T5
H24	970	T1
H25	1181	T5
H26	1457	T5
H27	1248	T5
H28	1310	T5
H29	1577	T8
H30	1460	T5
H31	1543	T8
H32	1503	T8
H33	1947	E1
H34	883	T5
H35	1409	T8
H36	1630	T8
H37	1853	E1
H38	1367	T8
H39	907	T1
H40	1327	T8
H41	1746	E1
H42	1644	T8
H43	1785	E1
H44	1408	T8
H45	1644	E1
H46	1661	E1
H47	1591	E1

Table 9.21: Distances from Residential Properties to Nearest Cumulative Turbine

House ID	Distance to nearest Turbine (m)	Nearest Turbine
H48	1002	T2
H49	1291	T2
H50	1314	C1
H52	1287	T2
H53	1313	T2
H54	1402	T2
H55	1360	T2
H56	1240	J1
H57	1202	J1
H58	1259	J1
H59	1257	J1
H60	1248	J1
H61	1237	J1
H62	1215	J1
H63	1234	J1
H64	1229	J1
H65	1223	J1
H66	1217	J1
H67	1150	J1
H68	442	J1
H69	276	J1
H70	567	J1
H71	1277	J1
H72	852	E1
H73	304	J1
H74	290	J1
H75	555	A1
H76	359	J1
H77	357	J1
H78	416	A1
H79	574	A1
H80	263	A1
H81	481	I1
H82	221	A1
H83	221	A1
H84	83	I1
H85	505	I1
H86	565	I1
H87	464	I1
H88	1258	T8
H89	1139	T8

Turbines prefixed ‘T’ are part of the proposed development, those prefixed ‘B’ belong to Baillie, those prefixed ‘F’ belong to Forss. All other prefixes denote single turbine schemes whose associated planning references can be found in Table 9.20.

CUMULATIVE ASSESSMENT METHODOLOGY

9.4.38 ETSU-R-97 recommends that the derived noise limits applicable at nearby residential properties shall relate to the cumulative effects of noise from all wind turbines that may affect a particular location.

9.4.39 The methodology is therefore to:

- Identify appropriate overall ETSU-R-97 noise limits for each noise-sensitive receptor;
- Predict the level of noise resulting from the operation of the turbines being considered in the cumulative assessment without the proposed development;
- Subtract the predicted noise levels calculated in step 2 from the ETSU-R-97 limits identified in step 1. Such a calculation shall provide the limit remaining at each property which the proposed development should not exceed; and
- Compare the predicted noise levels due to the proposed development to the limit calculated in step 3 to determine whether the proposed development complies with ETSU-R-97.

9.4.40 The methodology outlined above is in accordance with the appropriate guidance on cumulative wind farm noise assessment as described in ETSU-R-97 and the IoA GPG.

PREDICTIONS OF NOISE LEVELS AT RESIDENTIAL PROPERTIES

9.4.41 The existing Baillie Wind Farm consists of Nordex N90/2500 machines. Warranted acoustic data for these turbines is taken from the manufacturer's performance specification and an uncertainty of 2 dB has been included. Details used in this analysis are as follows:

- hub height of 65 m;
- rotor diameter of 90 m;
- sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}) as shown in Table 9.22; and
- octave band sound power level data, at the wind speeds where it is available, as shown in Table 9.23.

Table 9.22: A-Weighted Sound Power Levels (dB(A) re 1 pW) for the Nordex N90/2500

Standardised 10 m Height Wind Speed, v10 (ms-1)	Warranted	Warranted Plus Uncertainty
1	93.5	95.5
2	93.5	95.5
3	93.5	95.5
4	97.0	99.0
5	100.5	102.5
6	103.5	105.5
7	104.8	106.8
8	105.4	107.4
9	105.5	107.5
10	105.5	107.5
11	105.5	107.5
12	105.5	107.5

Table 9.23: Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at 8 ms^{-1} for the Nordex N90/2500	
Octave Band (Hz)	**Sound Power Level, dB(A)**
63	92.6
125	96.7
250	101.1
500	101.5
1000	100.0
2000	98.9
4000	94.9
8000	87.3
OVERALL	107.4

9.4.42 The existing Baillie Wind Farm is conditioned to the noise limits specified in its Decision Notice[19]. These noise limits are used to calculate the worst case predicted noise levels using the 'Controlling Property' method outlined in the IoA GPG as follows:

- Predictions are made using appropriate acoustic emission data, as specified above;
- Comparison is made between the predictions and the limits from the planning conditions in order to identify the controlling property; and
- The predictions are scaled by the minimum margin between the predictions and the conditioned noise limits at the controlling property. This yields predicted noise levels which do not exceed the conditioned noise limits at any property and are equal to the conditioned noise limit at the controlling property.

9.4.43 The existing Forss Wind Farm was developed in two phases and consists of Siemens SWT-1.3-62 machines. Warranted acoustic data for these turbines is provided by the manufacturer and includes an allowance for uncertainty. Details used in this analysis are as follows:

- hub height of 47 m;
- rotor diameter of 62 m;
- sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}) as shown in Table 9.24; and
- octave band sound power level data, at the wind speeds where it is available, as shown in Table 9.25.

[19] The Scottish Government, Enterprise, Energy and Tourism Directorate, Renewable Energy Division, Consent for Baillie Wind Farm, January 2010, Highland Council Application Reference 04/00342/S36CA

Table 9.24: A-Weighted Sound Power Levels (dB(A) re 1 pW) for the Siemens SWT-1.3-62		
Standardised 10 m Height Wind Speed, v_{10} (ms^{-1})	**Phase 1**	**Phase 2**
1	100.0	102.0
2	100.0	102.0
3	100.0	102.0
4	100.0	102.0
5	100.0	102.0
6	100.0	102.0
7	100.9	102.5
8	101.0	103.0
9	102.6	104.3
10	103.5	105.5
11	103.5	105.5
12	103.5	105.5

Table 9.25: Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at 8 ms^{-1} for the Siemens SWT-1.3-62		
Octave Band (Hz)	**Phase 1**	**Phase 2**
63	85.1	87.1
125	91.7	93.7
250	94.6	96.6
500	93.7	95.7
1000	93.6	95.6
2000	93.9	95.9
4000	88.3	90.3
8000	80.1	82.1
OVERALL	101.0	103.0

9.4.44 The existing Forss Wind Farm is conditioned to the noise limits specified in its Decision Notice[20]. These noise limits are used to calculate the worst case predicted noise levels using the 'Controlling Property' method outlined in the IoA GPG and described above.

9.4.45 Details of the existing and consented single turbine schemes are as follows:

- Turbine types and hub heights as detailed in Table 9.26;

[20] The Highland Council, Consent for Forss Wind Farm, October 2006, Application Reference 01/00380/FULCA

- sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}) as shown in Table 9.27; and
- octave band sound power level data, at the wind speeds where it is available, as shown in Table 9.28.

Table 9.26: Single Turbine Types and Dimensions

Turbine ID	Turbine Type	Hub Height (m)
L1	Enercon E70 E4 2.3MW	64.5
A1	Harbon HWT60	23.4
C1	Xzeres 442SR 10kW	15.9
D1	Xzeres 442SR 10kW	15.9
E1	Harbon HWT60	18.0
G1	Harbon HWT60	18.0
J1	Proven P35	15.0
I1	Xzeres 442SR 10kW	9.0

Table 9.27: A-Weighted Sound Power Levels (dB(A) re 1 pW) for Single Turbines

Standardised 10 m Height Wind Speed, v_{10} (ms^{-1})	L1	A1	C1	D1	E1	G1	J1	I1
1	89.4	83.8	88.0	88.0	83.8	83.8	89.2	88.0
2	89.4	83.8	88.0	88.0	83.8	83.8	89.2	88.0
3	89.4	83.8	88.0	88.0	83.8	83.8	89.2	88.0
4	89.4	84.0	88.0	88.0	83.8	83.8	89.2	88.0
5	91.9	85.6	88.2	88.2	85.3	85.3	91.2	88.1
6	96.7	87.1	88.3	88.3	86.7	86.7	93.1	88.2
7	101.1	88.7	88.5	88.5	88.2	88.2	95.1	88.4
8	104.2	90.2	88.7	88.7	89.7	89.7	97.0	88.6
9	106.0	91.8	88.9	88.9	91.2	91.2	98.9	88.7
10	106.0	93.3	89.1	89.1	92.7	92.7	100.9	88.9
11	106.0	94.9	89.2	89.2	94.1	94.1	102.8	89.0
12	106.0	95.6	89.4	89.4	95.6	95.6	104.8	89.2

Table 9.28: Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at 8 ms^{-1} for Single Turbines								
Octave Band (Hz)	**L1**	**A1**	**C1**	**D1**	**E1**	**G1**	**J1**	**I1**
63	88.1	87.2	65.3	65.3	86.7	86.7	73.8	65.2
125	96.7	84.0	76.5	76.5	83.5	83.5	79.6	76.4
250	99.2	80.2	82.1	82.1	79.7	79.7	85.6	82.0
500	97.8	77.6	82.3	82.3	77.1	77.1	90.8	82.2
1000	96.3	75.7	83.2	83.2	75.2	75.2	92.4	83.1
2000	93.0	73.7	80.6	80.6	73.2	73.2	89.3	80.5
4000	86.1	76.4	74.6	74.6	75.9	75.9	88.6	74.5
8000	78.5	70.1	69.7	69.7	69.6	69.6	74.4	69.6
OVERALL	104.2	90.2	88.7	88.7	89.7	89.7	97.0	88.6

9.4.46 The existing and consented single turbine schemes are conditioned to the noise limits specified in their Decision Notices[21]. These noise limits are used to calculate the worst case predicted noise levels using the 'Controlling Property' method outlined in the IoA GPG and described above. Where no noise limits are specified, or no Decision Notice is available, the predicted noise levels calculated using the turbine specified in any information available on the Highland Council planning portal are used without scaling.

9.4.47 A check on whether significant headroom (defined as 5 – 10 dB by the IoA GPG) exists between the predicted noise levels and the conditioned limits has been carried out for the consented and existing sites considered in the cumulative assessment. Rather than assuming that the site could be operating right up to its consented limit, which would be unrealistic where significant headroom exists, an additional 3 dB buffer has been added to the predicted noise levels for use in the cumulative assessment in these circumstances. This approach has been agreed in consultation with the EHO (Table 9.1).

9.4.48 The predicted noise levels at the nearest residential properties due to the operation of the sites considered in the cumulative assessment, excluding the proposed development, are detailed in Tables 9.29 and 9.30 for day and night time periods respectively. The cumulative predicted noise levels are different for day and night as some of the sites considered are conditioned to different limits for the two periods and the predicted noise levels have been scaled to these limits. The maximum cumulative noise level is predicted to be 42.9 dB(A) at H84 during both day and night time periods.

[21] The Highland Council, Decision Notice for Application Reference 17/04934/FUL, dated June 2019
The Highland Council, Decision Notice for Application Reference 17/01450/FUL, dated January 2018
The Highland Council, Decision Notice for Application Reference 12/01053/FUL, dated July 2012
The Highland Council, Decision Notice for Application Reference 12/00224/FUL, dated July 2012
The Highland Council, Decision Notice for Application Reference 11/04131/FUL, dated December 2011
The Highland Council, Decision Notice for Application Reference 11/03913/FUL, dated February 2012
The Highland Council, Decision Notice for Application Reference 10/03869/FUL, dated November 2010

9.4.49 The methodology used to calculate the cumulative predicted noise levels makes the assumption that the properties in question are downwind of all of the considered sites simultaneously, which is not the case in practice. These downwind cumulative predicted noise levels are conservative due to the reductions in noise that would be expected when a property is situated crosswind or upwind of a noise source.

Table 9.29: Cumulative Downwind Predicted Noise Levels during the Day, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H1	23.9	23.9	24.1	23.9	25.0	26.2	27.9	29.7	30.4	30.6	31.9	32.4
H2	23.8	23.8	24.0	23.8	24.9	26.2	27.8	29.7	30.4	30.5	31.8	32.3
H3	24.0	24.0	24.2	24.0	25.1	26.3	28.0	29.8	30.5	30.7	32.0	32.5
H4	24.0	24.0	24.2	24.0	25.1	26.3	28.0	29.8	30.6	30.7	32.0	32.5
H5	24.1	24.1	24.3	24.1	25.2	26.4	28.1	29.9	30.7	30.8	32.1	32.6
H6	19.3	19.3	19.7	19.9	21.1	22.1	23.5	25.2	26.0	26.4	27.5	28.1
H7	26.4	26.4	26.6	26.5	27.6	28.8	30.4	32.3	33.0	33.2	34.4	34.9
H8	28.6	28.6	28.7	28.5	29.5	30.8	32.5	34.4	35.1	35.2	36.6	37.0
H9	27.6	27.6	27.7	27.5	28.5	29.8	31.5	33.4	34.1	34.2	35.6	36.0
H10	27.0	27.0	27.3	27.3	28.4	29.5	31.1	32.9	33.6	33.8	35.0	35.5
H11	27.0	27.0	27.3	27.3	28.4	29.5	31.1	32.9	33.6	33.8	35.0	35.5
H12	27.2	27.2	27.5	27.5	28.7	29.8	31.3	33.0	33.8	34.0	35.2	35.6
H13	19.6	19.7	20.0	20.2	21.4	22.4	23.9	25.5	26.3	26.7	27.8	28.4
H14	27.7	27.7	27.9	27.7	28.8	30.0	31.6	33.5	34.2	34.3	35.6	36.1
H15	27.5	27.5	27.7	27.6	28.7	29.9	31.5	33.3	34.0	34.2	35.4	35.9
H16	16.7	16.8	17.3	17.7	19.1	19.9	21.2	22.7	23.6	24.2	25.2	25.8
H17	19.6	19.7	20.1	20.4	21.7	22.6	24.0	25.6	26.5	26.9	27.9	28.5
H18	20.4	20.4	20.8	21.1	22.4	23.4	24.8	26.3	27.2	27.6	28.7	29.2
H19	19.0	19.1	19.6	20.1	21.5	22.3	23.6	25.0	26.0	26.5	27.5	28.0
H20	20.4	20.4	20.8	21.2	22.5	23.4	24.8	26.3	27.2	27.6	28.7	29.2
H21	18.7	18.8	19.3	19.9	21.2	22.0	23.3	24.7	25.7	26.3	27.2	27.8
H22	18.8	18.9	19.4	20.0	21.3	22.1	23.4	24.8	25.8	26.4	27.3	27.9
H23	18.8	18.9	19.5	20.0	21.4	22.2	23.5	24.8	25.8	26.4	27.3	27.9
H24	27.5	27.5	28.0	28.3	29.5	30.4	31.8	33.3	34.2	34.5	35.5	35.9
H25	20.2	20.3	20.7	21.1	22.4	23.3	24.7	26.2	27.1	27.6	28.6	29.1
H26	18.5	18.5	19.1	19.7	21.1	21.9	23.1	24.5	25.5	26.1	27.0	27.6
H27	19.3	19.4	19.9	20.4	21.8	22.6	23.9	25.3	26.2	26.8	27.7	28.4
H28	19.0	19.1	19.6	20.2	21.5	22.3	23.6	25.0	26.0	26.6	27.5	28.1
H29	18.3	18.4	18.9	19.5	20.9	21.7	23.0	24.3	25.3	26.0	26.9	27.5
H30	18.5	18.6	19.1	19.7	21.1	21.9	23.1	24.5	25.5	26.1	27.0	27.7
H31	18.3	18.4	18.9	19.5	20.9	21.7	23.0	24.3	25.3	25.9	26.9	27.5
H32	18.2	18.2	18.8	19.4	20.8	21.6	22.8	24.2	25.2	25.9	26.7	27.4

Table 9.29: Cumulative Downwind Predicted Noise Levels during the Day, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H33	17.4	17.5	18.0	18.6	20.0	20.8	22.1	23.4	24.5	25.3	26.3	27.1
H34	20.7	20.7	21.2	21.6	22.9	23.8	25.1	26.6	27.5	28.0	29.0	29.6
H35	18.3	18.4	19.0	19.6	21.0	21.8	23.0	24.3	25.3	26.0	26.9	27.6
H36	17.6	17.6	18.2	18.9	20.3	21.0	22.2	23.5	24.6	25.3	26.2	26.9
H37	17.5	17.5	18.0	18.6	20.1	20.9	22.1	23.4	24.5	25.4	26.3	27.2
H38	18.3	18.4	19.0	19.6	21.0	21.8	23.0	24.3	25.3	26.0	26.9	27.6
H39	27.1	27.2	27.8	28.3	29.6	30.3	31.6	33.0	33.9	34.4	35.3	35.6
H40	18.4	18.5	19.1	19.7	21.1	21.9	23.1	24.4	25.5	26.2	27.0	27.7
H41	17.8	17.9	18.4	19.0	20.4	21.2	22.5	23.8	24.9	25.7	26.7	27.6
H42	17.5	17.5	18.1	18.8	20.2	21.0	22.2	23.5	24.6	25.3	26.2	26.9
H43	17.5	17.6	18.1	18.7	20.1	21.0	22.2	23.5	24.6	25.5	26.4	27.3
H44	18.2	18.2	18.8	19.4	20.8	21.6	22.9	24.2	25.2	25.9	26.8	27.5
H45	17.4	17.5	18.0	18.7	20.1	20.9	22.1	23.4	24.4	25.2	26.1	26.8
H46	17.6	17.7	18.2	18.8	20.3	21.1	22.3	23.6	24.7	25.6	26.6	27.5
H47	17.7	17.7	18.2	18.9	20.3	21.1	22.4	23.6	24.8	25.7	26.7	27.6
H48	27.1	27.2	27.8	28.5	29.9	30.6	31.8	33.1	34.1	34.6	35.4	35.7
H49	27.2	27.3	28.0	28.8	30.2	30.9	32.1	33.2	34.3	34.9	35.6	35.9
H50	27.2	27.3	28.1	28.9	30.3	30.9	32.1	33.2	34.3	34.9	35.5	35.8
H52	27.4	27.5	28.2	29.1	30.6	31.2	32.4	33.5	34.5	35.2	35.8	36.2
H53	27.3	27.4	28.1	29.0	30.4	31.1	32.2	33.4	34.4	35.1	35.7	36.1
H54	27.3	27.4	28.3	29.2	30.7	31.2	32.4	33.5	34.6	35.2	35.8	36.2
H55	27.1	27.2	28.1	29.1	30.6	31.2	32.3	33.3	34.4	35.1	35.7	36.0
H56	27.0	27.1	27.9	28.8	30.3	30.9	32.0	33.0	34.1	34.8	35.4	35.8
H57	27.0	27.1	27.8	28.8	30.3	30.8	31.9	32.9	34.0	34.7	35.3	35.7
H58	27.0	27.1	27.9	28.9	30.4	30.9	32.0	33.0	34.1	34.8	35.4	35.8
H59	27.0	27.1	27.9	28.9	30.4	30.9	32.0	33.0	34.1	34.8	35.4	35.8
H60	27.0	27.1	27.9	28.9	30.4	30.9	32.0	33.0	34.1	34.8	35.4	35.8
H61	27.0	27.1	27.9	28.8	30.4	30.9	32.0	33.0	34.1	34.8	35.4	35.8
H62	27.0	27.1	27.9	28.8	30.3	30.8	31.9	32.9	34.0	34.8	35.3	35.7
H63	27.0	27.1	27.9	28.9	30.4	30.9	32.0	33.0	34.1	34.8	35.4	35.8
H64	27.0	27.1	27.9	28.8	30.4	30.9	32.0	32.9	34.1	34.8	35.4	35.8
H65	27.0	27.1	27.9	28.8	30.4	30.9	32.0	32.9	34.1	34.8	35.4	35.8
H66	26.9	27.1	27.9	28.8	30.3	30.9	32.0	32.9	34.1	34.8	35.3	35.8
H67	26.9	27.1	27.8	28.7	30.2	30.8	31.9	32.8	34.0	34.7	35.3	35.7
H68	30.3	30.3	30.6	31.0	32.7	33.0	33.6	34.2	34.9	35.5	36.0	36.5
H69	34.0	34.0	34.1	34.3	36.0	36.2	36.5	36.9	37.4	37.8	38.3	38.8

Table 9.29: Cumulative Downwind Predicted Noise Levels during the Day, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H70	28.6	28.6	29.0	29.5	31.2	31.5	32.3	33.0	33.9	34.5	35.1	35.6
H71	27.0	27.1	28.0	29.0	30.6	31.1	32.1	33.0	34.2	34.9	35.5	35.8
H72	17.7	17.7	18.1	18.6	20.1	21.1	22.4	23.7	24.9	25.9	27.0	28.2
H73	34.0	34.0	34.1	34.3	36.0	36.3	36.9	37.5	38.2	39.0	39.8	40.7
H74	34.6	34.6	34.7	34.8	36.5	36.9	37.4	38.1	38.8	39.6	40.4	41.4
H75	24.4	24.5	24.8	25.4	26.9	27.9	29.1	30.4	31.3	32.0	32.6	33.9
H76	33.1	33.2	33.3	33.5	35.1	35.5	36.1	36.9	37.7	38.5	39.4	40.3
H77	33.2	33.2	33.4	33.6	35.1	35.6	36.2	36.9	37.8	38.6	39.4	40.4
H78	25.9	26.0	26.3	26.8	28.3	29.3	30.6	31.9	32.7	33.2	33.7	35.0
H79	27.5	27.5	27.8	28.2	29.7	30.6	31.7	32.9	33.7	34.3	34.9	36.1
H80	28.6	28.6	28.8	29.2	30.7	31.9	33.3	34.7	35.3	35.6	35.9	37.4
H81	29.6	29.7	29.9	30.2	31.4	32.2	33.3	34.3	35.4	36.3	37.2	38.4
H82	29.7	29.7	29.9	30.3	31.8	33.1	34.5	35.9	36.5	36.7	36.9	38.6
H83	29.7	29.7	29.9	30.3	31.8	33.1	34.5	35.9	36.5	36.7	36.9	38.6
H84	40.7	40.7	40.7	40.7	40.9	41.1	41.3	41.6	41.9	42.2	42.5	42.9
H85	28.3	28.3	28.7	29.3	30.5	31.0	31.8	32.7	33.6	34.4	35.0	35.7
H86	27.7	27.8	28.2	28.8	30.1	30.6	31.5	32.3	33.3	34.0	34.7	35.3
H87	28.5	28.5	28.9	29.4	30.6	31.0	31.8	32.7	33.6	34.3	34.9	35.6
H88	18.6	18.7	19.2	19.8	21.2	22.0	23.3	24.6	25.6	26.3	27.2	28.0
H89	19.3	19.4	19.8	20.4	21.7	22.6	23.9	25.3	26.2	26.9	27.9	28.6

Table 9.30: Cumulative Downwind Predicted Noise Levels at Night, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H1	24.2	24.2	24.2	27.3	29.5	29.7	30.0	30.2	30.4	31.4	31.9	31.9
H2	24.1	24.1	24.1	27.2	29.4	29.6	29.9	30.1	30.4	31.4	31.8	31.9
H3	24.3	24.3	24.3	27.4	29.6	29.8	30.1	30.3	30.5	31.5	32.0	32.0
H4	24.3	24.3	24.3	27.4	29.6	29.8	30.1	30.3	30.6	31.6	32.0	32.1
H5	24.4	24.4	24.4	27.5	29.7	29.9	30.2	30.4	30.7	31.7	32.1	32.2
H6	19.9	19.9	19.9	22.5	24.6	24.9	25.3	25.5	26.0	27.1	27.5	27.7
H7	26.8	26.8	26.8	29.8	32.1	32.2	32.6	32.7	33.0	34.0	34.4	34.5
H8	28.8	28.8	28.8	32.1	34.3	34.4	34.8	34.9	35.1	36.1	36.6	36.6
H9	27.8	27.8	27.8	31.0	33.3	33.4	33.7	33.9	34.1	35.1	35.6	35.6
H10	27.5	27.5	27.5	30.4	32.6	32.8	33.1	33.3	33.6	34.6	35.0	35.1
H11	27.5	27.5	27.5	30.4	32.6	32.8	33.1	33.3	33.6	34.6	35.0	35.1
H12	27.7	27.7	27.7	30.5	32.7	32.9	33.3	33.5	33.8	34.8	35.2	35.2

Table 9.30: Cumulative Downwind Predicted Noise Levels at Night, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H13	20.2	20.2	20.2	22.8	24.9	25.2	25.7	25.9	26.3	27.4	27.8	28.0
H14	28.0	28.0	28.0	31.1	33.3	33.4	33.8	33.9	34.2	35.2	35.6	35.7
H15	27.9	27.9	27.9	30.8	33.0	33.2	33.6	33.7	34.0	35.0	35.4	35.5
H16	17.6	17.6	17.6	19.5	21.4	22.0	22.5	22.9	23.6	24.6	25.2	25.6
H17	20.3	20.3	20.3	22.6	24.6	25.1	25.6	25.9	26.5	27.5	27.9	28.3
H18	21.1	21.1	21.1	23.4	25.4	25.8	26.3	26.6	27.2	28.2	28.7	28.9
H19	19.9	19.9	19.9	21.9	23.9	24.4	24.9	25.3	26.0	27.0	27.5	27.8
H20	21.1	21.1	21.1	23.4	25.4	25.8	26.3	26.6	27.2	28.2	28.7	29.0
H21	19.6	19.6	19.6	21.6	23.5	24.0	24.6	25.0	25.7	26.7	27.2	27.6
H22	19.7	19.7	19.7	21.6	23.5	24.1	24.7	25.1	25.8	26.8	27.3	27.7
H23	19.8	19.8	19.8	21.7	23.5	24.1	24.7	25.1	25.8	26.8	27.3	27.7
H24	28.2	28.2	28.2	30.7	32.7	33.1	33.5	33.7	34.2	35.2	35.5	35.6
H25	21.0	21.0	21.0	23.2	25.2	25.6	26.2	26.5	27.1	28.1	28.6	28.9
H26	19.4	19.4	19.4	21.2	23.0	23.7	24.3	24.7	25.5	26.5	27.0	27.4
H27	20.2	20.2	20.2	22.1	24.0	24.6	25.2	25.5	26.2	27.3	27.7	28.1
H28	19.9	19.9	19.9	21.8	23.7	24.3	24.8	25.3	26.0	27.0	27.5	27.9
H29	19.3	19.3	19.3	21.1	22.9	23.6	24.2	24.6	25.3	26.4	26.9	27.3
H30	19.4	19.4	19.4	21.2	23.0	23.7	24.3	24.7	25.5	26.5	27.0	27.5
H31	19.3	19.3	19.3	21.0	22.9	23.5	24.1	24.6	25.3	26.3	26.9	27.3
H32	19.1	19.1	19.1	20.8	22.6	23.3	23.9	24.4	25.2	26.2	26.7	27.2
H33	18.3	18.3	18.3	19.8	21.6	22.4	23.0	23.6	24.5	25.6	26.3	27.0
H34	21.5	21.5	21.5	23.6	25.5	26.0	26.5	26.9	27.5	28.5	29.0	29.4
H35	19.3	19.3	19.3	20.9	22.7	23.4	24.1	24.5	25.3	26.4	26.9	27.4
H36	18.6	18.6	18.6	20.1	21.9	22.6	23.2	23.8	24.6	25.6	26.2	26.7
H37	18.4	18.4	18.4	19.8	21.5	22.3	23.0	23.6	24.5	25.6	26.3	27.1
H38	19.3	19.3	19.3	20.9	22.7	23.4	24.0	24.5	25.3	26.4	26.9	27.4
H39	28.1	28.1	28.1	30.2	32.2	32.7	33.1	33.3	33.9	34.9	35.3	35.3
H40	19.4	19.4	19.4	21.0	22.8	23.5	24.1	24.6	25.5	26.5	27.0	27.6
H41	18.7	18.7	18.7	20.1	21.8	22.6	23.4	24.0	24.9	26.0	26.7	27.5
H42	18.5	18.5	18.5	19.9	21.7	22.5	23.2	23.7	24.6	25.6	26.2	26.8
H43	18.4	18.4	18.4	19.8	21.5	22.3	23.1	23.7	24.6	25.7	26.4	27.2
H44	19.1	19.1	19.1	20.7	22.4	23.2	23.9	24.4	25.2	26.2	26.8	27.4
H45	18.4	18.4	18.4	19.8	21.5	22.3	23.0	23.6	24.4	25.5	26.1	26.7
H46	18.5	18.5	18.5	19.7	21.4	22.3	23.1	23.8	24.7	25.9	26.6	27.4
H47	18.6	18.6	18.6	19.7	21.4	22.3	23.1	23.8	24.8	25.9	26.7	27.5
H48	28.2	28.2	28.2	30.1	32.0	32.6	33.1	33.4	34.1	35.0	35.4	35.5

Table 9.30: Cumulative Downwind Predicted Noise Levels at Night, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H49	28.4	28.4	28.4	30.1	31.8	32.5	33.1	33.5	34.3	35.3	35.6	35.7
H50	28.5	28.5	28.5	30.1	31.8	32.6	33.2	33.5	34.3	35.3	35.5	35.6
H52	28.7	28.7	28.7	30.2	31.9	32.7	33.3	33.7	34.5	35.5	35.8	36.0
H53	28.6	28.6	28.6	30.1	31.8	32.6	33.2	33.6	34.4	35.4	35.7	35.9
H54	28.7	28.7	28.7	30.1	31.8	32.7	33.3	33.7	34.6	35.6	35.8	36.0
H55	28.6	28.6	28.6	29.8	31.4	32.4	33.1	33.4	34.4	35.4	35.7	35.9
H56	28.4	28.4	28.4	29.5	31.1	32.1	32.7	33.1	34.1	35.0	35.4	35.6
H57	28.3	28.3	28.3	29.5	31.1	32.0	32.7	33.1	34.0	35.0	35.3	35.6
H58	28.4	28.4	28.4	29.5	31.2	32.1	32.8	33.2	34.1	35.1	35.4	35.7
H59	28.4	28.4	28.4	29.5	31.1	32.1	32.8	33.2	34.1	35.1	35.4	35.7
H60	28.4	28.4	28.4	29.5	31.1	32.1	32.7	33.1	34.1	35.1	35.4	35.6
H61	28.4	28.4	28.4	29.5	31.1	32.1	32.7	33.1	34.1	35.1	35.4	35.6
H62	28.3	28.3	28.3	29.5	31.1	32.0	32.7	33.1	34.0	35.0	35.3	35.6
H63	28.4	28.4	28.4	29.5	31.1	32.1	32.7	33.1	34.1	35.1	35.4	35.6
H64	28.4	28.4	28.4	29.5	31.1	32.0	32.7	33.1	34.1	35.0	35.4	35.6
H65	28.4	28.4	28.4	29.5	31.1	32.0	32.7	33.1	34.1	35.0	35.4	35.6
H66	28.4	28.4	28.4	29.5	31.1	32.0	32.7	33.1	34.1	35.0	35.3	35.6
H67	28.3	28.3	28.3	29.4	31.0	31.9	32.6	33.0	34.0	34.9	35.3	35.6
H68	30.8	30.8	30.8	31.3	33.0	33.6	33.9	34.3	34.9	35.7	36.0	36.4
H69	34.2	34.2	34.2	34.4	36.2	36.5	36.7	37.0	37.4	37.9	38.3	38.7
H70	29.3	29.3	29.3	30.0	31.7	32.3	32.8	33.2	33.9	34.7	35.1	35.5
H71	28.5	28.5	28.5	29.5	31.0	32.1	32.8	33.2	34.2	35.2	35.5	35.7
H72	18.3	18.3	18.3	19.1	20.7	21.8	22.8	23.8	24.9	26.0	27.0	28.1
H73	34.2	34.2	34.2	34.4	36.1	36.6	37.0	37.5	38.2	39.0	39.8	40.6
H74	34.7	34.7	34.7	34.9	36.6	37.0	37.5	38.1	38.8	39.7	40.4	41.4
H75	25.1	25.1	25.1	25.6	27.1	28.3	29.4	30.5	31.3	32.1	32.6	33.8
H76	33.4	33.4	33.4	33.6	35.2	35.7	36.3	36.9	37.7	38.6	39.4	40.3
H77	33.5	33.5	33.5	33.7	35.2	35.8	36.4	37.0	37.8	38.6	39.4	40.4
H78	26.5	26.5	26.5	27.0	28.4	29.7	30.8	31.9	32.7	33.3	33.7	35.0
H79	28.0	28.0	28.0	28.4	29.8	30.9	31.9	32.9	33.7	34.4	34.9	36.1
H80	28.9	28.9	28.9	29.3	30.8	32.1	33.4	34.7	35.3	35.6	35.9	37.4
H81	30.0	30.0	30.0	30.3	31.6	32.6	33.5	34.4	35.4	36.3	37.2	38.4
H82	30.0	30.0	30.0	30.3	31.8	33.2	34.5	35.9	36.5	36.7	36.9	38.6
H83	30.0	30.0	30.0	30.3	31.8	33.2	34.5	35.9	36.5	36.7	36.9	38.6
H84	40.7	40.7	40.7	40.7	40.9	41.1	41.4	41.6	41.9	42.2	42.5	42.9
H85	29.0	29.0	29.0	29.5	30.7	31.6	32.2	32.8	33.6	34.5	35.0	35.6

Table 9.30: Cumulative Downwind Predicted Noise Levels at Night, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H86	28.5	28.5	28.5	29.1	30.4	31.2	31.9	32.4	33.3	34.2	34.7	35.3
H87	29.1	29.1	29.1	29.6	30.8	31.6	32.2	32.7	33.6	34.5	34.9	35.6
H88	19.6	19.6	19.6	21.1	22.9	23.7	24.3	24.8	25.6	26.7	27.2	27.8
H89	20.1	20.1	20.1	21.9	23.7	24.4	25.0	25.5	26.2	27.3	27.9	28.4

9.4.50 As downwind cumulative predicted noise levels are known to be conservative, directional attenuation factors can be accounted for in order to calculate more realistic cumulative noise levels. This results in sets of separate cumulative noise levels by direction sector but these can be combined by weighting the results by the proportion of the time that the wind is expected to come from each direction. This puts the cumulative noise levels on the same basis as the background noise data used to derive the noise limits in that they both encompass data from a range of wind directions.

9.4.51 The directional attenuation factors adopted are detailed in Table 9.31. These are consistent with the recommendations of the IoA GPG, with reductions in noise of 2 dB(A) when a receiver is crosswind, and 10 dB(A) when a receiver is upwind of a noise source respectively and a polynomial interpolation in the intermediate directions. The IoA GPG goes on to state that such reductions would only come into play gradually at distances of between five and ten tip heights. As such, the attenuation factors applied have been adjusted by the separation distance between the source and receiver accordingly.

Table 9.31: Directional Attenuation Factors	
Directional Offset from Directly Downwind (°)	**Directional Attenuation Factor (dB)**
0	0
30	0
60	0
90	-2
120	-6.7
150	-9.3
180	-10
210	-9.3
240	-6.7
270	-2
300	0
330	0

9.4.52 The expected long-term wind rose, showing the proportion of the time that the wind is predicted to blow from each direction sector is shown in Table 9.32. The resulting, directionally weighted, cumulative predicted noise levels (without the proposed development) are shown in Tables 9.33 and 9.34 for day and night time periods respectively.

Table 9.32: Long-Term Wind Rose

Directional Sector (°)	Frequency (%)
0	7
30	4
60	4
90	4
120	9
150	11
180	9
210	8
240	12
270	13
300	11
330	8

Table 9.33: Directional Cumulative Predicted Noise Levels during the Day, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H1	22.2	22.3	22.5	23.1	24.4	25.7	27.4	28.8	29.1	29.3	31.2	31.9
H2	22.2	22.2	22.4	23.1	24.3	25.6	27.3	28.7	29.1	29.2	31.2	31.8
H3	22.3	22.4	22.6	23.2	24.5	25.8	27.5	28.9	29.2	29.4	31.3	32.0
H4	22.3	22.4	22.6	23.3	24.5	25.8	27.5	28.9	29.3	29.4	31.4	32.0
H5	22.4	22.5	22.7	23.4	24.6	25.9	27.6	29.0	29.4	29.5	31.5	32.1
H6	17.7	17.8	18.2	19.0	20.1	21.2	22.7	24.1	24.6	24.9	26.6	27.3
H7	24.8	24.9	25.1	25.8	27.0	28.3	30.0	31.3	31.8	31.9	33.8	34.5
H8	27.0	27.0	27.1	27.8	29.0	30.4	32.1	33.6	33.9	34.0	36.0	36.7
H9	26.0	26.1	26.2	26.8	28.0	29.4	31.1	32.6	33.0	33.1	35.0	35.7
H10	25.5	25.5	25.8	26.6	27.7	28.9	30.6	31.9	32.4	32.6	34.4	35.0
H11	25.5	25.5	25.8	26.6	27.7	28.9	30.6	31.9	32.4	32.6	34.4	35.0
H12	25.7	25.7	26.0	26.8	28.0	29.1	30.7	32.1	32.6	32.8	34.6	35.2
H13	18.1	18.2	18.6	19.4	20.5	21.6	23.2	24.5	25.0	25.3	27.0	27.7
H14	26.1	26.2	26.4	27.0	28.2	29.5	31.2	32.6	33.0	33.2	35.1	35.7
H15	26.0	26.0	26.2	26.9	28.1	29.3	31.0	32.4	32.9	33.0	34.8	35.5
H16	15.2	15.3	15.9	16.7	17.8	18.7	20.2	21.4	22.1	22.6	24.0	24.7
H17	18.1	18.2	18.7	19.5	20.6	21.6	23.1	24.4	25.1	25.5	27.0	27.6
H18	18.9	19.0	19.4	20.3	21.3	22.4	23.9	25.2	25.8	26.2	27.7	28.4

Table 9.33: Directional Cumulative Predicted Noise Levels during the Day, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H19	17.6	17.7	18.3	19.2	20.2	21.1	22.6	23.8	24.5	25.0	26.3	27.0
H20	18.9	19.0	19.5	20.3	21.4	22.4	23.9	25.2	25.8	26.2	27.7	28.4
H21	17.3	17.4	18.0	18.9	19.9	20.9	22.3	23.5	24.2	24.7	26.0	26.7
H22	17.4	17.5	18.1	19.0	20.0	21.0	22.3	23.5	24.3	24.8	26.1	26.8
H23	17.4	17.5	18.2	19.1	20.1	21.0	22.4	23.6	24.3	24.9	26.1	26.8
H24	26.1	26.1	26.6	27.5	28.5	29.5	31.0	32.3	32.9	33.2	34.8	35.3
H25	18.8	18.9	19.4	20.2	21.3	22.3	23.8	25.0	25.7	26.1	27.6	28.2
H26	17.1	17.2	17.9	18.8	19.7	20.6	22.0	23.2	24.0	24.6	25.8	26.5
H27	17.9	18.0	18.6	19.5	20.5	21.4	22.9	24.1	24.8	25.3	26.6	27.3
H28	17.6	17.7	18.4	19.2	20.2	21.2	22.5	23.7	24.5	25.1	26.3	27.0
H29	17.0	17.1	17.7	18.6	19.6	20.5	21.9	23.1	23.9	24.4	25.7	26.4
H30	17.1	17.2	17.9	18.8	19.8	20.7	22.0	23.2	24.0	24.6	25.8	26.5
H31	17.0	17.1	17.7	18.6	19.6	20.5	21.8	23.0	23.8	24.4	25.6	26.4
H32	16.8	16.9	17.6	18.5	19.4	20.3	21.7	22.9	23.7	24.3	25.5	26.2
H33	16.0	16.1	16.8	17.6	18.6	19.5	20.8	22.0	22.9	23.6	24.9	25.7
H34	19.2	19.3	19.9	20.7	21.7	22.7	24.2	25.4	26.1	26.6	28.0	28.6
H35	17.0	17.1	17.7	18.6	19.6	20.5	21.8	23.0	23.8	24.5	25.6	26.3
H36	16.3	16.4	17.1	18.0	18.9	19.8	21.1	22.2	23.1	23.7	24.9	25.6
H37	16.0	16.1	16.8	17.6	18.6	19.5	20.8	22.0	22.9	23.7	24.9	25.7
H38	17.0	17.1	17.8	18.7	19.6	20.5	21.8	23.0	23.8	24.5	25.6	26.3
H39	25.8	25.9	26.5	27.4	28.4	29.3	30.7	32.0	32.7	33.0	34.4	34.9
H40	17.1	17.2	17.9	18.7	19.7	20.6	21.9	23.1	23.9	24.6	25.7	26.5
H41	16.4	16.5	17.1	17.9	18.9	19.8	21.1	22.3	23.2	24.0	25.2	26.1
H42	16.2	16.3	17.0	17.9	18.8	19.7	21.0	22.1	23.0	23.7	24.8	25.6
H43	16.1	16.2	16.8	17.6	18.6	19.5	20.8	22.0	23.0	23.7	24.9	25.8
H44	16.8	16.9	17.6	18.5	19.4	20.3	21.6	22.8	23.7	24.3	25.5	26.2
H45	16.1	16.2	16.9	17.7	18.7	19.5	20.8	22.0	22.9	23.6	24.7	25.5
H46	16.2	16.3	16.9	17.7	18.7	19.6	20.9	22.0	23.0	23.9	25.0	25.9
H47	16.2	16.3	16.9	17.7	18.7	19.6	20.9	22.1	23.1	23.9	25.1	26.0
H48	25.8	25.9	26.7	27.6	28.6	29.4	30.8	31.9	32.7	33.2	34.3	34.8
H49	25.9	26.0	26.8	27.9	28.7	29.5	30.8	31.9	32.8	33.3	34.3	34.8
H50	25.9	26.1	26.9	28.0	28.8	29.6	30.9	31.9	32.9	33.4	34.3	34.7
H52	26.1	26.3	27.2	28.2	29.1	29.8	31.0	32.1	33.1	33.6	34.5	34.9
H53	26.0	26.2	27.0	28.1	28.9	29.6	30.9	32.0	33.0	33.5	34.4	34.9
H54	26.2	26.3	27.2	28.3	29.1	29.8	31.1	32.1	33.1	33.7	34.5	35.0
H55	26.0	26.2	27.2	28.3	29.1	29.7	30.9	31.8	32.9	33.5	34.3	34.7

Table 9.33: Directional Cumulative Predicted Noise Levels during the Day, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H56	25.7	25.9	26.8	27.9	28.7	29.3	30.5	31.5	32.5	33.2	34.0	34.4
H57	25.7	25.9	26.8	27.8	28.7	29.3	30.5	31.4	32.5	33.1	33.9	34.3
H58	25.8	26.0	26.9	28.0	28.8	29.4	30.6	31.5	32.6	33.2	34.0	34.4
H59	25.8	26.0	26.9	27.9	28.8	29.4	30.6	31.5	32.6	33.2	34.0	34.4
H60	25.8	26.0	26.9	27.9	28.8	29.4	30.6	31.5	32.6	33.2	34.0	34.4
H61	25.8	25.9	26.9	27.9	28.7	29.4	30.6	31.5	32.6	33.2	34.0	34.4
H62	25.8	25.9	26.8	27.9	28.7	29.3	30.5	31.5	32.5	33.2	33.9	34.4
H63	25.8	25.9	26.9	27.9	28.8	29.4	30.6	31.5	32.6	33.2	34.0	34.4
H64	25.8	25.9	26.9	27.9	28.7	29.3	30.5	31.5	32.5	33.2	33.9	34.4
H65	25.8	25.9	26.9	27.9	28.7	29.3	30.5	31.5	32.5	33.2	33.9	34.4
H66	25.8	25.9	26.9	27.9	28.7	29.3	30.5	31.5	32.5	33.2	33.9	34.4
H67	25.7	25.8	26.7	27.7	28.6	29.2	30.4	31.4	32.4	33.0	33.8	34.3
H68	28.0	28.1	28.5	29.1	30.4	30.9	31.7	32.5	33.3	33.8	34.4	34.9
H69	31.3	31.3	31.5	31.8	33.4	33.8	34.5	35.1	35.7	36.1	36.6	37.0
H70	26.5	26.6	27.2	27.8	29.0	29.6	30.5	31.3	32.2	32.8	33.5	34.0
H71	25.9	26.1	27.1	28.1	28.9	29.5	30.6	31.5	32.6	33.3	34.0	34.4
H72	16.4	16.4	16.9	17.5	18.5	19.6	20.9	22.2	23.3	24.3	25.5	26.7
H73	31.6	31.6	31.8	32.0	33.5	34.2	34.9	35.6	36.3	37.0	37.7	38.5
H74	32.2	32.2	32.4	32.6	34.1	34.8	35.6	36.3	37.1	37.8	38.5	39.3
H75	22.8	22.9	23.4	24.0	25.0	26.0	27.3	28.6	29.5	30.1	30.8	32.0
H76	30.8	30.8	31.1	31.3	32.7	33.5	34.2	35.0	35.9	36.6	37.4	38.2
H77	30.9	30.9	31.1	31.4	32.8	33.5	34.3	35.1	35.9	36.7	37.4	38.3
H78	24.1	24.1	24.5	25.1	26.2	27.3	28.6	29.8	30.7	31.2	31.8	33.0
H79	25.6	25.7	26.1	26.5	27.7	28.7	29.9	31.1	32.0	32.6	33.3	34.4
H80	26.6	26.6	26.9	27.4	28.6	29.8	31.2	32.6	33.3	33.6	33.9	35.4
H81	28.0	28.1	28.3	28.7	29.7	30.7	31.8	33.0	34.0	34.9	35.9	37.0
H82	28.2	28.3	28.4	28.8	30.2	31.5	32.9	34.4	35.0	35.2	35.4	37.1
H83	28.2	28.3	28.4	28.8	30.2	31.5	32.9	34.4	35.0	35.2	35.4	37.1
H84	39.6	39.6	39.6	39.6	39.8	40.0	40.3	40.5	40.8	41.1	41.4	41.7
H85	26.4	26.5	27.1	27.7	28.5	29.1	30.0	30.8	31.8	32.5	33.2	33.8
H86	25.9	26.0	26.6	27.3	28.1	28.7	29.7	30.5	31.5	32.2	32.9	33.6
H87	26.5	26.6	27.2	27.7	28.5	29.1	30.0	30.8	31.8	32.5	33.1	33.8
H88	17.3	17.4	18.0	18.9	19.8	20.7	22.1	23.3	24.1	24.7	25.9	26.7
H89	17.9	18.0	18.6	19.4	20.4	21.3	22.7	23.9	24.8	25.4	26.6	27.4

Table 9.34: Directional Cumulative Predicted Noise Levels at Night, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H1	22.6	22.6	22.6	25.6	28.1	28.1	28.5	28.9	29.2	30.1	31.4	31.5
H2	22.5	22.5	22.5	25.6	28.0	28.1	28.4	28.8	29.1	30.1	31.4	31.4
H3	22.7	22.7	22.7	25.7	28.2	28.2	28.6	29.0	29.2	30.2	31.5	31.6
H4	22.7	22.7	22.7	25.8	28.2	28.3	28.6	29.0	29.3	30.3	31.6	31.6
H5	22.8	22.8	22.8	25.9	28.3	28.4	28.7	29.1	29.4	30.4	31.7	31.7
H6	18.5	18.5	18.5	20.9	23.1	23.3	23.7	24.2	24.6	25.6	26.8	26.9
H7	25.2	25.2	25.2	28.2	30.7	30.7	31.1	31.5	31.8	32.8	34.0	34.0
H8	27.2	27.2	27.2	30.5	33.0	33.0	33.3	33.7	33.9	34.9	36.2	36.2
H9	26.3	26.3	26.3	29.5	32.0	32.0	32.4	32.8	33.0	34.0	35.2	35.3
H10	26.0	26.0	26.0	28.8	31.2	31.3	31.7	32.1	32.4	33.4	34.6	34.6
H11	26.0	26.0	26.0	28.8	31.2	31.3	31.7	32.1	32.4	33.4	34.6	34.6
H12	26.2	26.2	26.2	29.0	31.4	31.5	31.9	32.3	32.6	33.6	34.8	34.8
H13	18.8	18.8	18.8	21.3	23.6	23.7	24.2	24.6	25.0	26.0	27.2	27.3
H14	26.5	26.5	26.5	29.5	32.0	32.0	32.4	32.8	33.1	34.0	35.2	35.3
H15	26.4	26.4	26.4	29.3	31.7	31.8	32.2	32.6	32.9	33.9	35.0	35.1
H16	16.2	16.2	16.2	18.0	20.1	20.4	20.9	21.5	22.1	23.2	24.2	24.5
H17	18.9	18.9	18.9	21.1	23.3	23.5	24.0	24.6	25.1	26.1	27.1	27.4
H18	19.7	19.7	19.7	21.9	24.1	24.3	24.8	25.3	25.8	26.9	27.9	28.1
H19	18.6	18.6	18.6	20.5	22.5	22.8	23.4	23.9	24.5	25.6	26.5	26.8
H20	19.7	19.7	19.7	21.9	24.1	24.3	24.8	25.3	25.8	26.9	27.9	28.1
H21	18.3	18.3	18.3	20.2	22.1	22.5	23.0	23.6	24.2	25.3	26.2	26.5
H22	18.5	18.5	18.5	20.2	22.2	22.5	23.1	23.7	24.3	25.4	26.3	26.6
H23	18.5	18.5	18.5	20.3	22.2	22.6	23.1	23.7	24.4	25.4	26.3	26.6
H24	26.9	26.9	26.9	29.3	31.5	31.7	32.1	32.5	32.9	33.9	34.9	34.9
H25	19.7	19.7	19.7	21.7	23.9	24.1	24.6	25.2	25.7	26.7	27.7	28.0
H26	18.2	18.2	18.2	19.8	21.7	22.1	22.7	23.3	24.0	25.1	26.0	26.3
H27	18.9	18.9	18.9	20.7	22.7	23.0	23.6	24.2	24.8	25.9	26.8	27.1
H28	18.7	18.7	18.7	20.4	22.4	22.7	23.3	23.9	24.5	25.6	26.5	26.8
H29	18.0	18.0	18.0	19.7	21.6	22.0	22.6	23.2	23.9	24.9	25.9	26.2
H30	18.2	18.2	18.2	19.8	21.7	22.1	22.7	23.3	24.0	25.1	26.0	26.3
H31	18.0	18.0	18.0	19.7	21.6	21.9	22.5	23.1	23.9	24.9	25.8	26.2
H32	17.9	17.9	17.9	19.5	21.3	21.7	22.3	22.9	23.7	24.8	25.7	26.1
H33	17.1	17.1	17.1	18.5	20.3	20.8	21.4	22.1	22.9	24.0	25.0	25.6
H34	20.1	20.1	20.1	22.1	24.2	24.5	25.0	25.5	26.1	27.2	28.1	28.4
H35	18.1	18.1	18.1	19.6	21.4	21.8	22.5	23.1	23.9	24.9	25.8	26.2
H36	17.4	17.4	17.4	18.8	20.6	21.0	21.7	22.3	23.1	24.2	25.1	25.6

Table 9.34: Directional Cumulative Predicted Noise Levels at Night, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H37	17.1	17.1	17.1	18.4	20.2	20.7	21.3	22.1	22.9	24.1	25.0	25.7
H38	18.1	18.1	18.1	19.6	21.4	21.8	22.4	23.1	23.9	24.9	25.8	26.2
H39	26.8	26.8	26.8	28.9	31.0	31.2	31.7	32.2	32.7	33.7	34.5	34.5
H40	18.2	18.2	18.2	19.7	21.5	21.9	22.5	23.2	24.0	25.0	25.9	26.3
H41	17.4	17.4	17.4	18.7	20.5	21.0	21.7	22.4	23.3	24.4	25.4	26.0
H42	17.3	17.3	17.3	18.7	20.4	20.9	21.6	22.2	23.1	24.2	25.0	25.5
H43	17.1	17.1	17.1	18.4	20.2	20.7	21.4	22.1	23.0	24.1	25.1	25.8
H44	17.9	17.9	17.9	19.3	21.2	21.6	22.2	22.9	23.7	24.8	25.7	26.1
H45	17.2	17.2	17.2	18.5	20.3	20.7	21.4	22.1	22.9	24.0	24.9	25.4
H46	17.2	17.2	17.2	18.4	20.0	20.6	21.4	22.1	23.1	24.2	25.2	25.9
H47	17.3	17.3	17.3	18.3	20.0	20.6	21.3	22.1	23.1	24.3	25.2	26.0
H48	27.0	27.0	27.0	28.8	30.8	31.1	31.6	32.1	32.7	33.7	34.4	34.5
H49	27.2	27.2	27.2	28.7	30.6	30.9	31.5	32.1	32.8	33.8	34.4	34.5
H50	27.3	27.3	27.3	28.8	30.6	31.0	31.6	32.1	32.9	33.8	34.4	34.4
H52	27.6	27.6	27.6	28.9	30.7	31.1	31.7	32.3	33.1	34.0	34.6	34.7
H53	27.5	27.5	27.5	28.8	30.6	31.0	31.6	32.2	33.0	33.9	34.5	34.6
H54	27.7	27.7	27.7	28.9	30.6	31.1	31.7	32.3	33.1	34.1	34.6	34.7
H55	27.6	27.6	27.6	28.7	30.3	30.8	31.4	32.0	32.9	33.9	34.4	34.5
H56	27.3	27.3	27.3	28.3	29.9	30.4	31.1	31.6	32.5	33.5	34.0	34.2
H57	27.2	27.2	27.2	28.3	29.9	30.3	31.0	31.6	32.5	33.4	34.0	34.2
H58	27.4	27.4	27.4	28.4	30.0	30.4	31.1	31.7	32.6	33.6	34.1	34.3
H59	27.4	27.4	27.4	28.4	29.9	30.4	31.1	31.7	32.6	33.6	34.1	34.3
H60	27.3	27.3	27.3	28.4	29.9	30.4	31.1	31.7	32.6	33.5	34.1	34.2
H61	27.3	27.3	27.3	28.3	29.9	30.4	31.1	31.6	32.6	33.5	34.0	34.2
H62	27.3	27.3	27.3	28.3	29.9	30.4	31.0	31.6	32.5	33.5	34.0	34.2
H63	27.3	27.3	27.3	28.3	29.9	30.4	31.1	31.6	32.6	33.5	34.0	34.2
H64	27.3	27.3	27.3	28.3	29.9	30.4	31.1	31.6	32.6	33.5	34.0	34.2
H65	27.3	27.3	27.3	28.3	29.9	30.4	31.1	31.6	32.5	33.5	34.0	34.2
H66	27.3	27.3	27.3	28.3	29.9	30.4	31.0	31.6	32.5	33.5	34.0	34.2
H67	27.2	27.2	27.2	28.2	29.8	30.2	30.9	31.5	32.4	33.4	33.9	34.1
H68	28.8	28.8	28.8	29.3	31.0	31.5	32.0	32.5	33.3	34.0	34.5	34.8
H69	31.6	31.6	31.6	31.9	33.7	34.1	34.6	35.1	35.7	36.2	36.6	37.0
H70	27.5	27.5	27.5	28.2	29.9	30.3	30.9	31.4	32.2	33.0	33.6	33.9
H71	27.5	27.5	27.5	28.4	29.9	30.4	31.1	31.6	32.6	33.6	34.0	34.2
H72	17.1	17.1	17.1	17.8	19.4	20.2	21.2	22.2	23.4	24.7	25.8	26.8
H73	31.9	31.9	31.9	32.1	33.8	34.4	35.0	35.6	36.4	37.1	37.8	38.5

Table 9.34: Directional Cumulative Predicted Noise Levels at Night, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H74	32.4	32.4	32.4	32.6	34.3	35.0	35.7	36.3	37.1	37.8	38.5	39.3
H75	23.6	23.6	23.6	24.1	25.6	26.5	27.6	28.6	29.7	30.8	31.5	32.6
H76	31.2	31.2	31.2	31.4	33.0	33.7	34.4	35.0	35.9	36.7	37.4	38.2
H77	31.2	31.2	31.2	31.5	33.1	33.8	34.4	35.1	35.9	36.8	37.5	38.3
H78	24.7	24.7	24.7	25.2	26.6	27.6	28.7	29.9	30.9	31.8	32.5	33.6
H79	26.2	26.2	26.2	26.7	28.0	29.0	30.1	31.2	32.1	32.9	33.6	34.6
H80	27.0	27.0	27.0	27.4	28.8	30.0	31.3	32.6	33.6	34.4	35.0	36.3
H81	28.5	28.5	28.5	28.8	30.1	31.0	32.0	33.0	34.1	35.1	36.0	37.0
H82	28.5	28.5	28.5	28.9	30.3	31.6	33.0	34.4	35.4	36.3	37.0	38.3
H83	28.5	28.5	28.5	28.9	30.3	31.6	33.0	34.4	35.4	36.3	37.0	38.3
H84	39.6	39.6	39.6	39.6	39.8	40.0	40.3	40.5	40.8	41.1	41.4	41.7
H85	27.3	27.3	27.3	27.8	29.1	29.6	30.3	30.9	31.8	32.7	33.3	33.8
H86	26.9	26.9	26.9	27.5	28.7	29.3	30.0	30.6	31.5	32.5	33.1	33.5
H87	27.4	27.4	27.4	27.9	29.1	29.6	30.3	30.9	31.8	32.7	33.3	33.8
H88	18.3	18.3	18.3	19.8	21.6	22.1	22.7	23.4	24.2	25.2	26.1	26.5
H89	18.9	18.9	18.9	20.5	22.4	22.8	23.4	24.1	24.8	25.9	26.8	27.2

DERIVED ACOUSTIC ACCEPTANCE CRITERIA

9.4.53 The assessment criteria are determined by subtracting the directional cumulative predicted noise levels (without the proposed development) from the total noise limit to calculate the limit remaining for the proposed development. The results of this calculation for day and night time periods are shown in Tables 9.35 and 9.36. Charts 13-20 show the process of calculating the limit remaining at the background noise survey locations.

9.4.54 Where the directional cumulative predicted noise levels are greater than the total noise limit minus 3 dB(A) the limit remaining for the proposed development is set to the total limit minus 3 dB(A). This is to avoid the resulting noise limits being set so low, e.g. below the background noise level in some instances, that they become unenforceable due to it being impractical to monitor and hard to prove a breach. The introduction of this measure should also be judged in light of the conservatism of the prediction methodology which was shown by the noise levels measured during the background noise monitoring campaign being less than those predicted due to the existing wind turbines. A conservative prediction methodology would result in the cumulative predicted noise levels being higher and the remaining limit being lower than in reality.

Table 9.35: Limit Remaining for the Proposed Development during the Day, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H1	34.8	34.8	34.8	34.7	34.6	34.5	34.2	33.8	35.7	39.5	43.4	48.1
H2	34.8	34.8	34.8	34.7	34.6	34.5	34.2	33.8	35.8	39.5	43.5	48.1
H3	34.8	34.8	34.7	34.7	34.6	34.4	34.2	33.8	35.7	39.5	43.4	48.1
H4	34.8	34.8	34.7	34.7	34.6	34.4	34.2	33.8	35.7	39.5	43.4	48.1
H5	34.8	34.8	34.7	34.7	34.6	34.4	34.1	33.8	35.7	39.5	43.4	48.1
H6	34.9	34.9	34.9	34.9	34.9	34.8	34.7	34.6	36.3	39.8	43.6	48.2
H7	34.6	34.6	34.5	34.4	34.2	34.0	33.4	32.5	36.6	40.1	42.8	45.0
H8	34.3	34.2	34.2	34.1	33.7	33.2	32.0	32.0	35.5	39.7	42.4	44.8
H9	34.4	34.4	34.4	34.3	34.0	33.6	32.7	32.0	36.1	39.9	42.6	44.9
H10	34.5	34.5	34.4	34.3	34.1	33.8	33.1	32.1	36.3	40.0	42.7	45.0
H11	34.5	34.5	34.4	34.3	34.1	33.8	33.1	32.0	36.3	40.0	42.7	45.0
H12	44.9	44.9	44.9	44.9	44.9	44.9	44.8	44.8	44.7	44.7	44.6	45.0
H13	34.9	34.9	34.9	34.9	34.8	34.8	34.7	34.6	36.3	39.7	43.6	48.2
H14	34.4	34.4	34.4	34.2	34.0	33.6	32.7	32.0	36.0	39.9	42.6	44.9
H15	34.4	34.4	34.4	34.3	34.0	33.6	32.8	32.0	36.1	39.9	42.6	44.9
H16	35.0	35.0	34.9	34.9	34.9	34.9	34.9	34.8	36.4	39.8	43.7	48.2
H17	34.9	34.9	34.9	34.9	34.8	34.8	34.7	34.6	36.3	39.7	43.6	48.2
H18	34.9	34.9	34.9	34.9	34.8	34.8	34.6	34.5	36.2	39.7	43.6	48.2
H19	34.9	34.9	34.9	34.9	34.9	34.8	34.7	34.7	36.3	39.8	43.6	48.2
H20	34.9	34.9	34.9	34.9	34.8	34.8	34.6	34.5	36.2	39.7	43.6	48.2
H21	34.9	34.9	34.9	34.9	34.9	34.8	34.8	34.7	36.3	39.8	43.6	48.2
H22	34.9	34.9	34.9	34.9	34.9	34.8	34.8	34.7	36.3	39.8	43.6	48.2
H23	34.9	34.9	34.9	34.9	34.9	34.8	34.8	34.7	36.3	39.8	43.6	48.2
H24	34.4	34.4	34.3	34.2	33.9	33.5	32.8	32.0	36.1	39.8	42.6	45.0
H25	34.9	34.9	34.9	34.9	34.8	34.8	34.7	34.5	36.2	39.7	43.6	48.2
H26	34.9	34.9	34.9	34.9	34.9	34.8	34.8	34.7	36.4	39.8	43.6	48.2
H27	34.9	34.9	34.9	34.9	34.8	34.8	34.7	34.6	36.3	39.7	43.6	48.2
H28	34.9	34.9	34.9	34.9	34.9	34.8	34.7	34.7	36.3	39.8	43.6	48.2
H29	34.9	34.9	34.9	34.9	34.9	34.8	34.8	34.7	36.4	39.8	43.6	48.2
H30	34.9	34.9	34.9	34.9	34.9	34.8	34.8	34.7	36.4	39.8	43.6	48.2
H31	34.9	34.9	34.9	34.9	34.9	34.8	34.8	34.7	36.4	39.8	43.6	48.2
H32	34.9	34.9	34.9	34.9	34.9	34.8	34.8	34.7	36.4	39.8	43.6	48.2
H33	34.9	34.9	34.9	34.9	34.9	34.9	34.8	34.8	36.4	39.8	43.6	48.2
H34	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	44.9	44.9	44.9	48.2
H35	34.9	34.9	34.9	34.9	34.9	34.8	34.8	34.7	36.4	39.8	43.6	48.2
H36	34.9	34.9	34.9	34.9	34.9	34.9	34.8	34.8	36.4	39.8	43.6	48.2

Table 9.35: Limit Remaining for the Proposed Development during the Day, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H37	34.9	34.9	34.9	34.9	34.9	34.9	34.8	34.8	36.4	39.8	43.6	48.2
H38	34.9	34.9	34.9	34.9	34.9	34.8	34.8	34.7	36.4	39.8	43.6	48.2
H39	34.4	34.4	34.3	34.2	33.9	33.6	33.0	32.0	36.2	39.9	42.7	45.0
H40	34.9	34.9	34.9	34.9	34.9	34.8	34.8	34.7	36.4	39.8	43.6	48.2
H41	34.9	34.9	34.9	34.9	34.9	34.9	34.8	34.8	36.4	39.8	43.6	48.2
H42	34.9	34.9	34.9	34.9	34.9	34.9	34.8	34.8	36.4	39.8	43.6	48.2
H43	34.9	34.9	34.9	34.9	34.9	34.9	34.8	34.8	36.4	39.8	43.6	48.2
H44	34.9	34.9	34.9	34.9	34.9	34.9	34.8	34.7	36.4	39.8	43.6	48.2
H45	34.9	34.9	34.9	34.9	34.9	34.9	34.8	34.8	36.4	39.8	43.6	48.2
H46	34.9	34.9	34.9	34.9	34.9	34.9	34.8	34.8	36.4	39.8	43.6	48.2
H47	34.9	34.9	34.9	34.9	34.9	34.9	35.6	38.2	41.2	44.7	48.4	52.5
H48	34.4	34.4	34.3	34.1	33.9	33.6	33.0	32.1	36.2	39.9	42.7	45.0
H49	34.4	34.4	34.3	34.1	33.8	33.6	32.9	32.1	36.1	39.8	42.7	45.0
H50	34.4	34.4	34.3	34.0	33.8	33.5	32.9	32.1	36.1	39.8	42.7	45.0
H52	34.4	34.4	34.2	34.0	33.7	33.5	32.8	32.0	36.0	39.8	42.7	45.0
H53	34.4	34.4	34.2	34.0	33.8	33.5	32.8	32.0	36.1	39.8	42.7	45.0
H54	34.4	34.4	34.2	34.0	33.7	33.4	32.7	32.0	36.0	39.7	42.7	45.0
H55	34.8	35.0	35.0	35.2	35.6	36.2	37.1	38.2	39.7	41.7	44.0	46.6
H56	34.8	35.0	35.1	35.3	35.7	36.3	37.1	38.3	39.7	41.7	44.0	46.6
H57	34.8	35.0	35.1	35.3	35.7	36.3	37.2	38.3	39.8	41.7	44.0	46.7
H58	34.8	35.0	35.1	35.3	35.7	36.3	37.1	38.3	39.7	41.7	44.0	46.6
H59	34.8	35.0	35.1	35.3	35.7	36.3	37.1	38.3	39.7	41.7	44.0	46.6
H60	34.8	35.0	35.1	35.3	35.7	36.3	37.1	38.3	39.7	41.7	44.0	46.6
H61	34.8	35.0	35.1	35.3	35.7	36.3	37.1	38.3	39.7	41.7	44.0	46.6
H62	34.8	35.0	35.1	35.3	35.7	36.3	37.1	38.3	39.7	41.7	44.0	46.7
H63	34.8	35.0	35.1	35.3	35.7	36.3	37.1	38.3	39.7	41.7	44.0	46.6
H64	34.8	35.0	35.1	35.3	35.7	36.3	37.1	38.3	39.7	41.7	44.0	46.6
H65	34.8	35.0	35.1	35.3	35.7	36.3	37.1	38.3	39.7	41.7	44.0	46.7
H66	34.8	35.0	35.1	35.3	35.7	36.3	37.1	38.3	39.7	41.7	44.0	46.7
H67	34.8	35.0	35.1	35.3	35.7	36.3	37.2	38.3	39.8	41.8	44.0	46.7
H68	34.4	34.6	34.8	35.0	35.3	35.9	36.8	38.0	39.6	41.6	43.9	46.6
H69	44.8	44.8	44.8	44.8	44.7	44.7	44.6	44.5	44.5	44.4	44.3	46.4
H70	34.7	34.9	35.0	35.3	35.6	36.3	37.1	38.3	39.8	41.8	44.0	46.7
H71	34.8	35.0	35.1	35.2	35.7	36.3	37.1	38.3	39.7	41.7	44.0	46.7
H72	34.9	34.9	34.9	34.9	34.9	34.9	35.6	38.2	41.2	44.7	48.4	52.5
H73	32.9	33.2	33.4	33.8	33.5	34.1	35.1	36.5	38.4	40.8	43.3	46.2

Table 9.35: Limit Remaining for the Proposed Development during the Day, dB(A)												
House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H74	32.4	32.7	33.0	33.4	33.5	34.1	35.0	36.1	37.9	40.4	43.1	46.1
H75	34.7	34.7	34.7	34.6	34.5	34.4	35.0	37.8	41.0	44.5	48.3	52.5
H76	33.4	33.7	33.9	34.2	34.1	34.6	35.6	36.9	38.7	40.9	43.4	46.3
H77	33.3	33.6	33.8	34.2	34.1	34.6	35.6	36.9	38.6	40.9	43.4	46.3
H78	34.6	34.6	34.6	34.5	34.4	34.2	34.8	37.6	40.9	44.5	48.3	52.5
H79	34.8	35.0	35.2	35.5	35.9	36.4	37.3	38.3	39.8	41.8	44.1	46.7
H80	34.3	34.3	34.3	34.2	33.9	33.4	33.8	36.9	40.6	44.3	48.2	52.4
H81	34.4	34.6	34.8	35.1	35.5	36.0	36.8	37.9	39.4	41.4	43.7	46.4
H82	34.0	34.0	33.9	33.8	33.3	32.4	32.7	36.1	40.1	44.2	48.2	52.4
H83	34.0	34.0	33.9	33.8	33.3	32.4	32.7	36.1	40.1	44.2	48.2	52.4
H84	32.3	32.5	32.7	33.0	33.5	34.1	35.0	36.1	37.5	39.3	41.4	45.3
H85	34.7	34.9	35.1	35.3	35.8	36.4	37.2	38.4	39.9	41.8	44.1	46.7
H86	34.8	35.0	35.1	35.4	35.8	36.4	37.3	38.4	39.9	41.9	44.1	46.7
H87	34.7	34.9	35.0	35.3	35.8	36.4	37.3	38.4	39.9	41.8	44.1	46.7
H88	34.9	34.9	34.9	34.9	34.9	34.8	34.8	34.7	36.3	39.8	43.6	48.2
H89	34.9	34.9	34.9	34.9	34.8	34.8	34.7	34.6	36.3	39.7	43.6	48.2

Table 9.36: Limit Remaining for the Proposed Development at Night, dB(A)												
House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H1	37.9	37.9	37.9	37.7	37.5	37.5	37.5	37.4	37.4	37.2	40.7	46.2
H2	37.9	37.9	37.9	37.7	37.5	37.5	37.5	37.4	37.4	37.2	40.7	46.2
H3	37.9	37.9	37.9	37.7	37.5	37.5	37.5	37.4	37.4	37.2	40.7	46.2
H4	37.9	37.9	37.9	37.7	37.5	37.5	37.5	37.4	37.4	37.2	40.7	46.2
H5	37.9	37.9	37.9	37.7	37.5	37.5	37.5	37.4	37.4	37.2	40.7	46.1
H6	38.0	38.0	38.0	37.9	37.9	37.9	37.8	37.8	37.8	37.7	41.0	46.2
H7	37.8	37.8	37.8	37.5	37.1	37.1	37.0	36.9	36.8	36.7	40.6	45.0
H8	37.6	37.6	37.6	37.2	36.4	36.3	36.2	36.0	35.8	35.4	40.0	44.7
H9	37.7	37.7	37.7	37.3	36.7	36.7	36.6	36.4	36.4	36.1	40.3	44.8
H10	37.7	37.7	37.7	37.4	37.0	37.0	36.8	36.7	36.6	36.5	40.5	44.9
H11	37.7	37.7	37.7	37.4	37.0	37.0	36.8	36.7	36.6	36.5	40.5	44.9
H12	44.9	44.9	44.9	44.9	44.8	44.8	44.8	44.8	44.7	44.7	44.6	44.9
H13	37.9	37.9	37.9	37.9	37.8	37.8	37.8	37.8	37.8	37.7	41.0	46.2
H14	37.7	37.7	37.7	37.3	36.8	36.7	36.6	36.4	36.3	36.1	40.3	44.8
H15	37.7	37.7	37.7	37.4	36.8	36.8	36.7	36.5	36.4	36.2	40.4	44.9
H16	38.0	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.9	41.1	46.3

Table 9.36: Limit Remaining for the Proposed Development at Night, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H17	37.9	37.9	37.9	37.9	37.9	37.8	37.8	37.8	37.8	37.7	41.0	46.2
H18	37.9	37.9	37.9	37.9	37.8	37.8	37.8	37.8	37.7	37.7	41.0	46.2
H19	38.0	38.0	38.0	37.9	37.9	37.9	37.8	37.8	37.8	37.7	41.0	46.3
H20	37.9	37.9	37.9	37.9	37.8	37.8	37.8	37.8	37.7	37.7	41.0	46.2
H21	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.8	37.8	37.8	41.1	46.3
H22	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.8	37.8	37.8	41.1	46.3
H23	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.8	37.8	37.8	41.1	46.3
H24	37.7	37.7	37.7	37.4	36.9	36.9	36.7	36.5	36.4	36.2	40.4	44.9
H25	37.9	37.9	37.9	37.9	37.8	37.8	37.8	37.8	37.7	37.7	41.0	46.2
H26	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	37.8	41.1	46.3
H27	37.9	37.9	37.9	37.9	37.9	37.9	37.8	37.8	37.8	37.7	41.0	46.2
H28	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.8	37.8	37.7	41.1	46.3
H29	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	37.8	41.1	46.3
H30	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	37.8	41.1	46.3
H31	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	37.8	41.1	46.3
H32	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	37.8	41.1	46.3
H33	38.0	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	41.1	46.3
H34	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	44.9	44.9	44.9	46.2
H35	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	37.8	41.1	46.3
H36	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.9	37.8	41.1	46.3
H37	38.0	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	41.1	46.3
H38	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	37.8	41.1	46.3
H39	37.7	37.7	37.7	37.4	37.0	37.0	36.9	36.7	36.5	36.3	40.5	44.9
H40	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	37.8	41.1	46.3
H41	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.9	37.8	41.1	46.3
H42	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.9	37.8	41.1	46.3
H43	38.0	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	41.1	46.3
H44	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	37.8	41.1	46.3
H45	38.0	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	41.1	46.3
H46	38.0	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.9	37.8	41.1	46.3
H47	38.0	38.0	38.0	38.0	37.9	37.9	37.9	37.9	39.6	43.2	47.5	52.2
H48	37.6	37.6	37.6	37.4	37.1	37.0	36.9	36.7	36.5	36.3	40.5	44.9
H49	37.6	37.6	37.6	37.5	37.1	37.0	36.9	36.7	36.4	36.3	40.6	44.9
H50	37.6	37.6	37.6	37.4	37.1	37.0	36.9	36.7	36.4	36.2	40.6	44.9
H52	37.6	37.6	37.6	37.4	37.1	37.0	36.8	36.7	36.3	36.1	40.5	44.9
H53	37.6	37.6	37.6	37.4	37.1	37.0	36.9	36.7	36.4	36.2	40.5	44.9

Table 9.36: Limit Remaining for the Proposed Development at Night, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H54	37.6	37.6	37.6	37.4	37.1	37.0	36.8	36.6	36.3	36.1	40.5	44.9
H55	37.6	37.6	37.6	37.5	37.2	37.1	36.9	36.7	36.5	39.3	42.7	46.5
H56	37.6	37.6	37.6	37.5	37.3	37.2	37.0	36.9	36.7	39.4	42.8	46.6
H57	37.6	37.6	37.6	37.5	37.3	37.2	37.0	36.9	36.7	39.4	42.8	46.6
H58	37.6	37.6	37.6	37.5	37.3	37.2	37.0	36.8	36.7	39.4	42.7	46.6
H59	37.6	37.6	37.6	37.5	37.3	37.2	37.0	36.8	36.7	39.4	42.7	46.6
H60	37.6	37.6	37.6	37.5	37.3	37.2	37.0	36.9	36.7	39.4	42.7	46.6
H61	37.6	37.6	37.6	37.5	37.3	37.2	37.0	36.9	36.7	39.4	42.8	46.6
H62	37.6	37.6	37.6	37.5	37.3	37.2	37.0	36.9	36.7	39.4	42.8	46.6
H63	37.6	37.6	37.6	37.5	37.3	37.2	37.0	36.9	36.7	39.4	42.8	46.6
H64	37.6	37.6	37.6	37.5	37.3	37.2	37.0	36.9	36.7	39.4	42.8	46.6
H65	37.6	37.6	37.6	37.5	37.3	37.2	37.0	36.9	36.7	39.4	42.8	46.6
H66	37.6	37.6	37.6	37.5	37.3	37.2	37.0	36.9	36.7	39.4	42.8	46.6
H67	37.6	37.6	37.6	37.5	37.3	37.2	37.1	36.9	36.7	39.4	42.8	46.6
H68	37.4	37.4	37.4	37.4	37.0	36.9	36.7	36.5	36.4	39.3	42.7	46.5
H69	44.8	44.8	44.8	44.8	44.7	44.6	44.6	44.5	44.5	44.4	44.3	46.3
H70	37.6	37.6	37.6	37.5	37.3	37.2	37.1	36.9	36.8	39.5	42.8	46.6
H71	37.6	37.6	37.6	37.5	37.3	37.2	37.0	36.9	36.7	39.4	42.8	46.6
H72	38.0	38.0	38.0	38.0	37.9	37.9	37.9	37.9	39.6	43.2	47.5	52.2
H73	36.8	36.8	36.8	36.7	35.9	35.5	35.0	35.0	35.1	37.7	41.9	46.1
H74	36.6	36.6	36.6	36.5	35.6	35.0	35.0	35.0	35.1	37.4	41.5	46.0
H75	37.8	37.8	37.8	37.8	37.7	37.7	37.6	37.5	39.2	43.0	47.4	52.2
H76	37.0	37.0	37.0	36.9	36.4	36.0	35.5	35.0	35.1	38.0	42.0	46.2
H77	37.0	37.0	37.0	36.9	36.3	35.9	35.5	35.0	35.1	37.9	42.0	46.1
H78	37.8	37.8	37.8	37.8	37.7	37.6	37.5	37.3	39.1	43.0	47.4	52.1
H79	37.7	37.7	37.7	37.7	37.5	37.4	37.2	37.0	36.8	39.5	42.8	46.5
H80	37.6	37.6	37.6	37.6	37.4	37.2	37.0	36.5	38.5	42.7	47.2	52.1
H81	37.5	37.5	37.5	37.4	37.2	37.0	36.8	36.4	35.9	38.9	42.4	46.3
H82	37.5	37.5	37.5	37.4	37.2	36.9	36.4	35.5	37.7	42.3	47.1	52.0
H83	37.5	37.5	37.5	37.4	37.2	36.9	36.4	35.5	37.7	42.3	47.1	52.0
H84	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.1	37.4	40.3	45.2
H85	37.6	37.6	37.6	37.6	37.4	37.3	37.2	37.1	36.9	39.6	42.8	46.6
H86	37.7	37.7	37.7	37.6	37.5	37.4	37.3	37.1	37.0	39.6	42.9	46.6
H87	37.6	37.6	37.6	37.6	37.4	37.3	37.2	37.1	36.9	39.6	42.8	46.6
H88	38.0	38.0	38.0	37.9	37.9	37.9	37.9	37.8	37.8	37.8	41.1	46.3
H89	37.9	37.9	37.9	37.9	37.9	37.9	37.8	37.8	37.8	37.7	41.0	46.2

CUMULATIVE ACOUSTIC ASSESSMENT

9.4.55 A comparison of the predicted noise levels for the proposed development, as shown in Table 9.15 with the noise limits is shown in Tables 9.37 and 9.38. A negative margin indicates that the limit is met and a positive margin that the limit is predicted to be exceeded. Table 9.37 shows that the daytime limit is predicted to be exceeded by a maximum of 7.4 dB(A) at a standardised 10m wind speed of 8 ms^{-1} at H39. Table 9.38 shows that the night limit is predicted to be exceeded by a maximum of 4.1 dB(A) at H68, H73 and H74.

Table 9.37: Predictions vs Limit Remaining for the Proposed Development during the Day, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H1	-17.6	-17.6	-17.5	-14.8	-10.7	-6.8	-4.4	-3.7	-5.6	-9.4	-13.3	-18.0
H2	-17.5	-17.5	-17.5	-14.8	-10.7	-6.8	-4.4	-3.7	-5.6	-9.4	-13.3	-18.0
H3	-17.4	-17.4	-17.4	-14.7	-10.5	-6.6	-4.3	-3.6	-5.5	-9.3	-13.2	-17.9
H4	-17.4	-17.4	-17.4	-14.7	-10.5	-6.6	-4.2	-3.5	-5.5	-9.2	-13.2	-17.8
H5	-17.3	-17.3	-17.3	-14.5	-10.4	-6.5	-4.1	-3.4	-5.3	-9.1	-13.1	-17.7
H6	-17.6	-17.6	-17.6	-14.9	-10.8	-7.0	-4.9	-4.5	-6.1	-9.6	-13.4	-18.0
H7	-15.0	-15.0	-14.9	-12.1	-7.9	-3.9	-1.2	-0.1	-4.1	-7.6	-10.3	-12.5
H8	-16.8	-16.8	-16.7	-13.9	-9.5	-5.2	-2.0	-1.6	-5.1	-9.3	-12.0	-14.4
H9	-16.0	-16.0	-16.0	-13.2	-8.9	-4.7	-1.7	-0.7	-4.7	-8.6	-11.3	-13.6
H10	-13.5	-13.5	-13.5	-10.7	-6.4	-2.3	0.4	1.8	-2.5	-6.1	-8.9	-11.1
H11	-13.5	-13.5	-13.4	-10.6	-6.3	-2.2	0.5	1.9	-2.4	-6.0	-8.8	-11.1
H12	-23.0	-23.0	-23.0	-20.3	-16.3	-12.5	-10.4	-10.0	-9.9	-9.9	-9.8	-10.2
H13	-15.6	-15.6	-15.6	-12.9	-8.8	-5.0	-2.8	-2.4	-4.1	-7.5	-11.4	-15.9
H14	-15.2	-15.2	-15.2	-12.4	-8.1	-3.9	-0.9	0.1	-3.9	-7.8	-10.5	-12.8
H15	-14.9	-14.9	-14.9	-12.1	-7.8	-3.6	-0.7	0.4	-3.7	-7.5	-10.2	-12.5
H16	-15.5	-15.5	-15.5	-12.8	-8.8	-5.0	-2.9	-2.5	-4.1	-7.5	-11.3	-15.9
H17	-11.8	-11.8	-11.8	-9.1	-5.0	-1.2	1.0	1.4	-0.3	-3.7	-7.6	-12.2
H18	-10.9	-10.9	-10.8	-8.1	-4.1	-0.2	1.9	2.4	0.7	-2.8	-6.7	-11.2
H19	-11.9	-11.9	-11.9	-9.1	-5.1	-1.3	0.9	1.3	-0.4	-3.8	-7.7	-12.2
H20	-10.6	-10.6	-10.6	-7.8	-3.8	0.0	2.2	2.7	1.0	-2.5	-6.4	-10.9
H21	-12.1	-12.1	-12.1	-9.4	-5.3	-1.5	0.6	1.0	-0.6	-4.0	-7.9	-12.4
H22	-11.6	-11.6	-11.6	-8.8	-4.8	-1.0	1.2	1.6	-0.1	-3.5	-7.4	-11.9
H23	-11.4	-11.4	-11.4	-8.7	-4.6	-0.8	1.3	1.8	0.1	-3.3	-7.2	-11.7
H24	-9.6	-9.6	-9.5	-6.7	-2.4	1.8	4.6	5.7	1.6	-2.1	-4.9	-7.2
H25	-9.9	-9.9	-9.8	-7.1	-3.1	0.8	2.9	3.4	1.7	-1.8	-5.7	-10.2
H26	-11.8	-11.8	-11.8	-9.1	-5.1	-1.3	0.9	1.3	-0.4	-3.8	-7.6	-12.2
H27	-10.3	-10.3	-10.3	-7.6	-3.5	0.3	2.4	2.8	1.2	-2.3	-6.1	-10.7
H28	-10.8	-10.8	-10.8	-8.0	-4.0	-0.2	2.0	2.4	0.7	-2.7	-6.6	-11.1
H29	-12.8	-12.8	-12.8	-10.1	-6.0	-2.2	-0.1	0.3	-1.3	-4.7	-8.6	-13.1

Table 9.37: Predictions vs Limit Remaining for the Proposed Development during the Day, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H30	-11.8	-11.8	-11.8	-9.0	-5.0	-1.2	0.9	1.3	-0.3	-3.7	-7.6	-12.1
H31	-12.6	-12.6	-12.6	-9.9	-5.8	-2.0	0.1	0.5	-1.2	-4.6	-8.4	-13.0
H32	-12.5	-12.5	-12.5	-9.7	-5.7	-1.9	0.2	0.6	-1.0	-4.4	-8.3	-12.8
H33	-16.0	-16.0	-16.0	-13.3	-9.3	-5.5	-3.4	-3.0	-4.6	-8.0	-11.8	-16.4
H34	-17.4	-17.4	-17.4	-14.7	-10.6	-6.9	-4.8	-4.4	-4.4	-4.4	-4.4	-7.6
H35	-11.9	-11.9	-11.9	-9.1	-5.1	-1.3	0.8	1.2	-0.4	-3.8	-7.7	-12.2
H36	-13.7	-13.7	-13.7	-11.0	-7.0	-3.2	-1.1	-0.7	-2.3	-5.7	-9.5	-14.1
H37	-15.6	-15.6	-15.6	-12.9	-8.9	-5.1	-3.0	-2.6	-4.2	-7.6	-11.4	-16.0
H38	-11.6	-11.6	-11.6	-8.9	-4.8	-1.0	1.1	1.5	-0.2	-3.6	-7.4	-12.0
H39	-7.9	-7.9	-7.8	-4.9	-0.7	3.4	6.1	7.4	3.2	-0.4	-3.3	-5.5
H40	-11.4	-11.4	-11.4	-8.7	-4.7	-0.9	1.3	1.7	0.0	-3.4	-7.2	-11.8
H41	-14.8	-14.8	-14.8	-12.1	-8.0	-4.2	-2.1	-1.7	-3.3	-6.7	-10.6	-15.1
H42	-14.0	-14.0	-14.0	-11.3	-7.3	-3.5	-1.3	-1.0	-2.6	-6.0	-9.8	-14.4
H43	-15.6	-15.6	-15.6	-12.8	-8.8	-5.0	-2.9	-2.5	-4.1	-7.5	-11.4	-15.9
H44	-12.3	-12.3	-12.3	-9.6	-5.5	-1.7	0.4	0.8	-0.8	-4.2	-8.1	-12.6
H45	-14.3	-14.3	-14.3	-11.6	-7.6	-3.8	-1.7	-1.3	-2.9	-6.3	-10.1	-14.7
H46	-15.0	-15.0	-15.0	-12.3	-8.2	-4.4	-2.3	-1.9	-3.5	-6.9	-10.8	-15.3
H47	-15.0	-15.0	-15.0	-12.3	-8.3	-4.5	-3.1	-5.4	-8.4	-11.9	-15.6	-19.7
H48	-9.4	-9.4	-9.3	-6.4	-2.1	1.9	4.6	5.8	1.7	-1.9	-4.8	-7.1
H49	-11.8	-11.8	-11.6	-8.7	-4.5	-0.4	2.3	3.4	-0.6	-4.3	-7.2	-9.5
H50	-12.3	-12.3	-12.1	-9.2	-4.9	-0.9	1.8	3.0	-1.1	-4.8	-7.7	-10.0
H52	-11.7	-11.7	-11.6	-8.6	-4.3	-0.3	2.5	3.5	-0.5	-4.2	-7.1	-9.4
H53	-11.9	-11.9	-11.8	-8.8	-4.6	-0.5	2.2	3.4	-0.7	-4.4	-7.3	-9.6
H54	-12.5	-12.5	-12.3	-9.4	-5.1	-1.0	1.7	2.8	-1.2	-4.9	-7.9	-10.2
H55	-12.4	-12.7	-12.7	-10.2	-6.6	-3.4	-2.2	-3.0	-4.5	-6.5	-8.7	-11.4
H56	-11.6	-11.8	-11.9	-9.4	-5.8	-2.6	-1.4	-2.2	-3.7	-5.7	-7.9	-10.6
H57	-11.4	-11.6	-11.7	-9.2	-5.6	-2.4	-1.2	-2.0	-3.5	-5.5	-7.7	-10.4
H58	-11.9	-12.1	-12.2	-9.7	-6.1	-2.9	-1.7	-2.5	-3.9	-5.9	-8.2	-10.8
H59	-11.9	-12.1	-12.2	-9.7	-6.1	-2.9	-1.7	-2.5	-3.9	-5.9	-8.2	-10.8
H60	-11.8	-12.0	-12.1	-9.6	-6.0	-2.8	-1.6	-2.4	-3.9	-5.9	-8.1	-10.8
H61	-11.8	-12.0	-12.1	-9.6	-6.0	-2.8	-1.6	-2.4	-3.8	-5.8	-8.1	-10.7
H62	-11.6	-11.8	-11.9	-9.4	-5.8	-2.7	-1.4	-2.2	-3.7	-5.7	-7.9	-10.6
H63	-11.8	-12.0	-12.1	-9.6	-6.0	-2.9	-1.6	-2.4	-3.9	-5.9	-8.1	-10.8
H64	-11.8	-12.0	-12.1	-9.6	-6.0	-2.8	-1.6	-2.4	-3.9	-5.8	-8.1	-10.8
H65	-11.8	-12.0	-12.1	-9.6	-6.0	-2.8	-1.6	-2.4	-3.8	-5.8	-8.1	-10.7

Table 9.37: Predictions vs Limit Remaining for the Proposed Development during the Day, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H66	-11.8	-12.0	-12.1	-9.5	-6.0	-2.8	-1.6	-2.4	-3.8	-5.8	-8.1	-10.7
H67	-11.4	-11.6	-11.7	-9.2	-5.6	-2.4	-1.2	-2.0	-3.4	-5.4	-7.7	-10.3
H68	-6.8	-7.1	-7.2	-4.8	-1.0	2.1	3.3	2.4	0.9	-1.2	-3.5	-6.2
H69	-16.9	-16.9	-16.9	-14.2	-10.0	-6.2	-4.1	-3.7	-3.6	-3.6	-3.5	-5.6
H70	-8.7	-8.9	-9.0	-6.6	-2.9	0.3	1.4	0.6	-0.9	-2.9	-5.1	-7.7
H71	-12.9	-13.1	-13.2	-10.7	-7.1	-4.0	-2.7	-3.6	-5.0	-7.0	-9.3	-11.9
H72	-17.1	-17.1	-17.1	-14.4	-10.3	-6.5	-5.1	-7.4	-10.5	-13.9	-17.6	-21.7
H73	-6.7	-7.0	-7.2	-4.9	-0.6	2.6	3.7	2.5	0.7	-1.7	-4.2	-7.1
H74	-6.1	-6.5	-6.7	-4.4	-0.5	2.6	3.8	3.0	1.3	-1.3	-4.0	-6.9
H75	-9.1	-9.1	-9.1	-6.4	-2.2	1.7	3.1	0.7	-2.5	-6.1	-9.8	-14.0
H76	-7.8	-8.0	-8.2	-5.9	-1.8	1.5	2.6	1.6	-0.1	-2.4	-4.9	-7.7
H77	-7.7	-8.0	-8.2	-5.8	-1.7	1.6	2.6	1.6	-0.1	-2.4	-4.9	-7.7
H78	-8.6	-8.6	-8.6	-5.8	-1.6	2.3	3.8	1.3	-2.0	-5.6	-9.4	-13.5
H79	-8.1	-8.3	-8.5	-6.1	-2.4	0.8	2.0	1.3	-0.2	-2.2	-4.4	-7.0
H80	-9.5	-9.5	-9.4	-6.7	-2.3	1.9	3.6	0.8	-2.8	-6.6	-10.5	-14.7
H81	-9.1	-9.3	-9.5	-7.1	-3.5	-0.2	1.0	0.3	-1.2	-3.2	-5.6	-8.3
H82	-9.6	-9.6	-9.6	-6.7	-2.2	2.4	4.2	1.2	-2.9	-6.9	-10.9	-15.1
H83	-9.6	-9.6	-9.6	-6.7	-2.2	2.4	4.2	1.2	-2.9	-6.9	-10.9	-15.1
H84	-8.8	-9.0	-9.2	-6.8	-3.3	-0.1	1.0	0.2	-1.1	-2.9	-5.1	-9.0
H85	-13.3	-13.5	-13.6	-11.2	-7.6	-4.4	-3.2	-4.1	-5.5	-7.5	-9.7	-12.3
H86	-13.6	-13.8	-14.0	-11.5	-7.9	-4.8	-3.6	-4.4	-5.9	-7.8	-10.0	-12.6
H87	-13.4	-13.6	-13.8	-11.3	-7.8	-4.6	-3.4	-4.3	-5.7	-7.7	-9.9	-12.5
H88	-11.1	-11.1	-11.1	-8.4	-4.4	-0.6	1.6	2.0	0.3	-3.1	-6.9	-11.5
H89	-10.5	-10.5	-10.4	-7.7	-3.7	0.1	2.3	2.7	1.0	-2.4	-6.3	-10.8

Table 9.38: Predictions vs Limit Remaining for the Proposed Development at Night, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H1	-20.7	-20.7	-20.7	-17.8	-13.6	-9.8	-7.7	-7.3	-7.3	-7.1	-10.6	-16.0
H2	-20.7	-20.7	-20.7	-17.8	-13.6	-9.8	-7.7	-7.3	-7.3	-7.1	-10.6	-16.0
H3	-20.5	-20.5	-20.5	-17.7	-13.5	-9.7	-7.6	-7.2	-7.1	-7.0	-10.5	-15.9
H4	-20.5	-20.5	-20.5	-17.7	-13.4	-9.7	-7.6	-7.2	-7.1	-6.9	-10.4	-15.9
H5	-20.4	-20.4	-20.4	-17.6	-13.3	-9.5	-7.4	-7.1	-7.0	-6.8	-10.3	-15.8
H6	-20.7	-20.7	-20.7	-17.9	-13.8	-10.1	-8.0	-7.6	-7.6	-7.6	-10.9	-16.1

Table 9.38: Predictions vs Limit Remaining for the Proposed Development at Night, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H7	-18.2	-18.2	-18.2	-15.2	-10.8	-7.0	-4.8	-4.4	-4.3	-4.2	-8.1	-12.5
H8	-20.1	-20.1	-20.1	-17.0	-12.2	-8.4	-6.1	-5.6	-5.5	-5.1	-9.6	-14.3
H9	-19.3	-19.3	-19.3	-16.2	-11.6	-7.8	-5.6	-5.1	-5.0	-4.8	-9.0	-13.5
H10	-16.8	-16.8	-16.8	-13.8	-9.3	-5.5	-3.3	-2.9	-2.8	-2.6	-6.7	-11.1
H11	-16.7	-16.7	-16.7	-13.7	-9.2	-5.4	-3.3	-2.8	-2.7	-2.5	-6.6	-11.0
H12	-23.0	-23.0	-23.0	-20.3	-16.2	-12.4	-10.3	-10.0	-9.9	-9.9	-9.8	-10.1
H13	-18.6	-18.6	-18.6	-15.9	-11.8	-8.0	-5.9	-5.6	-5.6	-5.5	-8.8	-14.0
H14	-18.5	-18.5	-18.5	-15.5	-10.8	-7.1	-4.9	-4.4	-4.2	-4.0	-8.2	-12.8
H15	-18.2	-18.2	-18.2	-15.2	-10.6	-6.8	-4.6	-4.1	-4.0	-3.8	-8.0	-12.4
H16	-18.6	-18.6	-18.6	-15.9	-11.8	-8.0	-5.9	-5.6	-5.6	-5.5	-8.8	-14.0
H17	-14.8	-14.8	-14.8	-12.1	-8.0	-4.2	-2.2	-1.8	-1.8	-1.7	-5.0	-10.2
H18	-13.9	-13.9	-13.9	-11.2	-7.1	-3.3	-1.2	-0.8	-0.8	-0.7	-4.1	-9.3
H19	-14.9	-14.9	-14.9	-12.2	-8.1	-4.3	-2.2	-1.9	-1.9	-1.8	-5.1	-10.3
H20	-13.6	-13.6	-13.6	-10.9	-6.8	-3.0	-0.9	-0.6	-0.5	-0.4	-3.8	-9.0
H21	-15.1	-15.1	-15.1	-12.4	-8.3	-4.5	-2.5	-2.1	-2.1	-2.0	-5.3	-10.5
H22	-14.6	-14.6	-14.6	-11.9	-7.8	-4.0	-1.9	-1.6	-1.6	-1.5	-4.8	-10.0
H23	-14.4	-14.4	-14.4	-11.7	-7.6	-3.8	-1.8	-1.4	-1.4	-1.3	-4.6	-9.8
H24	-12.8	-12.8	-12.8	-9.9	-5.4	-1.6	0.6	1.1	1.3	1.5	-2.7	-7.2
H25	-12.9	-12.9	-12.9	-10.2	-6.1	-2.3	-0.2	0.2	0.2	0.3	-3.1	-8.3
H26	-14.9	-14.9	-14.9	-12.1	-8.1	-4.3	-2.2	-1.9	-1.8	-1.8	-5.1	-10.3
H27	-13.4	-13.4	-13.4	-10.7	-6.6	-2.8	-0.7	-0.4	-0.3	-0.3	-3.6	-8.8
H28	-13.8	-13.8	-13.8	-11.1	-7.0	-3.2	-1.1	-0.8	-0.8	-0.7	-4.0	-9.2
H29	-15.8	-15.8	-15.8	-13.1	-9.0	-5.3	-3.2	-2.8	-2.8	-2.8	-6.0	-11.2
H30	-14.8	-14.8	-14.8	-12.1	-8.0	-4.2	-2.1	-1.8	-1.8	-1.7	-5.0	-10.2
H31	-15.7	-15.7	-15.7	-12.9	-8.9	-5.1	-3.0	-2.7	-2.6	-2.6	-5.9	-11.1
H32	-15.5	-15.5	-15.5	-12.8	-8.7	-4.9	-2.9	-2.5	-2.5	-2.4	-5.7	-10.9
H33	-19.1	-19.1	-19.1	-16.4	-12.3	-8.5	-6.4	-6.1	-6.1	-6.0	-9.3	-14.5
H34	-17.4	-17.4	-17.4	-14.7	-10.6	-6.8	-4.8	-4.4	-4.4	-4.4	-4.4	-5.7
H35	-14.9	-14.9	-14.9	-12.2	-8.1	-4.3	-2.2	-1.9	-1.9	-1.8	-5.1	-10.3
H36	-16.8	-16.8	-16.8	-14.0	-10.0	-6.2	-4.1	-3.8	-3.7	-3.7	-7.0	-12.2
H37	-18.6	-18.6	-18.6	-15.9	-11.9	-8.1	-6.0	-5.7	-5.6	-5.6	-8.9	-14.0
H38	-14.6	-14.6	-14.6	-11.9	-7.9	-4.1	-2.0	-1.7	-1.6	-1.6	-4.9	-10.1
H39	-11.1	-11.1	-11.1	-8.2	-3.8	0.1	2.3	2.7	3.0	3.1	-1.1	-5.5
H40	-14.5	-14.5	-14.5	-11.8	-7.7	-3.9	-1.8	-1.5	-1.4	-1.4	-4.7	-9.9
H41	-17.8	-17.8	-17.8	-15.1	-11.0	-7.3	-5.2	-4.8	-4.8	-4.7	-8.0	-13.2

Table 9.38: Predictions vs Limit Remaining for the Proposed Development at Night, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H42	-17.0	-17.0	-17.0	-14.3	-10.3	-6.5	-4.4	-4.1	-4.0	-4.0	-7.3	-12.4
H43	-18.6	-18.6	-18.6	-15.9	-11.8	-8.0	-6.0	-5.6	-5.6	-5.5	-8.8	-14.0
H44	-15.3	-15.3	-15.3	-12.6	-8.5	-4.7	-2.7	-2.3	-2.3	-2.2	-5.5	-10.7
H45	-17.4	-17.4	-17.4	-14.7	-10.6	-6.8	-4.7	-4.4	-4.4	-4.3	-7.6	-12.8
H46	-18.0	-18.0	-18.0	-15.3	-11.2	-7.5	-5.4	-5.0	-5.0	-4.9	-8.2	-13.4
H47	-18.1	-18.1	-18.1	-15.4	-11.3	-7.5	-5.4	-5.1	-6.8	-10.4	-14.7	-19.4
H48	-12.6	-12.6	-12.6	-9.7	-5.3	-1.5	0.7	1.2	1.4	1.6	-2.6	-7.0
H49	-15.0	-15.0	-15.0	-12.1	-7.8	-3.9	-1.7	-1.2	-0.9	-0.7	-5.0	-9.4
H50	-15.5	-15.5	-15.5	-12.6	-8.3	-4.4	-2.2	-1.7	-1.4	-1.2	-5.5	-9.9
H52	-14.9	-14.9	-14.9	-12.1	-7.7	-3.9	-1.6	-1.1	-0.8	-0.6	-4.9	-9.3
H53	-15.1	-15.1	-15.1	-12.3	-7.9	-4.1	-1.8	-1.3	-1.0	-0.8	-5.1	-9.5
H54	-15.7	-15.7	-15.7	-12.8	-8.5	-4.6	-2.4	-1.9	-1.5	-1.3	-5.7	-10.1
H55	-15.3	-15.3	-15.3	-12.5	-8.2	-4.3	-2.0	-1.6	-1.3	-4.1	-7.5	-11.3
H56	-14.4	-14.4	-14.4	-11.6	-7.4	-3.5	-1.3	-0.8	-0.6	-3.3	-6.7	-10.5
H57	-14.2	-14.2	-14.2	-11.4	-7.2	-3.3	-1.1	-0.6	-0.4	-3.1	-6.5	-10.3
H58	-14.7	-14.7	-14.7	-11.9	-7.6	-3.8	-1.5	-1.0	-0.8	-3.6	-6.9	-10.7
H59	-14.7	-14.7	-14.7	-11.9	-7.6	-3.8	-1.5	-1.0	-0.8	-3.6	-6.9	-10.7
H60	-14.6	-14.6	-14.6	-11.8	-7.6	-3.7	-1.5	-1.0	-0.8	-3.5	-6.9	-10.7
H61	-14.6	-14.6	-14.6	-11.8	-7.5	-3.7	-1.4	-0.9	-0.8	-3.5	-6.8	-10.6
H62	-14.5	-14.5	-14.5	-11.7	-7.4	-3.5	-1.3	-0.8	-0.6	-3.4	-6.7	-10.5
H63	-14.7	-14.7	-14.7	-11.9	-7.6	-3.7	-1.5	-1.0	-0.8	-3.5	-6.9	-10.7
H64	-14.6	-14.6	-14.6	-11.8	-7.6	-3.7	-1.5	-1.0	-0.8	-3.5	-6.9	-10.7
H65	-14.6	-14.6	-14.6	-11.8	-7.5	-3.7	-1.5	-1.0	-0.8	-3.5	-6.8	-10.6
H66	-14.6	-14.6	-14.6	-11.8	-7.5	-3.7	-1.4	-1.0	-0.8	-3.5	-6.8	-10.6
H67	-14.2	-14.2	-14.2	-11.4	-7.1	-3.3	-1.1	-0.6	-0.4	-3.1	-6.4	-10.2
H68	-9.9	-9.9	-9.9	-7.1	-2.8	1.1	3.4	3.9	4.1	1.2	-2.2	-6.1
H69	-16.9	-16.9	-16.9	-14.2	-10.0	-6.2	-4.1	-3.7	-3.6	-3.6	-3.5	-5.5
H70	-11.6	-11.6	-11.6	-8.8	-4.5	-0.7	1.5	2.0	2.1	-0.6	-3.9	-7.6
H71	-15.8	-15.8	-15.8	-13.0	-8.7	-4.9	-2.6	-2.2	-1.9	-4.7	-8.0	-11.8
H72	-20.1	-20.1	-20.1	-17.4	-13.3	-9.6	-7.5	-7.1	-8.8	-12.5	-16.7	-21.4
H73	-10.6	-10.6	-10.6	-7.8	-3.0	1.2	3.8	4.1	4.0	1.4	-2.8	-7.0
H74	-10.3	-10.3	-10.3	-7.6	-2.6	1.7	3.8	4.1	4.1	1.8	-2.4	-6.8
H75	-12.3	-12.3	-12.3	-9.5	-5.4	-1.6	0.6	1.0	-0.7	-4.6	-8.9	-13.7
H76	-11.4	-11.4	-11.4	-8.6	-4.0	0.1	2.7	3.5	3.4	0.5	-3.5	-7.6
H77	-11.3	-11.3	-11.3	-8.5	-3.9	0.2	2.7	3.5	3.5	0.6	-3.4	-7.6

Table 9.38: Predictions vs Limit Remaining for the Proposed Development at Night, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H78	-11.8	-11.8	-11.8	-9.0	-4.9	-1.1	1.1	1.6	-0.2	-4.1	-8.4	-13.2
H79	-11.0	-11.0	-11.0	-8.2	-4.1	-0.2	2.1	2.6	2.8	0.1	-3.2	-6.9
H80	-12.8	-12.8	-12.8	-10.1	-5.9	-1.9	0.4	1.2	-0.8	-5.0	-9.5	-14.4
H81	-12.2	-12.2	-12.2	-9.5	-5.2	-1.3	1.1	1.8	2.3	-0.7	-4.2	-8.1
H82	-13.1	-13.1	-13.1	-10.4	-6.1	-2.0	0.6	1.7	-0.4	-5.1	-9.8	-14.8
H83	-13.1	-13.1	-13.1	-10.4	-6.1	-2.0	0.6	1.7	-0.4	-5.1	-9.8	-14.8
H84	-11.5	-11.5	-11.5	-8.8	-4.8	-1.0	1.0	1.3	1.3	-1.0	-3.9	-8.8
H85	-16.2	-16.2	-16.2	-13.4	-9.2	-5.4	-3.2	-2.7	-2.6	-5.2	-8.5	-12.2
H86	-16.5	-16.5	-16.5	-13.7	-9.6	-5.7	-3.5	-3.1	-3.0	-5.6	-8.8	-12.5
H87	-16.3	-16.3	-16.3	-13.6	-9.4	-5.6	-3.4	-2.9	-2.8	-5.4	-8.7	-12.4
H88	-14.2	-14.2	-14.2	-11.5	-7.4	-3.6	-1.5	-1.2	-1.1	-1.1	-4.4	-9.6
H89	-13.5	-13.5	-13.5	-10.8	-6.7	-2.9	-0.8	-0.5	-0.4	-0.4	-3.7	-8.9

9.4.56 A noise management strategy can be implemented to reduce the predicted noise levels to below the limit remaining for the proposed development. This involves operating certain turbines within the proposed development in reduced noise mode in certain conditions. The Vestas V117 4.2 MW machine has three reduced noise modes whereby the pitch of the turbine blades can be altered, sacrificing power production, to decrease the amount of noise produced. Acoustic emission data for the available reduced noise modes, with the inclusion of a 2 dB(A) allowance for measurement uncertainty, is shown in Table 9.39.

Table 9.39: A-Weighted Sound Power Levels (dB(A) re 1 pW) for Vestas V117 4.2 MW Reduced Noise Modes

Standardised 10 m Height Wind Speed, v10 (ms-1)	Mode 1	Mode 2	Mode 3
1	95.0	95.0	95.0
2	95.0	95.0	95.0
3	95.0	95.0	95.0
4	97.8	97.8	97.8
5	102.0	101.9	101.8
6	105.3	103.9	102.9
7	106.8	104.3	103.0
8	107.0	104.5	103.0
9	107.0	104.9	103.0
10	107.0	105.0	103.0
11	107.0	105.0	103.0

Table 9.39: A-Weighted Sound Power Levels (dB(A) re 1 pW) for Vestas V117 4.2 MW Reduced Noise Modes			
Standardised 10 m Height Wind Speed, v10 (ms-1)	**Mode 1**	**Mode 2**	**Mode 3**
12	107.0	105.0	103.0

9.4.57 An example of a noise management strategy which would allow the noise limit to be met is provided in Tables 9.40 and 9.41. 'Mode 0' refers to the turbine operating in its standard setting as per Table 9.13. There are many different combinations of turbines operating in different modes which would result in the limit being met and this is just one example to demonstrate the principle rather than being optimised from an energy capture perspective.

Table 9.40: Example Daytime Noise Management Strategy				
Standardised 10 m Height Wind Speed, v10 (ms-1)	**6**	**7**	**8**	**9**
T1	Mode 2	OFF	OFF	Mode 3
T2	OFF	Mode 3	OFF	Mode 3
T3	Mode 3	Mode 3	Mode 2	Mode 2
T4	Mode 2	Mode 3	Mode 2	Mode 2
T5	Mode 2	Mode 3	Mode 3	Mode 1
T6	Mode 2	Mode 3	Mode 3	Mode 1
T7	Mode 2	Mode 2	Mode 3	Mode 1
T8	Mode 3	Mode 3	Mode 1	Mode 0

Table 9.41: Example Night-time Noise Management Strategy					
Standardised 10 m Height Wind Speed, v_{10} (ms^{-1})	**6**	**7**	**8**	**9**	**10**
T1	Mode 1	Mode 1	Mode 2	Mode 2	Mode 3
T2	Mode 2	Mode 2	Mode 2	Mode 3	Mode 2
T3	Mode 2	Mode 2	Mode 2	Mode 2	Mode 2
T4	Mode 2	Mode 3	Mode 3	Mode 3	Mode 2
T5	Mode 2	Mode 2	Mode 2	Mode 2	Mode 2
T6	Mode 2	Mode 3	Mode 3	Mode 3	Mode 1
T7	Mode 2	Mode 2	Mode 2	Mode 2	Mode 2
T8	Mode 2	Mode 2	Mode 2	Mode 2	Mode 0

9.4.58 The presented noise levels during day and night-time periods with the above noise management strategies in place are provided in Tables 9.42 and 9.43. The resulting margins to the limit remaining for the proposed development are shown in Tables 9.44 and 9.45 and there are no longer any exceedances. Charts 21-28 show the predicted noise levels for the proposed development with and without noise management against the noise criteria for the four background noise survey locations.

Table 9.42: Predicted Noise Levels for Proposed Development with Daytime Noise Management, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H1	17.2	17.2	17.2	19.9	23.9	24.9	23.8	24.2	27.3	30.1	30.1	30.1
H2	17.2	17.2	17.2	19.9	23.9	24.9	23.8	24.2	27.3	30.1	30.1	30.1
H3	17.3	17.3	17.3	20.0	24.1	25.0	23.9	24.3	27.4	30.2	30.2	30.2
H4	17.4	17.4	17.4	20.0	24.1	25.1	24.0	24.3	27.4	30.3	30.3	30.3
H5	17.5	17.5	17.5	20.2	24.2	25.2	24.0	24.4	27.5	30.4	30.4	30.4
H6	17.3	17.3	17.3	20.0	24.0	25.2	24.6	25.3	28.1	30.2	30.2	30.2
H7	19.6	19.6	19.6	22.3	26.3	27.4	26.2	26.5	29.7	32.5	32.5	32.5
H8	17.5	17.5	17.5	20.2	24.2	25.1	24.2	24.3	27.6	30.4	30.4	30.4
H9	18.4	18.4	18.4	21.1	25.1	26.1	25.1	25.2	28.5	31.3	31.3	31.3
H10	20.9	20.9	20.9	23.6	27.7	28.7	27.4	27.6	30.9	33.8	33.8	33.8
H11	21.0	21.0	21.0	23.7	27.7	28.8	27.4	27.7	31.0	33.9	33.9	33.9
H12	21.9	21.9	21.9	24.6	28.6	29.7	28.2	28.4	31.8	34.8	34.8	34.8
H13	19.3	19.3	19.3	22.0	26.0	27.3	26.7	27.5	30.3	32.2	32.2	32.2
H14	19.2	19.2	19.2	21.9	25.9	26.8	25.8	25.8	29.2	32.1	32.1	32.1
H15	19.5	19.5	19.5	22.2	26.2	27.1	26.1	25.9	29.4	32.4	32.4	32.4
H16	19.4	19.4	19.4	22.1	26.1	27.4	27.0	27.9	30.6	32.3	32.3	32.3
H17	23.1	23.1	23.1	25.8	29.8	31.2	30.7	31.6	34.3	36.0	36.0	36.0
H18	24.0	24.0	24.0	26.7	30.8	32.1	31.6	32.5	35.2	36.9	36.9	36.9
H19	23.0	23.0	23.0	25.7	29.8	31.1	30.7	31.6	34.2	35.9	35.9	35.9
H20	24.3	24.3	24.3	27.0	31.0	32.4	31.9	32.7	35.4	37.2	37.2	37.2
H21	22.8	22.8	22.8	25.5	29.6	30.9	30.5	31.4	34.1	35.7	35.7	35.7
H22	23.4	23.4	23.4	26.1	30.1	31.4	31.0	31.9	34.6	36.3	36.3	36.3
H23	23.5	23.5	23.5	26.2	30.3	31.6	31.2	32.1	34.8	36.4	36.4	36.4
H24	24.8	24.8	24.8	27.5	31.5	32.2	30.7	30.1	34.1	37.7	37.7	37.7
H25	25.0	25.0	25.0	27.7	31.8	33.1	32.7	33.5	36.2	37.9	37.9	37.9
H26	23.1	23.1	23.1	25.8	29.8	31.2	30.8	31.8	34.4	36.0	36.0	36.0
H27	24.6	24.6	24.6	27.3	31.3	32.7	32.3	33.2	35.9	37.5	37.5	37.5
H28	24.1	24.1	24.1	26.8	30.9	32.2	31.9	32.8	35.5	37.0	37.0	37.0
H29	22.1	22.1	22.1	24.8	28.9	30.2	29.9	31.0	33.5	35.0	35.0	35.0
H30	23.2	23.2	23.2	25.9	29.9	31.2	30.9	32.0	34.5	36.1	36.1	36.1
H31	22.3	22.3	22.3	25.0	29.0	30.4	30.0	31.2	33.7	35.2	35.2	35.2
H32	22.5	22.5	22.5	25.2	29.2	30.5	30.2	31.4	33.9	35.4	35.4	35.4

Table 9.42: Predicted Noise Levels for Proposed Development with Daytime Noise Management, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H33	18.9	18.9	18.9	21.6	25.6	26.9	26.6	27.8	30.3	31.8	31.8	31.8
H34	27.6	27.6	27.6	30.3	34.4	35.8	35.4	36.2	38.9	40.5	40.5	40.5
H35	23.1	23.1	23.1	25.8	29.8	31.1	30.9	32.0	34.5	36.0	36.0	36.0
H36	21.2	21.2	21.2	23.9	27.9	29.3	29.0	30.2	32.7	34.1	34.1	34.1
H37	19.3	19.3	19.3	22.0	26.0	27.3	27.1	28.3	30.7	32.2	32.2	32.2
H38	23.3	23.3	23.3	26.0	30.0	31.4	31.1	32.3	34.8	36.2	36.2	36.2
H39	26.5	26.5	26.5	29.2	33.3	33.6	32.9	32.0	36.0	39.4	39.4	39.4
H40	23.5	23.5	23.5	26.2	30.2	31.6	31.3	32.5	35.0	36.4	36.4	36.4
H41	20.2	20.2	20.2	22.9	26.9	28.2	27.9	29.2	31.6	33.1	33.1	33.1
H42	20.9	20.9	20.9	23.6	27.6	29.0	28.7	29.9	32.4	33.8	33.8	33.8
H43	19.4	19.4	19.4	22.1	26.1	27.4	27.1	28.3	30.8	32.3	32.3	32.3
H44	22.7	22.7	22.7	25.4	29.4	30.7	30.5	31.7	34.2	35.6	35.6	35.6
H45	20.6	20.6	20.6	23.3	27.3	28.6	28.4	29.7	32.1	33.5	33.5	33.5
H46	20.0	20.0	20.0	22.7	26.7	28.0	27.8	29.0	31.5	32.9	32.9	32.9
H47	19.9	19.9	19.9	22.6	26.6	27.9	27.7	29.0	31.4	32.8	32.8	32.8
H48	25.0	25.0	25.0	27.7	31.7	31.7	32.0	30.9	34.7	37.9	37.9	37.9
H49	22.6	22.6	22.6	25.3	29.4	29.5	29.8	29.0	32.5	35.5	35.5	35.5
H50	22.1	22.1	22.1	24.8	28.9	29.1	29.3	28.6	32.1	35.0	35.0	35.0
H52	22.7	22.7	22.7	25.4	29.4	29.6	29.9	29.2	32.6	35.6	35.6	35.6
H53	22.5	22.5	22.5	25.2	29.2	29.4	29.7	29.0	32.4	35.4	35.4	35.4
H54	21.9	21.9	21.9	24.6	28.6	28.9	29.1	28.6	31.9	34.8	34.8	34.8
H55	22.3	22.3	22.3	25.0	29.0	29.3	29.7	29.2	32.4	35.2	35.2	35.2
H56	23.2	23.2	23.2	25.9	29.9	30.2	30.6	30.0	33.3	36.1	36.1	36.1
H57	23.4	23.4	23.4	26.1	30.1	30.4	30.8	30.3	33.5	36.3	36.3	36.3
H58	22.9	22.9	22.9	25.6	29.6	29.9	30.3	29.8	33.1	35.8	35.8	35.8
H59	22.9	22.9	22.9	25.6	29.6	30.0	30.3	29.8	33.1	35.8	35.8	35.8
H60	23.0	23.0	23.0	25.7	29.7	30.0	30.4	29.9	33.1	35.9	35.9	35.9
H61	23.0	23.0	23.0	25.7	29.7	30.1	30.4	29.9	33.2	35.9	35.9	35.9
H62	23.2	23.2	23.2	25.8	29.9	30.2	30.6	30.1	33.3	36.1	36.1	36.1
H63	23.0	23.0	23.0	25.6	29.7	30.0	30.4	29.9	33.1	35.9	35.9	35.9
H64	23.0	23.0	23.0	25.7	29.7	30.0	30.4	29.9	33.1	35.9	35.9	35.9
H65	23.0	23.0	23.0	25.7	29.7	30.1	30.4	29.9	33.2	35.9	35.9	35.9
H66	23.0	23.0	23.0	25.7	29.8	30.1	30.4	30.0	33.2	35.9	35.9	35.9
H67	23.4	23.4	23.4	26.1	30.2	30.5	30.9	30.4	33.6	36.3	36.3	36.3
H68	27.6	27.6	27.6	30.3	34.3	34.9	35.2	35.0	38.0	40.5	40.5	40.5
H69	27.9	27.9	27.9	30.6	34.6	35.5	35.6	35.6	38.6	40.8	40.8	40.8

Table 9.42: Predicted Noise Levels for Proposed Development with Daytime Noise Management, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H70	26.0	26.0	26.0	28.7	32.8	33.3	33.6	33.4	36.5	38.9	38.9	38.9
H71	21.8	21.8	21.8	24.5	28.6	29.0	29.3	29.0	32.1	34.7	34.7	34.7
H72	17.9	17.9	17.9	20.6	24.6	26.0	25.7	27.2	29.5	30.8	30.8	30.8
H73	26.2	26.2	26.2	28.9	32.9	34.0	33.9	34.2	37.1	39.1	39.1	39.1
H74	26.3	26.3	26.3	28.9	33.0	34.0	34.0	34.3	37.2	39.2	39.2	39.2
H75	25.6	25.6	25.6	28.3	32.3	33.6	33.5	35.4	37.5	38.5	38.5	38.5
H76	25.6	25.6	25.6	28.3	32.4	33.4	33.4	33.7	36.6	38.5	38.5	38.5
H77	25.7	25.7	25.7	28.4	32.4	33.5	33.4	33.7	36.6	38.6	38.6	38.6
H78	26.0	26.0	26.0	28.7	32.8	34.1	34.0	35.6	37.9	38.9	38.9	38.9
H79	26.7	26.7	26.7	29.4	33.5	34.8	34.6	35.8	38.4	39.6	39.6	39.6
H80	24.8	24.8	24.8	27.5	31.5	32.9	32.7	34.1	36.5	37.7	37.7	37.7
H81	25.3	25.3	25.3	28.0	32.0	33.3	33.1	33.9	36.7	38.2	38.2	38.2
H82	24.4	24.4	24.4	27.1	31.1	32.4	32.3	33.6	36.0	37.3	37.3	37.3
H83	24.4	24.4	24.4	27.1	31.1	32.4	32.3	33.6	36.0	37.3	37.3	37.3
H84	23.5	23.5	23.5	26.2	30.2	31.4	31.2	31.8	34.6	36.4	36.4	36.4
H85	21.4	21.4	21.4	24.1	28.2	29.2	29.1	29.5	32.3	34.3	34.3	34.3
H86	21.2	21.2	21.2	23.9	27.9	28.8	28.8	29.2	32.0	34.1	34.1	34.1
H87	21.3	21.3	21.3	24.0	28.0	29.0	28.9	29.3	32.2	34.2	34.2	34.2
H88	23.8	23.8	23.8	26.5	30.5	31.9	31.6	32.9	35.4	36.7	36.7	36.7
H89	24.5	24.5	24.5	27.1	31.2	32.5	32.3	33.7	36.1	37.4	37.4	37.4

Table 9.43: Predicted Noise Levels for Proposed Development with Night-time Noise Management, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H1	17.2	17.2	17.2	19.9	23.9	26.3	27.0	26.4	26.6	27.1	30.1	30.1
H2	17.2	17.2	17.2	19.9	23.9	26.3	27.0	26.4	26.6	27.1	30.1	30.1
H3	17.3	17.3	17.3	20.0	24.1	26.4	27.2	26.5	26.7	27.2	30.2	30.2
H4	17.4	17.4	17.4	20.0	24.1	26.4	27.2	26.5	26.7	27.2	30.3	30.3
H5	17.5	17.5	17.5	20.2	24.2	26.5	27.3	26.7	26.8	27.3	30.4	30.4
H6	17.3	17.3	17.3	20.0	24.0	26.2	26.7	26.4	26.6	27.6	30.2	30.2
H7	19.6	19.6	19.6	22.3	26.3	28.7	29.4	28.8	28.9	29.5	32.5	32.5
H8	17.5	17.5	17.5	20.2	24.2	26.5	27.2	26.6	26.7	27.4	30.4	30.4
H9	18.4	18.4	18.4	21.1	25.1	27.5	28.2	27.5	27.6	28.3	31.3	31.3
H10	20.9	20.9	20.9	23.6	27.7	30.1	30.8	30.1	30.3	30.7	33.8	33.8

Table 9.43: Predicted Noise Levels for Proposed Development with Night-time Noise Management, dB(A)												
House ID	**Reference Wind Speed, Standardised v_{10} (ms^{-1})**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H11	21.0	21.0	21.0	23.7	27.7	30.1	30.9	30.2	30.3	30.8	33.9	33.9
H12	21.9	21.9	21.9	24.6	28.6	31.1	31.9	31.1	31.2	31.6	34.8	34.8
H13	19.3	19.3	19.3	22.0	26.0	28.2	28.7	28.5	28.7	29.7	32.2	32.2
H14	19.2	19.2	19.2	21.9	25.9	28.3	29.0	28.3	28.4	29.1	32.1	32.1
H15	19.5	19.5	19.5	22.2	26.2	28.6	29.3	28.6	28.7	29.3	32.4	32.4
H16	19.4	19.4	19.4	22.1	26.1	28.2	28.7	28.5	28.8	30.0	32.3	32.3
H17	23.1	23.1	23.1	25.8	29.8	31.9	32.4	32.3	32.5	33.6	36.0	36.0
H18	24.0	24.0	24.0	26.7	30.8	32.9	33.4	33.2	33.5	34.5	36.9	36.9
H19	23.0	23.0	23.0	25.7	29.8	31.9	32.3	32.2	32.5	33.6	35.9	35.9
H20	24.3	24.3	24.3	27.0	31.0	33.1	33.6	33.5	33.8	34.8	37.2	37.2
H21	22.8	22.8	22.8	25.5	29.6	31.6	32.1	32.0	32.3	33.4	35.7	35.7
H22	23.4	23.4	23.4	26.1	30.1	32.2	32.6	32.5	32.8	33.9	36.3	36.3
H23	23.5	23.5	23.5	26.2	30.3	32.3	32.8	32.7	33.0	34.1	36.4	36.4
H24	24.8	24.8	24.8	27.5	31.5	34.0	34.9	34.0	34.0	34.3	37.7	37.7
H25	25.0	25.0	25.0	27.7	31.8	33.8	34.3	34.2	34.5	35.5	37.9	37.9
H26	23.1	23.1	23.1	25.8	29.8	31.9	32.3	32.2	32.5	33.7	36.0	36.0
H27	24.6	24.6	24.6	27.3	31.3	33.4	33.8	33.7	34.0	35.2	37.5	37.5
H28	24.1	24.1	24.1	26.8	30.9	32.9	33.4	33.3	33.6	34.8	37.0	37.0
H29	22.1	22.1	22.1	24.8	28.9	30.9	31.3	31.3	31.6	32.9	35.0	35.0
H30	23.2	23.2	23.2	25.9	29.9	31.9	32.4	32.3	32.6	33.9	36.1	36.1
H31	22.3	22.3	22.3	25.0	29.0	31.1	31.5	31.5	31.7	33.1	35.2	35.2
H32	22.5	22.5	22.5	25.2	29.2	31.2	31.7	31.6	31.9	33.3	35.4	35.4
H33	18.9	18.9	18.9	21.6	25.6	27.7	28.1	28.0	28.3	29.7	31.8	31.8
H34	27.6	27.6	27.6	30.3	34.4	36.4	36.9	36.8	37.1	38.1	40.5	40.5
H35	23.1	23.1	23.1	25.8	29.8	31.8	32.3	32.2	32.5	33.9	36.0	36.0
H36	21.2	21.2	21.2	23.9	27.9	30.0	30.4	30.4	30.6	32.1	34.1	34.1
H37	19.3	19.3	19.3	22.0	26.0	28.1	28.5	28.4	28.7	30.2	32.2	32.2
H38	23.3	23.3	23.3	26.0	30.0	32.1	32.5	32.5	32.8	34.1	36.2	36.2
H39	26.5	26.5	26.5	29.2	33.3	35.7	36.4	35.7	35.6	36.2	39.4	39.4
H40	23.5	23.5	23.5	26.2	30.2	32.2	32.7	32.6	32.9	34.4	36.4	36.4
H41	20.2	20.2	20.2	22.9	26.9	28.9	29.3	29.3	29.6	31.1	33.1	33.1
H42	20.9	20.9	20.9	23.6	27.6	29.7	30.1	30.1	30.3	31.8	33.8	33.8
H43	19.4	19.4	19.4	22.1	26.1	28.1	28.6	28.5	28.8	30.3	32.3	32.3
H44	22.7	22.7	22.7	25.4	29.4	31.4	31.8	31.8	32.1	33.6	35.6	35.6
H45	20.6	20.6	20.6	23.3	27.3	29.4	29.8	29.7	30.0	31.5	33.5	33.5
H46	20.0	20.0	20.0	22.7	26.7	28.7	29.1	29.1	29.4	30.9	32.9	32.9

Table 9.43: Predicted Noise Levels for Proposed Development with Night-time Noise Management, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H47	19.9	19.9	19.9	22.6	26.6	28.7	29.1	29.0	29.3	30.9	32.8	32.8
H48	25.0	25.0	25.0	27.7	31.7	34.0	34.5	34.1	33.9	34.9	37.9	37.9
H49	22.6	22.6	22.6	25.3	29.4	31.5	32.0	31.7	31.5	32.7	35.5	35.5
H50	22.1	22.1	22.1	24.8	28.9	31.1	31.5	31.2	31.0	32.2	35.0	35.0
H52	22.7	22.7	22.7	25.4	29.4	31.5	32.0	31.7	31.5	32.8	35.6	35.6
H53	22.5	22.5	22.5	25.2	29.2	31.4	31.8	31.5	31.3	32.6	35.4	35.4
H54	21.9	21.9	21.9	24.6	28.6	30.8	31.2	30.9	30.7	32.0	34.8	34.8
H55	22.3	22.3	22.3	25.0	29.0	31.2	31.5	31.3	31.1	32.5	35.2	35.2
H56	23.2	23.2	23.2	25.9	29.9	32.0	32.3	32.1	31.9	33.4	36.1	36.1
H57	23.4	23.4	23.4	26.1	30.1	32.2	32.5	32.3	32.1	33.6	36.3	36.3
H58	22.9	22.9	22.9	25.6	29.6	31.7	32.1	31.9	31.7	33.2	35.8	35.8
H59	22.9	22.9	22.9	25.6	29.6	31.7	32.1	31.9	31.7	33.2	35.8	35.8
H60	23.0	23.0	23.0	25.7	29.7	31.8	32.1	31.9	31.7	33.2	35.9	35.9
H61	23.0	23.0	23.0	25.7	29.7	31.8	32.2	32.0	31.8	33.3	35.9	35.9
H62	23.2	23.2	23.2	25.8	29.9	32.0	32.3	32.1	31.9	33.4	36.1	36.1
H63	23.0	23.0	23.0	25.6	29.7	31.8	32.1	31.9	31.7	33.2	35.9	35.9
H64	23.0	23.0	23.0	25.7	29.7	31.8	32.1	31.9	31.7	33.2	35.9	35.9
H65	23.0	23.0	23.0	25.7	29.7	31.8	32.1	31.9	31.8	33.3	35.9	35.9
H66	23.0	23.0	23.0	25.7	29.8	31.9	32.2	32.0	31.8	33.3	35.9	35.9
H67	23.4	23.4	23.4	26.1	30.2	32.3	32.6	32.4	32.2	33.7	36.3	36.3
H68	27.6	27.6	27.6	30.3	34.3	36.3	36.4	36.3	36.2	38.1	40.5	40.5
H69	27.9	27.9	27.9	30.6	34.6	36.7	36.7	36.6	36.5	38.6	40.8	40.8
H70	26.0	26.0	26.0	28.7	32.8	34.8	34.9	34.8	34.7	36.5	38.9	38.9
H71	21.8	21.8	21.8	24.5	28.6	30.6	30.9	30.7	30.6	32.2	34.7	34.7
H72	17.9	17.9	17.9	20.6	24.6	26.6	27.0	26.9	27.2	29.0	30.8	30.8
H73	26.2	26.2	26.2	28.9	32.9	34.9	35.0	34.9	34.9	37.0	39.1	39.1
H74	26.3	26.3	26.3	28.9	33.0	35.0	35.0	35.0	35.0	37.0	39.2	39.2
H75	25.6	25.6	25.6	28.3	32.3	34.3	34.5	34.6	34.9	37.1	38.5	38.5
H76	25.6	25.6	25.6	28.3	32.4	34.4	34.4	34.4	34.4	36.4	38.5	38.5
H77	25.7	25.7	25.7	28.4	32.4	34.4	34.4	34.4	34.4	36.5	38.6	38.6
H78	26.0	26.0	26.0	28.7	32.8	34.7	34.9	35.0	35.3	37.5	38.9	38.9
H79	26.7	26.7	26.7	29.4	33.5	35.4	35.5	35.6	35.7	38.0	39.6	39.6
H80	24.8	24.8	24.8	27.5	31.5	33.5	33.7	33.7	34.0	36.2	37.7	37.7
H81	25.3	25.3	25.3	28.0	32.0	34.0	34.0	34.1	34.2	36.4	38.2	38.2
H82	24.4	24.4	24.4	27.1	31.1	33.1	33.2	33.3	33.5	35.7	37.3	37.3

Table 9.43: Predicted Noise Levels for Proposed Development with Night-time Noise Management, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H83	24.4	24.4	24.4	27.1	31.1	33.1	33.2	33.3	33.5	35.7	37.3	37.3
H84	23.5	23.5	23.5	26.2	30.2	32.2	32.3	32.2	32.3	34.4	36.4	36.4
H85	21.4	21.4	21.4	24.1	28.2	30.2	30.4	30.3	30.3	32.2	34.3	34.3
H86	21.2	21.2	21.2	23.9	27.9	29.9	30.1	30.0	30.0	31.9	34.1	34.1
H87	21.3	21.3	21.3	24.0	28.0	30.0	30.2	30.1	30.1	32.0	34.2	34.2
H88	23.8	23.8	23.8	26.5	30.5	32.5	32.9	32.9	33.2	34.7	36.7	36.7
H89	24.5	24.5	24.5	27.1	31.2	33.2	33.6	33.6	33.9	35.5	37.4	37.4

Table 9.44: Predictions with Noise Management vs Limit Remaining for the Proposed Development during the Day, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H1	-17.6	-17.6	-17.5	-14.8	-10.7	-9.5	-10.3	-9.6	-8.5	-9.4	-13.3	-18.0
H2	-17.5	-17.5	-17.5	-14.8	-10.7	-9.5	-10.3	-9.6	-8.5	-9.4	-13.3	-18.0
H3	-17.4	-17.4	-17.4	-14.7	-10.5	-9.4	-10.2	-9.5	-8.3	-9.3	-13.2	-17.9
H4	-17.4	-17.4	-17.4	-14.7	-10.5	-9.4	-10.2	-9.5	-8.3	-9.2	-13.2	-17.8
H5	-17.3	-17.3	-17.3	-14.5	-10.4	-9.3	-10.1	-9.4	-8.2	-9.1	-13.1	-17.7
H6	-17.6	-17.6	-17.6	-14.9	-10.8	-9.6	-10.1	-9.3	-8.2	-9.6	-13.4	-18.0
H7	-15.0	-15.0	-14.9	-12.1	-7.9	-6.6	-7.2	-6.0	-6.8	-7.6	-10.3	-12.5
H8	-16.8	-16.8	-16.7	-13.9	-9.5	-8.0	-7.8	-7.7	-7.9	-9.3	-12.0	-14.4
H9	-16.0	-16.0	-16.0	-13.2	-8.9	-7.5	-7.6	-6.8	-7.6	-8.6	-11.3	-13.6
H10	-13.5	-13.5	-13.5	-10.7	-6.4	-5.1	-5.7	-4.4	-5.4	-6.1	-8.9	-11.1
H11	-13.5	-13.5	-13.4	-10.6	-6.3	-5.0	-5.6	-4.4	-5.3	-6.0	-8.8	-11.1
H12	-23.0	-23.0	-23.0	-20.3	-16.3	-15.2	-16.6	-16.4	-13.0	-9.9	-9.8	-10.2
H13	-15.6	-15.6	-15.6	-12.9	-8.8	-7.5	-8.0	-7.1	-6.0	-7.5	-11.4	-15.9
H14	-15.2	-15.2	-15.2	-12.4	-8.1	-6.8	-6.9	-6.2	-6.9	-7.8	-10.5	-12.8
H15	-14.9	-14.9	-14.9	-12.1	-7.8	-6.6	-6.7	-6.1	-6.7	-7.5	-10.2	-12.5
H16	-15.5	-15.5	-15.5	-12.8	-8.8	-7.5	-7.9	-6.9	-5.9	-7.5	-11.3	-15.9
H17	-11.8	-11.8	-11.8	-9.1	-5.0	-3.6	-4.0	-3.0	-2.0	-3.7	-7.6	-12.2
H18	-10.9	-10.9	-10.8	-8.1	-4.1	-2.7	-3.0	-2.1	-1.1	-2.8	-6.7	-11.2
H19	-11.9	-11.9	-11.9	-9.1	-5.1	-3.7	-4.1	-3.1	-2.1	-3.8	-7.7	-12.2
H20	-10.6	-10.6	-10.6	-7.8	-3.8	-2.4	-2.8	-1.8	-0.8	-2.5	-6.4	-10.9
H21	-12.1	-12.1	-12.1	-9.4	-5.3	-3.9	-4.3	-3.3	-2.3	-4.0	-7.9	-12.4
H22	-11.6	-11.6	-11.6	-8.8	-4.8	-3.4	-3.8	-2.7	-1.8	-3.5	-7.4	-11.9
H23	-11.4	-11.4	-11.4	-8.7	-4.6	-3.2	-3.6	-2.5	-1.6	-3.3	-7.2	-11.7

Table 9.44: Predictions with Noise Management vs Limit Remaining for the Proposed Development during the Day, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H24	-9.6	-9.6	-9.5	-6.7	-2.4	-1.4	-2.1	-1.9	-2.0	-2.1	-4.9	-7.2
H25	-9.9	-9.9	-9.8	-7.1	-3.1	-1.6	-2.0	-1.0	0.0	-1.8	-5.7	-10.2
H26	-11.8	-11.8	-11.8	-9.1	-5.1	-3.7	-4.0	-2.9	-2.0	-3.8	-7.6	-12.2
H27	-10.3	-10.3	-10.3	-7.6	-3.5	-2.1	-2.5	-1.4	-0.4	-2.3	-6.1	-10.7
H28	-10.8	-10.8	-10.8	-8.0	-4.0	-2.6	-2.9	-1.8	-0.9	-2.7	-6.6	-11.1
H29	-12.8	-12.8	-12.8	-10.1	-6.0	-4.7	-4.9	-3.8	-2.9	-4.7	-8.6	-13.1
H30	-11.8	-11.8	-11.8	-9.0	-5.0	-3.6	-3.9	-2.7	-1.8	-3.7	-7.6	-12.1
H31	-12.6	-12.6	-12.6	-9.9	-5.8	-4.5	-4.7	-3.6	-2.7	-4.6	-8.4	-13.0
H32	-12.5	-12.5	-12.5	-9.7	-5.7	-4.3	-4.6	-3.4	-2.5	-4.4	-8.3	-12.8
H33	-16.0	-16.0	-16.0	-13.3	-9.3	-8.0	-8.2	-7.0	-6.1	-8.0	-11.8	-16.4
H34	-17.4	-17.4	-17.4	-14.7	-10.6	-9.2	-9.6	-8.7	-6.0	-4.4	-4.4	-7.6
H35	-11.9	-11.9	-11.9	-9.1	-5.1	-3.7	-3.9	-2.7	-1.8	-3.8	-7.7	-12.2
H36	-13.7	-13.7	-13.7	-11.0	-7.0	-5.6	-5.8	-4.6	-3.7	-5.7	-9.5	-14.1
H37	-15.6	-15.6	-15.6	-12.9	-8.9	-7.5	-7.8	-6.5	-5.7	-7.6	-11.4	-16.0
H38	-11.6	-11.6	-11.6	-8.9	-4.8	-3.5	-3.7	-2.4	-1.6	-3.6	-7.4	-12.0
H39	-7.9	-7.9	-7.8	-4.9	-0.7	0.0	0.0	-0.1	-0.2	-0.4	-3.3	-5.5
H40	-11.4	-11.4	-11.4	-8.7	-4.7	-3.3	-3.5	-2.2	-1.4	-3.4	-7.2	-11.8
H41	-14.8	-14.8	-14.8	-12.1	-8.0	-6.7	-6.9	-5.6	-4.8	-6.7	-10.6	-15.1
H42	-14.0	-14.0	-14.0	-11.3	-7.3	-5.9	-6.1	-4.8	-4.0	-6.0	-9.8	-14.4
H43	-15.6	-15.6	-15.6	-12.8	-8.8	-7.5	-7.7	-6.4	-5.6	-7.5	-11.4	-15.9
H44	-12.3	-12.3	-12.3	-9.6	-5.5	-4.1	-4.3	-3.0	-2.2	-4.2	-8.1	-12.6
H45	-14.3	-14.3	-14.3	-11.6	-7.6	-6.2	-6.4	-5.1	-4.3	-6.3	-10.1	-14.7
H46	-15.0	-15.0	-15.0	-12.3	-8.2	-6.9	-7.1	-5.8	-4.9	-6.9	-10.8	-15.3
H47	-15.0	-15.0	-15.0	-12.3	-8.3	-6.9	-7.9	-9.2	-9.8	-11.9	-15.6	-19.7
H48	-9.4	-9.4	-9.3	-6.4	-2.1	-1.9	-1.0	-1.2	-1.5	-1.9	-4.8	-7.1
H49	-11.8	-11.8	-11.6	-8.7	-4.5	-4.0	-3.1	-3.0	-3.6	-4.3	-7.2	-9.5
H50	-12.3	-12.3	-12.1	-9.2	-4.9	-4.4	-3.6	-3.4	-4.1	-4.8	-7.7	-10.0
H52	-11.7	-11.7	-11.6	-8.6	-4.3	-3.9	-2.9	-2.8	-3.4	-4.2	-7.1	-9.4
H53	-11.9	-11.9	-11.8	-8.8	-4.6	-4.1	-3.1	-3.0	-3.6	-4.4	-7.3	-9.6
H54	-12.5	-12.5	-12.3	-9.4	-5.1	-4.5	-3.6	-3.4	-4.1	-4.9	-7.9	-10.2
H55	-12.4	-12.7	-12.7	-10.2	-6.6	-6.9	-7.4	-9.0	-7.2	-6.5	-8.7	-11.4
H56	-11.6	-11.8	-11.9	-9.4	-5.8	-6.1	-6.6	-8.2	-6.4	-5.7	-7.9	-10.6
H57	-11.4	-11.6	-11.7	-9.2	-5.6	-5.9	-6.4	-8.0	-6.2	-5.5	-7.7	-10.4
H58	-11.9	-12.1	-12.2	-9.7	-6.1	-6.3	-6.8	-8.4	-6.7	-5.9	-8.2	-10.8
H59	-11.9	-12.1	-12.2	-9.7	-6.1	-6.3	-6.8	-8.4	-6.7	-5.9	-8.2	-10.8

Table 9.44: Predictions with Noise Management vs Limit Remaining for the Proposed Development during the Day, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H60	-11.8	-12.0	-12.1	-9.6	-6.0	-6.3	-6.8	-8.4	-6.6	-5.9	-8.1	-10.8
H61	-11.8	-12.0	-12.1	-9.6	-6.0	-6.2	-6.7	-8.3	-6.6	-5.8	-8.1	-10.7
H62	-11.6	-11.8	-11.9	-9.4	-5.8	-6.1	-6.6	-8.2	-6.4	-5.7	-7.9	-10.6
H63	-11.8	-12.0	-12.1	-9.6	-6.0	-6.3	-6.8	-8.4	-6.6	-5.9	-8.1	-10.8
H64	-11.8	-12.0	-12.1	-9.6	-6.0	-6.3	-6.7	-8.4	-6.6	-5.8	-8.1	-10.8
H65	-11.8	-12.0	-12.1	-9.6	-6.0	-6.3	-6.7	-8.3	-6.6	-5.8	-8.1	-10.7
H66	-11.8	-12.0	-12.1	-9.5	-6.0	-6.2	-6.7	-8.3	-6.5	-5.8	-8.1	-10.7
H67	-11.4	-11.6	-11.7	-9.2	-5.6	-5.9	-6.3	-7.9	-6.2	-5.4	-7.7	-10.3
H68	-6.8	-7.1	-7.2	-4.8	-1.0	-1.0	-1.6	-3.0	-1.6	-1.2	-3.5	-6.2
H69	-16.9	-16.9	-16.9	-14.2	-10.0	-9.2	-9.0	-8.9	-5.9	-3.6	-3.5	-5.6
H70	-8.7	-8.9	-9.0	-6.6	-2.9	-2.9	-3.5	-4.9	-3.3	-2.9	-5.1	-7.7
H71	-12.9	-13.1	-13.2	-10.7	-7.1	-7.3	-7.9	-9.3	-7.6	-7.0	-9.3	-11.9
H72	-17.1	-17.1	-17.1	-14.4	-10.3	-8.9	-9.9	-11.0	-11.7	-13.9	-17.6	-21.7
H73	-6.7	-7.0	-7.2	-4.9	-0.6	-0.1	-1.2	-2.4	-1.3	-1.7	-4.2	-7.1
H74	-6.1	-6.5	-6.7	-4.4	-0.5	-0.1	-1.0	-1.8	-0.7	-1.3	-4.0	-6.9
H75	-9.1	-9.1	-9.1	-6.4	-2.2	-0.8	-1.5	-2.4	-3.5	-6.1	-9.8	-14.0
H76	-7.8	-8.0	-8.2	-5.9	-1.8	-1.2	-2.3	-3.3	-2.1	-2.4	-4.9	-7.7
H77	-7.7	-8.0	-8.2	-5.8	-1.7	-1.1	-2.2	-3.2	-2.0	-2.4	-4.9	-7.7
H78	-8.6	-8.6	-8.6	-5.8	-1.6	-0.1	-0.8	-2.1	-3.0	-5.6	-9.4	-13.5
H79	-8.1	-8.3	-8.5	-6.1	-2.4	-1.6	-2.6	-2.6	-1.5	-2.2	-4.4	-7.0
H80	-9.5	-9.5	-9.4	-6.7	-2.3	-0.5	-1.1	-2.8	-4.0	-6.6	-10.5	-14.7
H81	-9.1	-9.3	-9.5	-7.1	-3.5	-2.7	-3.7	-3.9	-2.7	-3.2	-5.6	-8.3
H82	-9.6	-9.6	-9.6	-6.7	-2.2	0.0	-0.4	-2.5	-4.1	-6.9	-10.9	-15.1
H83	-9.6	-9.6	-9.6	-6.7	-2.2	0.0	-0.4	-2.5	-4.1	-6.9	-10.9	-15.1
H84	-8.8	-9.0	-9.2	-6.8	-3.3	-2.7	-3.8	-4.3	-2.9	-2.9	-5.1	-9.0
H85	-13.3	-13.5	-13.6	-11.2	-7.6	-7.2	-8.1	-8.9	-7.5	-7.5	-9.7	-12.3
H86	-13.6	-13.8	-14.0	-11.5	-7.9	-7.6	-8.5	-9.3	-7.9	-7.8	-10.0	-12.6
H87	-13.4	-13.6	-13.8	-11.3	-7.8	-7.4	-8.3	-9.1	-7.7	-7.7	-9.9	-12.5
H88	-11.1	-11.1	-11.1	-8.4	-4.4	-3.0	-3.1	-1.8	-1.0	-3.1	-6.9	-11.5
H89	-10.5	-10.5	-10.4	-7.7	-3.7	-2.3	-2.4	-0.9	-0.2	-2.4	-6.3	-10.8

Table 9.45: Predictions with Noise Management vs Limit Remaining for the Proposed Development at Night, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H1	-20.7	-20.7	-20.7	-17.8	-13.6	-11.2	-10.4	-11.0	-10.8	-10.1	-10.6	-16.0
H2	-20.7	-20.7	-20.7	-17.8	-13.6	-11.2	-10.4	-11.0	-10.8	-10.1	-10.6	-16.0
H3	-20.5	-20.5	-20.5	-17.7	-13.5	-11.1	-10.3	-10.9	-10.7	-10.0	-10.5	-15.9
H4	-20.5	-20.5	-20.5	-17.7	-13.4	-11.1	-10.3	-10.9	-10.7	-10.0	-10.4	-15.9
H5	-20.4	-20.4	-20.4	-17.6	-13.3	-11.0	-10.1	-10.7	-10.5	-9.9	-10.3	-15.8
H6	-20.7	-20.7	-20.7	-17.9	-13.8	-11.7	-11.1	-11.4	-11.2	-10.1	-10.9	-16.1
H7	-18.2	-18.2	-18.2	-15.2	-10.8	-8.4	-7.6	-8.1	-7.9	-7.3	-8.1	-12.5
H8	-20.1	-20.1	-20.1	-17.0	-12.2	-9.8	-9.0	-9.4	-9.1	-8.0	-9.6	-14.3
H9	-19.3	-19.3	-19.3	-16.2	-11.6	-9.2	-8.4	-8.9	-8.7	-7.8	-9.0	-13.5
H10	-16.8	-16.8	-16.8	-13.8	-9.3	-6.9	-6.0	-6.6	-6.3	-5.7	-6.7	-11.1
H11	-16.7	-16.7	-16.7	-13.7	-9.2	-6.8	-5.9	-6.5	-6.3	-5.7	-6.6	-11.0
H12	-23.0	-23.0	-23.0	-20.3	-16.2	-13.7	-12.9	-13.7	-13.5	-13.0	-9.8	-10.1
H13	-18.6	-18.6	-18.6	-15.9	-11.8	-9.7	-9.1	-9.3	-9.1	-8.0	-8.8	-14.0
H14	-18.5	-18.5	-18.5	-15.5	-10.8	-8.5	-7.6	-8.1	-7.9	-7.0	-8.2	-12.8
H15	-18.2	-18.2	-18.2	-15.2	-10.6	-8.2	-7.4	-7.9	-7.7	-6.9	-8.0	-12.4
H16	-18.6	-18.6	-18.6	-15.9	-11.8	-9.7	-9.2	-9.4	-9.1	-7.9	-8.8	-14.0
H17	-14.8	-14.8	-14.8	-12.1	-8.0	-5.9	-5.4	-5.5	-5.2	-4.1	-5.0	-10.2
H18	-13.9	-13.9	-13.9	-11.2	-7.1	-5.0	-4.4	-4.6	-4.3	-3.2	-4.1	-9.3
H19	-14.9	-14.9	-14.9	-12.2	-8.1	-6.0	-5.5	-5.6	-5.3	-4.2	-5.1	-10.3
H20	-13.6	-13.6	-13.6	-10.9	-6.8	-4.7	-4.2	-4.3	-4.0	-2.9	-3.8	-9.0
H21	-15.1	-15.1	-15.1	-12.4	-8.3	-6.2	-5.7	-5.8	-5.5	-4.3	-5.3	-10.5
H22	-14.6	-14.6	-14.6	-11.9	-7.8	-5.7	-5.2	-5.3	-5.0	-3.8	-4.8	-10.0
H23	-14.4	-14.4	-14.4	-11.7	-7.6	-5.5	-5.0	-5.1	-4.8	-3.6	-4.6	-9.8
H24	-12.8	-12.8	-12.8	-9.9	-5.4	-2.8	-1.8	-2.6	-2.4	-1.9	-2.7	-7.2
H25	-12.9	-12.9	-12.9	-10.2	-6.1	-4.0	-3.5	-3.6	-3.2	-2.1	-3.1	-8.3
H26	-14.9	-14.9	-14.9	-12.1	-8.1	-6.0	-5.5	-5.6	-5.3	-4.0	-5.1	-10.3
H27	-13.4	-13.4	-13.4	-10.7	-6.6	-4.5	-4.0	-4.1	-3.8	-2.6	-3.6	-8.8
H28	-13.8	-13.8	-13.8	-11.1	-7.0	-4.9	-4.5	-4.5	-4.2	-3.0	-4.0	-9.2
H29	-15.8	-15.8	-15.8	-13.1	-9.0	-7.0	-6.5	-6.6	-6.3	-4.9	-6.0	-11.2
H30	-14.8	-14.8	-14.8	-12.1	-8.0	-5.9	-5.5	-5.5	-5.2	-3.9	-5.0	-10.2
H31	-15.7	-15.7	-15.7	-12.9	-8.9	-6.8	-6.4	-6.4	-6.1	-4.7	-5.9	-11.1
H32	-15.5	-15.5	-15.5	-12.8	-8.7	-6.7	-6.2	-6.2	-5.9	-4.5	-5.7	-10.9
H33	-19.1	-19.1	-19.1	-16.4	-12.3	-10.2	-9.8	-9.9	-9.6	-8.1	-9.3	-14.5
H34	-17.4	-17.4	-17.4	-14.7	-10.6	-8.6	-8.1	-8.1	-7.8	-6.8	-4.4	-5.7
H35	-14.9	-14.9	-14.9	-12.2	-8.1	-6.1	-5.6	-5.6	-5.3	-3.9	-5.1	-10.3

Table 9.45: Predictions with Noise Management vs Limit Remaining for the Proposed Development at Night, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H36	-16.8	-16.8	-16.8	-14.0	-10.0	-7.9	-7.5	-7.5	-7.2	-5.7	-7.0	-12.2
H37	-18.6	-18.6	-18.6	-15.9	-11.9	-9.8	-9.4	-9.4	-9.2	-7.6	-8.9	-14.0
H38	-14.6	-14.6	-14.6	-11.9	-7.9	-5.8	-5.4	-5.4	-5.1	-3.6	-4.9	-10.1
H39	-11.1	-11.1	-11.1	-8.2	-3.8	-1.3	-0.4	-1.0	-0.9	-0.1	-1.1	-5.5
H40	-14.5	-14.5	-14.5	-11.8	-7.7	-5.6	-5.2	-5.2	-4.9	-3.4	-4.7	-9.9
H41	-17.8	-17.8	-17.8	-15.1	-11.0	-9.0	-8.6	-8.6	-8.3	-6.7	-8.0	-13.2
H42	-17.0	-17.0	-17.0	-14.3	-10.3	-8.2	-7.8	-7.8	-7.5	-6.0	-7.3	-12.4
H43	-18.6	-18.6	-18.6	-15.9	-11.8	-9.8	-9.3	-9.4	-9.1	-7.5	-8.8	-14.0
H44	-15.3	-15.3	-15.3	-12.6	-8.5	-6.5	-6.1	-6.1	-5.7	-4.2	-5.5	-10.7
H45	-17.4	-17.4	-17.4	-14.7	-10.6	-8.6	-8.1	-8.2	-7.8	-6.3	-7.6	-12.8
H46	-18.0	-18.0	-18.0	-15.3	-11.2	-9.2	-8.8	-8.8	-8.5	-6.9	-8.2	-13.4
H47	-18.1	-18.1	-18.1	-15.4	-11.3	-9.3	-8.8	-8.9	-10.3	-12.4	-14.7	-19.4
H48	-12.6	-12.6	-12.6	-9.7	-5.3	-3.0	-2.3	-2.6	-2.6	-1.4	-2.6	-7.0
H49	-15.0	-15.0	-15.0	-12.1	-7.8	-5.5	-4.9	-5.1	-4.9	-3.6	-5.0	-9.4
H50	-15.5	-15.5	-15.5	-12.6	-8.3	-6.0	-5.3	-5.5	-5.4	-4.0	-5.5	-9.9
H52	-14.9	-14.9	-14.9	-12.1	-7.7	-5.5	-4.8	-5.0	-4.8	-3.3	-4.9	-9.3
H53	-15.1	-15.1	-15.1	-12.3	-7.9	-5.7	-5.1	-5.2	-5.1	-3.6	-5.1	-9.5
H54	-15.7	-15.7	-15.7	-12.8	-8.5	-6.2	-5.6	-5.8	-5.6	-4.0	-5.7	-10.1
H55	-15.3	-15.3	-15.3	-12.5	-8.2	-5.9	-5.4	-5.5	-5.4	-6.8	-7.5	-11.3
H56	-14.4	-14.4	-14.4	-11.6	-7.4	-5.2	-4.7	-4.7	-4.8	-6.0	-6.7	-10.5
H57	-14.2	-14.2	-14.2	-11.4	-7.2	-5.0	-4.5	-4.6	-4.6	-5.8	-6.5	-10.3
H58	-14.7	-14.7	-14.7	-11.9	-7.6	-5.4	-4.9	-5.0	-5.0	-6.2	-6.9	-10.7
H59	-14.7	-14.7	-14.7	-11.9	-7.6	-5.4	-4.9	-5.0	-5.0	-6.2	-6.9	-10.7
H60	-14.6	-14.6	-14.6	-11.8	-7.6	-5.4	-4.9	-4.9	-5.0	-6.2	-6.9	-10.7
H61	-14.6	-14.6	-14.6	-11.8	-7.5	-5.3	-4.8	-4.9	-4.9	-6.1	-6.8	-10.6
H62	-14.5	-14.5	-14.5	-11.7	-7.4	-5.2	-4.7	-4.8	-4.8	-6.0	-6.7	-10.5
H63	-14.7	-14.7	-14.7	-11.9	-7.6	-5.4	-4.9	-5.0	-5.0	-6.2	-6.9	-10.7
H64	-14.6	-14.6	-14.6	-11.8	-7.6	-5.4	-4.9	-4.9	-4.9	-6.2	-6.9	-10.7
H65	-14.6	-14.6	-14.6	-11.8	-7.5	-5.3	-4.9	-4.9	-4.9	-6.1	-6.8	-10.6
H66	-14.6	-14.6	-14.6	-11.8	-7.5	-5.3	-4.9	-4.9	-4.9	-6.1	-6.8	-10.6
H67	-14.2	-14.2	-14.2	-11.4	-7.1	-5.0	-4.5	-4.5	-4.6	-5.7	-6.4	-10.2
H68	-9.9	-9.9	-9.9	-7.1	-2.8	-0.6	-0.3	-0.2	-0.2	-1.2	-2.2	-6.1
H69	-16.9	-16.9	-16.9	-14.2	-10.0	-8.0	-7.9	-7.9	-7.9	-5.8	-3.5	-5.5
H70	-11.6	-11.6	-11.6	-8.8	-4.5	-2.4	-2.1	-2.1	-2.1	-3.0	-3.9	-7.6
H71	-15.8	-15.8	-15.8	-13.0	-8.7	-6.5	-6.1	-6.1	-6.0	-7.2	-8.0	-11.8
H72	-20.1	-20.1	-20.1	-17.4	-13.3	-11.3	-11.0	-10.9	-12.4	-14.2	-16.7	-21.4

Table 9.45: Predictions with Noise Management vs Limit Remaining for the Proposed Development at Night, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
H73	-10.6	-10.6	-10.6	-7.8	-3.0	-0.6	0.0	-0.1	-0.2	-0.7	-2.8	-7.0
H74	-10.3	-10.3	-10.3	-7.6	-2.6	0.0	0.0	0.0	-0.1	-0.4	-2.4	-6.8
H75	-12.3	-12.3	-12.3	-9.5	-5.4	-3.4	-3.1	-2.8	-4.3	-5.9	-8.9	-13.7
H76	-11.4	-11.4	-11.4	-8.6	-4.0	-1.6	-1.1	-0.6	-0.7	-1.6	-3.5	-7.6
H77	-11.3	-11.3	-11.3	-8.5	-3.9	-1.6	-1.1	-0.6	-0.7	-1.5	-3.4	-7.6
H78	-11.8	-11.8	-11.8	-9.0	-4.9	-2.9	-2.5	-2.3	-3.8	-5.5	-8.4	-13.2
H79	-11.0	-11.0	-11.0	-8.2	-4.1	-2.0	-1.7	-1.4	-1.1	-1.5	-3.2	-6.9
H80	-12.8	-12.8	-12.8	-10.1	-5.9	-3.7	-3.3	-2.8	-4.5	-6.5	-9.5	-14.4
H81	-12.2	-12.2	-12.2	-9.5	-5.2	-3.0	-2.7	-2.3	-1.7	-2.5	-4.2	-8.1
H82	-13.1	-13.1	-13.1	-10.4	-6.1	-3.8	-3.1	-2.2	-4.2	-6.7	-9.8	-14.8
H83	-13.1	-13.1	-13.1	-10.4	-6.1	-3.8	-3.1	-2.2	-4.2	-6.7	-9.8	-14.8
H84	-11.5	-11.5	-11.5	-8.8	-4.8	-2.8	-2.7	-2.8	-2.8	-3.0	-3.9	-8.8
H85	-16.2	-16.2	-16.2	-13.4	-9.2	-7.1	-6.8	-6.8	-6.6	-7.4	-8.5	-12.2
H86	-16.5	-16.5	-16.5	-13.7	-9.6	-7.5	-7.2	-7.1	-7.0	-7.8	-8.8	-12.5
H87	-16.3	-16.3	-16.3	-13.6	-9.4	-7.3	-7.0	-7.0	-6.8	-7.6	-8.7	-12.4
H88	-14.2	-14.2	-14.2	-11.5	-7.4	-5.4	-4.9	-4.9	-4.6	-3.0	-4.4	-9.6
H89	-13.5	-13.5	-13.5	-10.8	-6.7	-4.7	-4.3	-4.2	-3.9	-2.2	-3.7	-8.9

9.4.59 The presented noise management strategy is designed such that the limit would be met assuming the properties in question are downwind of the proposed development at all times. The amount of noise management required is likely to reduce for certain wind directions should an assessment considering the attenuation applicable when the property is located crosswind or upwind of the proposed development be undertaken.

9.4.60 Figure 9.2 shows a cumulative noise contour plot calculated using the ISO 9613 Part 2 propagation model. The plot is provided to illustrate the cumulative noise 'footprint' and should be considered indicative only. Where properties are located such that they cannot be downwind of all turbines simultaneously, the predictions made using a downwind propagation model such as ISO 9613-2 are conservative given that reductions in noise would be expected when a property is crosswind or upwind of a noise source. The footprint shows the proposed development without noise management and with no scaling applied to the predicted noise levels for consented or existing sites.

9.4.61 In addition to the assessment of predicted noise levels against noise limits, an assessment of the amount of the time that properties would be downwind of any turbine with and without the proposed development has also been made at the request of the EHO. The results of this assessment, shown in Table 9.46, allow the reader to gauge the increase in exposure due to the introduction of the proposed development. The table shows the percentage of the time that the four background noise survey locations are downwind of the turbines for a given site or combination of sites.

Table 9.46: Cumulative Exposure Assessment				
Sites Considered	**H34**	**H39**	**H69**	**H75**
Cairnmore Hill	32%	21%	29%	53%
Baillie	52%	42%	53%	52%
Forss	51%	51%	52%	52%
Baillie & Forss	68%	68%	72%	61%
Cairnmore Hill, Baillie & Forss	68%	89%	81%	72%
Change due to introduction of Cairnmore Hill	0%	21%	9%	11%

9.4.62 For the purposes of this assessment a property is defined as being downwind of a given site in the direction sectors where the maximum noise levels are predicted when noise levels due to the site are calculated by direction using the directional attenuation factors detailed in Table 9.31. The long-term wind rose shown in Table 9.32 is then used to determine the percentage of the time that the wind is expected to come from the identified sectors. It can be seen that the change in exposure level due to the introduction of the proposed development varies by location within the range of 0% to 21%. The results are shown in graphical form in Charts 29-32.

9.5 Mitigation

Mitigation during Construction

9.5.1 For all activities, measures would be taken to reduce noise levels with due regard to practicality and cost as per the concept of 'best practicable means' as defined in Section 72 of the Control of Pollution Act 1974.

9.5.2 BS 5228-1:2009 states that the 'attitude of the contractor' is important in minimising the likelihood of complaints and therefore consultation with the local authority along with letter drops are advised to inform residents of intended activity. Non-acoustic factors, which influence the overall level of complaints such as mud on roads and dust generation, would also be controlled through construction practices adopted on the site.

9.5.3 Furthermore, the following noise mitigation options could be implemented where appropriate:

- Consideration would be given to noise emissions when selecting plant and equipment to be used on site;
- All equipment should be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable;
- Stationary noise sources would be sited as far away as reasonably possible from residential properties and where necessary and appropriate, acoustic barriers could be used to screen them; and
- The movement of vehicles to and from the site would be controlled and employees instructed to ensure compliance with the noise control measures adopted.

9.5.4 Site operations would be limited to 0700-1900 Monday to Saturday except during turbine erection and commissioning or periods of emergency work. The number of activities occurring simultaneously, the location of activities or the amount of construction traffic could be controlled on Saturdays between 1300 and 1900, if necessary, to ensure that the relevant criterion of 55 dB(A) is met.

9.5.5 The increase of construction noise above the 65 dB(A) daytime target level would be temporary and could be mitigated by the installation of acoustic barriers if required. Noise levels would be expected to drop below 65 dB(A) after six days based on typical rates of track construction/upgrade. Work on the water crossing closest to the site entrance would be expected to take two days.

9.5.6 The mitigation measures that would be adopted during the construction phase would be agreed with the relevant parties as part of the Construction and Environmental Management Plan (CEMP).

Mitigation during Operation

9.5.7 One of the key constraints and considerations in designing the layout of the turbines was the minimisation of potential noise impacts at the nearest residential receptors. As such the turbine layout was designed with separation distances between the proposed turbines and nearby residential properties in mind.

9.5.8 Other than the noise management strategy identified in the Potential Cumulative Effects section of this Chapter, no further mitigation measures would be required for the operation of the proposed turbines as the proposed development would comply with noise criteria with this noise management strategy in place.

9.5.9 The noise management strategy takes advantage of the fact that the operation of modern wind turbines can be altered by changing the pitch of the wind turbine blades resulting in a trade-off between power production and noise reduction. This provides a potential mechanism for further reducing the level of noise experienced at nearby residential properties although the acoustic assessment demonstrates that this is not required.

9.5.10 If planning permission is granted for the proposed development, planning conditions can be proposed to provide protection to nearby residents in the form of limits relating to noise level and tonality. Technical Appendix 9.9 contains a set of noise conditions that RES considers appropriate.

Mitigation during Decommissioning

9.5.11 No specific mitigation measures are anticipated to be necessary during the decommissioning phase although general best practice methods of reducing noise, as employed during the construction phase, should be adopted as a precaution.

9.6 Assessment of Residual Effects

Residual Construction Effects

9.6.1 There could be a temporary increase in construction noise above the 65 dB(A) criteria level at properties close to the site entrance although this could be mitigated if necessary. There could also be construction noise levels of greater than the 55 dB(A) criteria level for 1300-1900 on Saturdays although again this could be mitigated if necessary. At all other times and locations, predicted noise levels from the worst-case combination of increased traffic and site operations would not exceed relevant criteria.

Residual Operational Effects

9.6.2 The acoustic assessment demonstrates that predicted noise levels at all residential properties would not exceed the derived noise limits with a noise management strategy in place. This should not be interpreted to mean that wind farm operational noise would be inaudible (or masked by background noise) under all conditions, but that the levels of noise would be acceptable under ETSU-R-97 and associated guidance.

Residual Decommissioning Effects

9.6.3 No significant effects are predicted as any noise levels due to decommissioning are expected to be less than during construction.

Residual Cumulative Effects

9.6.4 No significant additional residual effects would be anticipated due to construction in the cumulative scenario.

9.6.5 The predicted operational noise levels are within the limits at all nearby properties such that the impact would be deemed acceptable and no significant residual effects would be anticipated.

9.7 Summary

9.7.1 The acoustic impact for the operation of the proposed development on nearby residential properties has been assessed in accordance with the guidance on wind farm noise as issued in the DTI publication "The Assessment and Rating of Noise from Wind Farms", otherwise known as ETSU-R-97, and Institute of Acoustics Good Practice Guide (IoA GPG), as recommended for use by relevant planning policy.

9.7.2 To establish baseline conditions, background noise surveys were carried out at four nearby properties and the measured background noise levels used to determine appropriate noise limits, as specified by ETSU-R-97 and the IoA GPG.

9.7.3 Operational noise levels were predicted using the recommended noise propagation model. The limit remaining for the proposed development was determined by subtracting the predicted noise levels due to nearby consented and existing sites from the total noise limit. The predicted noise levels for the proposed development are within the derived noise limits at all considered wind speeds with an appropriate noise management strategy in place. The proposed development therefore complies with the relevant guidance on wind farm noise and the impact on the amenity of all nearby residential properties would be regarded as acceptable.

9.7.4 A construction noise assessment has been carried out in accordance with BS 5228-1:2009 "Noise control on construction and open sites Part 1 - Noise", and with due regard to mitigation outlined, indicates that predicted noise levels likely to be experienced at representative critical residential properties would be below relevant criteria.

9.7.5 The potential impact of the proposed development, along with the mitigation proposed and any residual impact, is summarised in Table 9.47.

Table 9.47: Summary of Potential Significant Effects of the Proposed Development

Potential Effect	Mitigation Proposed	Means of Implementation	Outcome/ Residual Effect
Construction			
General Construction Noise: potential for noise to be created during general construction activities	Due regard for 'best practicable means' (defined by Section 72 of the Control of Pollution Act 1974) A range of noise mitigation measures are proposed for the construction phase in accordance with measures outlined in BS 5228-1:2009 Site operations to be limited to 0700-1900 Monday to Saturday (except during turbine erection and commissioning/periods of emergency work)	Noise mitigation measures would be implemented as part of the CEMP which would be required to be agreed as a condition of consent.	Not significant
Construction Traffic Noise: potential for noise to be created due to construction traffic	Construction traffic to be controlled on Saturdays between 1300-1900, if necessary, to ensure relevant noise criteria are met	Provision of a Construction Traffic Management Plan to be incorporated into the CEMP and delivered as a condition of consent	Not significant
Cumulative Construction Noise	No additional measures required	Not applicable	Not significant
Cumulative Construction Traffic Noise	No additional measures required	Not applicable	Not significant
Operation			
Operational Noise: potential impact on residential amenity	Impact is deemed to be acceptable as wind farm meets noise limits specified by relevant guidance with a noise management strategy in place No additional mitigation measures are required due to absence of identified significant effect	Not applicable	Not significant
Cumulative Operational Noise	No additional measures required	Not applicable	Not significant
Decommissioning			
Potential noise from site decommissioning activities	General best practice measures of reducing noise, employed during the construction phase, would be adopted as precaution	A Decommissioning and Restoration Plan would be submitted to and approved in writing by The Highland Council in consultation with SNH and SEPA no later than twelve months prior to the final decommissioning of the wind farm.	Not significant

9.8 Glossary and Abbreviations

Term	Definition
A-weighting	A frequency-response function providing good correlation with the sensitivity of the human ear.
Broadband Noise	Noise which covers a wide range of frequencies (see Frequency).
Decibel dB(A)	The decibel (dB) is a logarithmic unit used in acoustics to quantify sound levels relative to a 0 dB reference (e.g. a sound pressure level of $2*10^{-5}$ Pa). The 'A' signifies A-weighting.
Equivalent Continuous Sound Level (L_{eq})	The equivalent continuous sound level is a notional steady noise level, which over a given time would provide the same energy as the intermittent noise.
Frequency	Refers to how quickly the air vibrates, or how close the sound waves are to each other and is measured in cycles per second, or Hertz (Hz). The lowest frequency audible to humans is 20 Hz and the highest is 20,000 Hz. The human ear is most sensitive to the 1 kHz, 2 kHz and 4 kHz octave bands and much less sensitive at lower audible frequencies.
Frequency Spectrum	Description of the sound pressure level of a source as a function of frequency.
Percentile Sound Level (L_{90})	Sound pressure level exceeded for 90% of the time for any given time interval. For example, $L_{(A)90,10min}$ means the A-weighted level that is exceeded for 90% of a ten minute interval. This indicates the noise levels during quieter periods, or the background noise level. It represents the lower estimate of the prevailing noise level and is useful for excluding such effects as aircraft or dogs barking on background noise levels.
Noise Emission	The noise energy emitted by a source (e.g. a wind turbine).
Noise Immission	The sound pressure level detected at a given location (e.g. nearest dwelling).
Octave Band	Range of frequencies between one frequency ($f_0*2^{-1/2}$) and a second frequency ($f_0*2^{+1/2}$). The quoted centre frequency of the octave band is f_0.
Sound Power Level	Sound power level is the acoustic power radiated from a sound source and is independent of the surroundings. It is a logarithmic measure in comparison to a reference level (10^{-12} watts).
Sound Pressure Level	A logarithmic measure of the effective sound pressure of a sound relative to a reference value which is for minimum audible field conditions ($20*10^{-6}$ Pa).
Third Octave Band	The range of frequencies between one frequency ($f_0*2^{-1/6}$) and a second frequency equal to ($f_0*2^{+1/6}$). The quoted centre frequency of the third octave band is f_0.
Tonal Noise	A noise that contains a noticeable or discrete, continuous note and includes noises such as hums, hisses, screeches.

Abbreviation	Expanded Term
BS	British Standard
CEMP	Construction and Environmental Management Plan
CTRN	Calculation of Road Traffic Noise
dB	Decibel
Hz	Hertz
L_B	Background Noise Level
L_{WA}	A-weighted Sound Power Level
ms^{-1}	Metres per Second
MW	Megawatt
Pa	Pascal
pW	Picowatt
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage
V_{10}	Standardised 10m Wind Speed

10 Potential Grid Connections

10.1 Introduction

The Consenting Context

10.1.1 Although a grid connection is an integral, requisite part of any wind farm project, it is typically subject to a separate consenting process. Depending upon size (installed capacity), consent for a wind farm is sought either from the relevant local authority under the Town and Country Planning (Scotland) Act 1997 (the 1997 Act) or from the Scottish Ministers under Section 36 of the Electricity Act 1989. In contrast, in relation to overhead lines (OHL), the grid connection may require consent from the Scottish Ministers under Section 37 of the Electricity Act 1989; or, alternatively for underground sections (i.e. underground electricity cables), either planning permission may be required from the local authority; or permitted development rights may apply, subject to specific circumstances.

10.1.2 Normally the wind farm applicant will be the developer, whereas the grid connection consent will be sought by the relevant owner of the local distribution or transmission network, in this case Scottish and Southern Electricity Networks (SSEN).

10.1.3 In this case, the Applicant's interpretation of the application requirements is that the Environmental Impact Assessment process for the proposed development should additionally assess the secondary and indirect environmental effects associated with the grid connection, insofar as is possible.

10.1.4 The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 ('the EIA Regs')[1] states that the ES should provide an indication of any difficulties encountered by the applicant in compiling the required information. The main technical difficulty in relation to predicting the likely significant environmental effects of the grid connection is that the applicant for the proposed development has no absolute control over the nature and routeing of the eventual grid connection. Equally, given that the optimum interconnection point depends upon power flows and available capacity in the wider network, and given that these are constantly changing, then it is impossible to guarantee the final form of the grid connection until the time at which the connection is secured for construction.

10.1.5 As such, the Applicant has made an assessment of the predicted environmental effects of the grid connection based upon its best understanding of a potentially suitable route corridor. It should be noted that, when the consent application for the grid connection is brought forward, the grid connection will be the subject of a separate environmental assessment process.

Scope

10.1.6 Given the above qualifications and context, the purpose of this section is:

- to describe the existing local grid infrastructure;
- to describe a potential grid connection corridor and its environmental sensitivities; and
- based upon the identified grid corridor, demonstrate that a connection solution is possible that would be unlikely to have significant environmental impacts.

[1] As stated in Chapter 1: Introduction, the EIA has been prepared in accordance with the Town and Country Planning (EIA Regulations) (Scotland) 2011 since the request for an EIA Scoping Opinion was submitted in July 2016.

10.1.7 If the final objective can be achieved, then for the purpose of consenting the proposed development, there would be no reason to withhold consent on grounds of likely significant environmental impact of necessary related development.

10.1.8 This chapter contains the following:

- Figure 10.1: Existing Grid Network;
- Figure 10.2: Potential Grid Connection Corridor; and
- Figure 10.3: Potential Grid Connection Corridor: Cultural Heritage.

10.2 Potential Grid Connection Corridor

10.2.1 RES has submitted an application for a grid connection for the proposed development to SSEN. A connection agreement is in place between the Applicant and SSEN.

10.2.2 The Applicant's initial assessment of the site was that it was physically capable of hosting a development of between20 MW and 50 MW.

10.2.3 As shown in Figure 10.1, the grid network local to the site contains existing 132 kV infrastructure and a newly constructed 275 kV infrastructure. The 132 kV circuit south of the site runs from Dounreay to Thurso, with another 132 kV circuit southeast of the site from Thurso to Mybster. The newly constructed 275 kV circuit passes through Thurso South substation and will replace the two 132 kV circuits from Dounreay to Mybster. It should be noted that Figure 10.1 does not show 33 kV or 11 kV networks.

10.2.4 The proposed development would most likely be connected to the Thurso South substation via sections of both OHL and underground cable. The potential grid connection corridor would begin at the on-site substation within the proposed development, travel initially southeastwards and thereafter would follow the public road corridor to Thurso South substation as shown in Figure 10.2: Potential Grid Connection Corridor. The only overhead section is anticipated to be where the corridor crosses B874 northeast into Thurso South substation.

Construction

10.2.5 For an underground cable connection, the trench would be similar to those used for the proposed development (i.e. underground cabling as described in Chapter 2: Development Description), as shown in Figure 2.11. The trench could run in the road side verges adjoining the carriageway, or within footways adjoining the carriageway, although it is also possible that the cable would be laid within the carriageway itself. At 33 kV, underground cables are normally laid to a depth of 0.9 m. To lay this cable a trench is dug, bedding material, normally sand, is placed along the trench-base, the cable laid and then covered with more sand. The cables are then protected by a layer of protective plastic covers and then backfilled with subsoil and original topsoil and turfs.

10.2.6 For bridge crossings along the road, the cable could be laid within the bridge, if there is sufficient excavation depth, or otherwise via either trenching or directional drilling under the watercourse.

10.2.7 Generally, when OHL are constructed over open ground, single pole supports are used with a typical height of 13 m to 15 m, a typical spacing of 50 m and a minimum ground to cable clearance of 5.2 m (5.8 m over roads). Where the line changes direction, a stayed, double-pole arrangement is adopted. Double poles are also used at line terminations, for instance when the cable goes underground, or on rising ground, where the spacing between supports would generally decrease. As set out in Paragraph 10.2.4, it is anticipated that only a very short section of OHL will be required.

10.2.8 In terms of construction, single poles are buried to a depth of approximately 2 m, dependent on the pole height. The pole is stabilised by underground cross arms which run in the line direction. Excavations can generally be carried out by a mini crawler digger. Additional site plant will typically include a powered lifting and handling machine.

10.2.9 The construction activities would include the following:

- clearance of land (including vegetation strip as appropriate);
- digging of trenches;
- backfilling of trenches and remediation;
- micrositing of proposed locations for wooden poles;
- construction of contractor compounds for materials/plant/worker accommodation;
- establishment of the working width;
- excavations for wood pole foundations and removal of bedrock if necessary;
- erection of wooden poles; and
- stringing of conductors.

10.2.10 The land should be reinstated as near as reasonably practicable to its original condition.

10.2.11 It is anticipated that the works would be implemented by SSEN.

10.3 Potential Impact

10.3.1 A preliminary assessment of the precited environmental effects of the potential grid connection corridor has been undertaken to verify that there are unlikely to be any unacceptable environmental effects.

10.3.2 The main receptors considered to have the potential for likely significant effects are:

- Landscape and Visual;
- Non-Avian Ecology;
- Ornithology;
- Archaeology and Cultural Heritage;
- Hydrology
- Traffic and Transport; and
- Noise.

10.3.3 These are described in turn in the following sections.

Landscape and Visual

10.3.4 Currently there is no detailed route for the potential grid connection, therefore only a high-level assessment of landscape and visual impacts of likely significant effects has been carried out. However, for the purpose of this assessment it has been assumed that the majority of the potential grid connection would, as described in 10.2, above, be undergrounded and that construction locations would be restored to existing condition, and any landscape elements, such as stone dykes, would be reinstated to their original specification.

Baseline Characteristics

LANDSCAPE FABRIC/TOPOGRAPHY AND LANDUSE

10.3.5 The grid connection corridor is located within a landscape that comprises:

- an essentially flat or gently undulating landform between 39 and 138 m AOD, the highest elevation occurring at the Hill of Forss, and the lowest at Geisse;
- occasional wet ditches and minor watercourses;
- a predominance of open, semi-improved grasslands, including grass verges;
- small scale minor local roads and small farm tracks;
- occasional stone dykes;
- farmsteads and scattered residential properties with associated boundary vegetation and garden vegetation; and
- small quarries and borrow pits.

LANDSCAPE CHARACTER

10.3.6 The potential grid connection corridor is located within the Farmed Lowland Plain landscape type, which is an extensive landscape, extending across the north east of Caithness between Wick to the east, and from Tang Head to Melvich along the north coast. This landscape as described in The Highland Council's Onshore Wind Energy Supplementary Guidance (SG)[2] as *"a broad and relatively low-lying plain and basin bounded by the sea and inland by the expansive Sweeping Moorland and Flows. The landscape is predominantly farmed and well settled with a range of field scales relative to local topography. Given the geographical extent of the area there is considerable local variety in the extent to which different characteristics are displayed. Of note between the east and west, the scale of field patterns and types of boundaries, presence of woodland, presence of infrastructure and prominent built development all vary."*

VISUAL AMENITY

10.3.7 The potential grid connection corridor and adjoining area contain a number of key visual receptors, including:

- local road users;
- residential receptors in scattered properties and farmsteads; and
- local walkers and cyclists.

10.3.8 No gateways or key routes, as described in the SG are present within or in the immediate vicinity of the potential grid connection corridor.

Construction Impacts

EFFECTS ON LANDSCAPE RECEPTORS

10.3.9 Construction activities associated with the potential grid connection are likely to result in temporary impacts on the landcover, landscape elements (e.g. stone dykes), and disturbance to the condition of the landscape along the route. The principal impacts on landscape fabric would arise from site preparations (including stripping of turf/existing vegetation), excavation of cable trenches and pole foundations, and subsequent backfilling and reinstatement of

[2] Adopted Onshore Wind Energy Supplementary Guidance, November 2016 (with addendum, December 2017)

trenches/excavations. Impacts would, however, be of relatively short duration, of limited geographical extent and reversible, and are therefore not considered likely to be significant.

10.3.10 Construction operations would introduce disturbance, additional vehicle movements and temporary compounds to the settled rural landscape of the Farmed Lowland Plain landscape character type (LCA CT9). However, the landscape already contains a number of borrow pits and excavations, and so the proposals would not represent a wholly new element in the landscape. Construction activities would also be of short duration, of limited extent and reversible, and are therefore considered unlikely to constitute a significant effect on the character of the site and adjoining landscape.

10.3.11 Whilst there is potential for indirect effects on nearby landscape designations such as the Dunnet Head SLA and the East Halladale Flows Wild Land Area (WLA 39), these areas are located over 10 km from the potential grid connection corridor. This distance, coupled with the temporary and reversible nature of construction impacts, suggest that these landscapes would not be subject to significant construction effects.

EFFECTS ON VISUAL RECEPTORS

10.3.12 The majority of visual receptors, including main settlements and communication corridors would be located distantly from the potential grid connection corridor. However, the potential grid connection would bisect a settled landscape where a large number of residential properties are located (i.e. in and around Janetstown) and where National Cycleway 1, and a network of locally important roads and footpaths are present. Thus, construction works would have potential effects on the amenity of visual receptors nearby, principally in respect of temporary visual disturbance. However, such effects would be geographically localised, short term and reversible, and are therefore not considered significant.

Operational Impacts

EFFECTS ON LANDSCAPE AND VISUAL RECEPTORS

10.3.13 As much of the potential grid connection corridor would be undergrounded, and measures are to be adopted to reinstate any disturbed land and /or loss of characteristic elements such as stone dykes, it is unlikely that there would be any effects on landscape fabric, landscape character or visual amenity. The only place where this would not be the case is where the line is over grounded on wooden poles, south-west of the Thurso South substation where, as it approaches the substation, it could be seen in conjunction with the existing 132 kV and 275 kV OHLs, adding to the existing wirescape converging on the substation. It is unlikely, however, that the modest scale and extent of this section of the grid connection would contribute to a significant cumulative or individual effect.

Mitigation

10.3.14 On the basis of the preceding assessment of potential construction and operational effects, the focus of mitigation would comprise:

- the careful selection of the detailed grid connection alignment and sites for compounds and material storage to avoid sensitive landscapes and visual receptors;
- the adoptions of a phased programme of construction that would minimise the extent of disturbance at any one time, and allow for rapid reinstatement of disturbed ground associated with trenching and foundations;
- undergrounding of the majority of connection;

- selection of the grid connection alignment to minimise its length and to avoid key features and landscape and visual receptors; and
- early restoration of disturbed ground to a condition consistent with the current baseline; and reinstatement of any landscape elements that might be lost or damaged during construction works.

Residual Impacts

10.3.15 Taking account of the embedded and additional mitigation measures outlined previously no significant effects are anticipated during either the construction or operational phase of the grid connection.

10.3.16 Effects on landscape fabric would be confined to the construction phase when undergrounding would take place and would entail disturbance or temporary and highly localised loss of ground cover. However, this would be reversed in the short term.

10.3.17 Similarly, whilst construction of the grid connection would introduce disturbance and additional vehicle and plant movements to the landscape, these would be highly localised, of a relatively small scale and temporary, the underlying character of the local landscape returning to its baseline condition in the short term.

10.3.18 The visual amenity of the area would also only be subject to small scale and temporary impacts associated with construction activities. The undergrounding of the majority of the grid connection would ensure that views are generally not affected following cessation of construction activities.

Non-Avian Ecology

Baseline Characteristics

10.3.19 Baseline surveys undertaken for the proposed development did not extend to include the potential grid connection corridor. A summary of the likely ecological sensitivities of the potential grid connection corridor (based on the findings of the baseline surveys for the proposed development (Chapter 5) and professional judgement) is provided below:

- Protected mammalian species: Otter, badger, water vole, bats, pine marten, and red squirrel may also be present depending on the availability of suitable habitat and resource, as their known ranges encompass the potential grid connection corridor;
- Protected reptilian species: The ranges of adder, common lizard, and slow worm also encompass the potential grid connection corridor, and consequently these species may also be present depending on the availability of suitable habitat and resource;
- Fish: The ranges of Atlantic salmon, brown trout, European eel and lamprey spp. all encompass the potential grid connection corridor and consequently these species may also be present depending on the availability of suitable habitat and resource in local watercourses; and
- Habitats/botany: Sensitive habitats and plant species may be present within the potential grid connection corridor.

Potential Effects

10.3.20 The potential effects during both construction and operation on ecological sensitivities are variable depending on the receptor and the proposed construction methods/design. Below is a summary of potential effects that a given development may have on ecological receptors:

- Direct and indirect habitat loss;

- Disturbance to / loss of breeding sites, resting places, etc.;
- Direct / indirect loss of foraging resource;
- Displacement / disruption to movement of animals;
- Direct effects upon protected fauna, i.e. road traffic accidents, etc.;
- Environmental effects, i.e. pollution of watercourses, etc.; and
- Changes to habitat composition through land-use change, increased human presence, etc.

Approach to Mitigation

10.3.21 Proposed mitigation will vary depending on the assessment of any ecological constraints identified from baseline surveys. The following points are provided as examples of the standard measures that may be utilised to mitigate any construction and/or operational impacts on ecological constraints:

- Appropriate buffers from ecological constraints to inform the route design (e.g. 30 m badger sett, 200 m breeding otter feature, 10 m water vole burrow, 30 m bat roost);
- Appropriate buffers from sensitive botanical and hydrological features to inform route design;
- Standard pollution prevention mitigation will be employed throughout the construction phase of the proposed development;
- Timing of works to avoid peak activity periods/seasons for protected species;
- Enhancement and creation of habitat to offset any habitat loss associated with the development (e.g. hibernacula, bat roosts, setts); and
- Where fish population are known to be present, pre-construction fish rescues prior to any instream construction works.

Residual Impacts

10.3.22 On the assumption that the final grid connection route and design is informed by any ecological sensitivities identified, and that mitigation measures and good practice methods are adopted, no significant residual impacts are anticipated to occur.

Ornithology

Existing Conditions

10.3.23 As detailed in Chapter 6 (Ornithology) the North Caithness Cliffs Special Protection Area (SPA), Caithness Lochs SPA and Caithness and Sutherland Peatlands SPA are within 20 km of the proposed development and are also within 20 km of the potential grid connection corridor. Consequently, as identified in Chapter 6 (Ornithology) there is potential for connectivity between the potential grid connection corridor and the Caithness Lochs SPA, whose qualifying features are listed as Greenland white-fronted geese, greylag geese and whooper swans.

10.3.24 Baseline surveys undertaken for the proposed development did not extend to include the potential grid connection corridor. (As explained in Section 10.1 baseline surveys would be carried out as part of a separate environmental assessment process once the consent application for the grid application is brought forward). A summary of the likely ornithological sensitivities of the potential grid connection corridor (based on the findings of the baseline surveys for the proposed development (Section 6.3, Chapter 6: Ornithology) and professional judgement) is provided below.

- Foraging wildfowl and waders (September to April). Wintering Greenland white-fronted goose, greylag goose, pink-footed goose, whooper swan and golden plover were all identified to be foraging in lowland fields surrounding the site and are likely to also be foraging in similar habitat in proximity to the potential grid connection corridor.
- Breeding waders (April to July). Curlew and lapwing were both identified to be regularly breeding at the site and are likely to be breeding in other areas along the potential grid connection corridor (although densities are likely to vary depending on the prevailing habitat).
- Breeding raptors (March to August). Hen harrier, merlin, peregrine falcon and short-eared owl were all occasionally recorded at the site and, whilst there is no evidence of these species nesting within 2 km of the proposed development, they are likely to be breeding further afield (which may be in proximity to the potential grid connection corridor). Some evidence of roosting barn owl was also recorded within 2 km of the site and barn owl may be using other structures along the potential grid connection corridor for roosting or breeding. Shawyer (2011[3]) provides recommended buffer distances for breeding barn owl (depending on the activity) for construction activities with a maximum buffer of 175 m recommended for continuous heavy construction works. Consequently, should any section of the grid connection (and associated construction areas) be within 175 m of any structures with barn owl potential, checks will be undertaken by a suitably licensed ornithologist and an appropriate buffer distance[3] applied.

Species Scoped Out of the Assessment

10.3.25 On the basis of experience from other relevant projects and policy guidance or standards (e.g. SNH 2018[4]), the following species are likely to be 'scoped out' since significant effects are unlikely:

- Common and/or low conservation species not recognised in statute as requiring special conservation measures, i.e. bird species <u>not</u> listed on Annex 1 of the EU Birds Directive[5] or Schedule 1 to the Wildlife & Countryside Act 1981 (as amended);
- Common and/or species of low nature conservation importance not included in non-statutory lists that indicate birds whose populations are at some risk either generally or in parts of their range (e.g. the Birds of Conservation Concern (BoCC) Red list, Eaton *et al.* 2015[6]); and
- Passerine species (not generally considered to be at risk from wind farm developments, SNH 2017[7], 2018[4]), unless being particularly rare or vulnerable at a national level.

Potential Construction/Decommissioning Effects

10.3.26 Based on the available information to date from baseline surveys for the adjacent proposed development (Chapter 6) and the preliminary results from the desk-based study for the grid connection corridor, the following construction/decommissioning effects are likely to require consideration:

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[3] Shawyer, C. R. 2011. Barn Owl Tyto alba Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting. IEEM, Winchester.

[4] Scottish Natural Heritage (2018). Assessing Significance of Impacts from Onshore Windfarms on Birds Outwith Designated Areas. Scottish Natural Heritage, Edinburgh.

[5] Council Directive 2009/147/EC on the conservation of wild birds (the Birds Directive).

[6] Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D. and Gregory, R. (2015). Birds of Conservation Concern 4: The population status of birds in the UK, Channel Islands and Isle of Man. British Birds 108: 708-746.

[7] Scottish Natural Heritage (2014, revised March 2017). Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms. Scottish Natural Heritage, Edinburgh.

- Disturbance/displacement to target species (breeding raptors, owls and waders, and foraging geese and swans) associated with construction/decommissioning activities.

Potential Operational Effects

10.3.27 Based on the available information to date from baseline surveys for the adjacent proposed development and the preliminary results from the desk-based study for the potential grid connection corridor, the following operational effects are likely to require consideration:

- Displacement of target species (breeding raptors, owls and waders, and foraging geese and swans) around any sections of the grid connection that are overhead; and
- Potential collision risks associated with any sections of the grid connection that are overhead for target species (most likely to be wildfowl).

Approach to Mitigation

10.3.28 Significant effects upon birds will be avoided/minimised where possible within the design process. Good practice during construction and operation of the grid connection will also be implemented. Subject to detailed studies, there may be a need to minimise the risk of line strike by geese and swans moving between foraging areas e.g. through the use of bird deflectors are used on any sections of the grid connection that are overhead.

10.3.29 Where potential likely significant effects on Important Ornithological Features (IOFs) are identified, measures to prevent, reduce and where possible to offset these adverse effects will be proposed.

10.3.30 Standard good practice (SNH 2015[8]) measures[9] will be applied to minimise any potential effects on any wintering foraging/roosting wildfowl and breeding waders within up to 500 m and/or breeding Schedule 1/Annex 1 raptors and owls within up to 800 m of the grid connection.

10.3.31 If required, a Breeding Bird Protection Plan (BBPP), will be produced for construction and decommissioning to ensure that all reasonable precautions are taken to ensure the relevant wildlife legislation is adhered to.

Residual Impacts

10.3.32 On the assumption that the final grid connection route and design is informed by any ornithological sensitivities identified, and that mitigation measures and good practice methods are adopted, no significant residual impacts are anticipated to occur.

Archaeology and Cultural Heritage

Baseline Characteristics

10.3.33 There are no heritage assets with statutory or non-statutory designations within the potential grid connection corridor. The closest scheduled monuments are Thing's Va, Broch 1000m E of Blackheath, Scrabster (SM587), 700 m to the northeast of the potential grid connection corridor through Janetstown, and Tulloch Of Shalmstry, Broch 275m SE of Shalmstry (SM594), which lies 1 km to the southeast of the Thurso South Substation. The nearest listed buildings are a category B listed farmhouse (LB14920) and a category C listed row of farm dwellings

[8] SNH joint publication (2015) Good Practice during Wind Farm Construction. Version 3 http://www.snh.gov.uk/docs/A1168678.pdf

[9] Including appropriate mitigation/monitoring and license application/consultation with SNH.

(LB14921) at Aimster, around 1.4 km from the potential grid connection corridor and south of the Thurso South Substation.

10.3.34 There are 48 non-designated heritage assets recorded in the HER within the potential grid connection corridor. These include five assets of prehistoric date, 41 of post-medieval date and two of unknown date.

10.3.35 The prehistoric assets include: a burnt mound (MHG1200); a broch (MHG1770) and a possible broch (MHG1465); and two burial cists (MHG1475 & MHG2536).

10.3.36 The post-medieval assets include: farmsteads and farmhouses, cottages and other residential buildings; windmills and a watermill; stone quarries; rig and furrow; a chapel; and an old distillery.

10.3.37 These assets are listed in Technical Appendix 10.1 and are shown on Figure 10.3.

10.3.38 Five of the assets are assessed as being of medium sensitivity, 38 are probably of no more than low sensitivity, while two are of unknown sensitivity and one find-spot is of negligible sensitivity.

Construction Impacts

10.3.39 Installation of underground sections of the grid connection would have potential to directly affect any identified heritage asset that lies along its route. Installation of poles to support an overhead line can usually easily be microsited to avoid identified assets along the route.

10.3.40 In addition to potential impacts from construction activities, the establishment of compounds for materials and plant storage, offices and workers welfare accommodation can also have direct impacts on identified heritage assets.

10.3.41 It is also possible that buried archaeological remains that have not been identified by the desk-based baseline study could be directly affected either as a result of construction activities or the establishment of working compounds.

10.3.42 Where works are proposed within road carriageways, the potential for direct impact on archaeology and cultural heritage assets is normally low or negligible as road construction work is likely to have had a detrimental impact on any buried remains that may have been present. Where cable trenches or pole erection is proposed in roadside verges or footpaths, the potential for direct impacts on archaeology and cultural heritage is likely to be low; although the possibility of buried archaeological remains surviving in undisturbed ground cannot be ruled out.

10.3.43 Only one asset along the potential grid connection corridor is likely to be directly affected: a burnt mound (MHG1200), which lies alongside, and is partly truncated by, the farm access track to the north of Hopefield, which would be crossed by the potential grid connection. Excavation of the trench for the installation of underground cable could reveal buried remains of the burnt mound that may survive either along the verge or below the track surface.

Operational Impacts

10.3.44 If the proposal to install underground cables is adopted, there would be a negligible potential for adverse impact on the settings of cultural heritage assets along the route.

10.3.45 If the section of overhead line crossing the B874 to connect to the Thurso South Substation were to be installed, there is a low potential for any adverse impact on the setting of cultural heritage assets. The closest scheduled monument to the proposed overhead line section is Tulloch of Shalmstry, Broch 275m SE of Shalmstry (SM594), which lies 1 km to the southeast of the Thurso South Substation and alongside the A9. The proposed overhead line would, if installed, have an impact on its setting of only negligible magnitude; an effect that would be minor and not significant.

Mitigation

10.3.46 Most of the identified heritage assets within the potential grid connection corridor can be avoided by design of the route alignment and the selection of the sites of construction compounds; thereby ensuring their preservation in situ.

10.3.47 Where the potential grid connection corridor passes the location of a burnt mound (MHG1200) a watching brief would be carried out to ensure that any buried remains are identified and recorded to an appropriate standard.

10.3.48 If required under the terms of a planning condition, the scope of any other required archaeological watching brief(s) would be agreed through consultation with HET in advance of development works commencing and would be set out in the Written Scheme of Investigation (WSI).

10.3.49 If significant discoveries are made during any archaeological monitoring works that are carried out, and it is not possible to preserve the discovered remains in situ, provision would be made for the excavation where necessary, of any archaeological deposits encountered. The provision would include the consequent production of written reports, on the findings, with post-excavation analysis and publication of the results of the works, where appropriate.

10.3.50 Written guidelines would be issued for use by all construction contractors, outlining the need to avoid causing unnecessary damage to known heritage assets. The guidelines would set out arrangements for calling upon retained professional support in the event that buried archaeological remains of potential archaeological interest (such as building remains, human remains, artefacts, etc.) should be discovered in areas not subject to archaeological monitoring. The guidelines would make clear the legal responsibilities placed upon those who disturb artefacts or human remains.

Residual Impacts

10.3.51 Provided that an approved scope of mitigation is carried out during the construction period and appropriate steps are taken to identify and record any discoveries the residual impact of the grid connection on archaeology and cultural heritage is likely to be no more than minor and not significant.

Hydrology

Baseline Characteristics

10.3.52 As noted previously, the grid connection corridor would begin at the on-site substation. It would then travel south-eastwards initially and thereafter follow the public road corridor to Thurso South substation as shown in Figure 10.2: Potential Grid Connection Corridor. The only overhead section is anticipated to be where the corridor crosses B874 northeast into Thurso South substation.

10.3.53 Where the grid connection comprises an overhead line, the potential for hydrological effects can be scoped out. Whilst a small area of ground disturbance would be required for the foundations this is not considered to be significant, assuming an access track is not required alongside the overhead line.

10.3.54 As the potential grid connection would comprise an overhead line from northeast of the B874, this would remove the need to drill under the River Thurso or its tributary, Burn of Geise. Assuming that the underground cable would also follow the line of the public road from the site boundary to the B874, it would not require any watercourse crossings, subject to excavation depth explained below.

10.3.55 The wider area is farmed and contains a high-density drainage network that the public road and potential grid connection would cross. As noted in paragraph 10.2.6,for bridge crossings along the road, the cable could be laid within the bridge, if there is sufficient excavation depth, and would become part of the crossing; otherwise it would be buried under the watercourse by either trenching or directional drilling. With this approach no work within the water environment is envisaged.

10.3.56 Baseline conditions with regards to wider hydrological sensitivities including GWDTE and public or private water supplies are not known and can only be established following a baseline survey. The following section outlines the wider hydrological sensitivities that would be considered when the grid connection application is brought forward.

Potential Hydrological Effects

10.3.57 The underground cable route would be assessed for the following potential effects:

- construction runoff and potential pollution events;
- potential effects on GWDTE; and
- potential effects on public or private water supplies.

10.3.58 The potential effects from construction runoff and potential pollution events would be controlled through adherence to best practice guidance as detailed in the Construction Environmental Management Plan (CEMP) for the proposed development.

10.3.59 If the final length of the underground cable route is greater than 5 km it would require a Simple Licence under the Controlled Activities (Scotland) Regulations (CAR) 2011, authorised by SEPA. This would include details of the drainage plans proposed to manage surface runoff from the cable route.

10.3.60 The potential effects of the cable route on GWDTE and any public and private water supplies would be assessed once baseline data has been obtained and any associated constraints identified.

Approach to Mitigation

10.3.61 The following section identifies potential mitigation measures that would need to be considered to reduce the likely significant effects.

10.3.62 If high or moderate GWDTE are identified within the survey corridor a 100 m buffer would need to be applied to the habitat in accordance with SEPA Land Use Planning System Guidance Note 31[10], in order to ensure no significant effect on GWDTE.

10.3.63 If the cable route does cross through habitat comprising high or moderate GWDTE further assessment would be needed, to ascertain whether the route passed through the preferential flow path and would consequently have a significant effect on the habitat.

10.3.64 The design of the cable route would aim to result in minimal disturbance to the ground. Any disturbance would be temporary. Backfilling of material around the cable without significant

[10] Land Use Planning System Guidance Note 31, Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems, Version 3, SEPA, September 2017.

compaction should allow shallow movement of water to reoccur once construction has been completed. This would be reviewed against the survey data once complete.

10.3.65 A 100 m buffer would also be required around groundwater abstractions for private water supplies. Where the supply may be influenced by surface water interactions, the wider hydrological connectivity of the working area to the supply source would need to be considered. The potential effect would be reviewed against the details of each individual supply including usage and rate of abstraction. Should the assessment identify a potential effect, mitigation measures would need to be submitted to SEPA and THC. Mitigation measures would be dependent on the assessed risk, for instance whether the effect would be a temporary reduction in water quality, or effect on water quantity, and the magnitude of this effect.

Residual Impacts

10.3.66 On the assumption that the final grid connection route is informed by identified hydrological sensitivities, and that mitigation measures are adopted. No significant residual impacts are anticipated to occur.

Traffic and Transport

Baseline Characteristics

10.3.67 Baseline surveys undertaken for the proposed development did not extend to include the potential grid connection corridor. As such the review of the grid connection corridor in terms of traffic and transport has been informed through desk top study and professional judgement alone.

10.3.68 From the south of the site boundary a potential grid connection corridor could follow the local road network at Viewfield/Langland Quarry. At this location the U2144 Langland – Newlands of Geise road travels north-east towards its junction with the A836. The grid connection corridor would follow this road for approximately 0.5 km before heading southbound towards Janetstown. At Janetstown the U2144 meets the C1001 Isauld – Glengolly Road, which the grid connection corridor would follow north-east towards Thurso, for approximately 1.2km. The corridor then turns southbound once more, following the B874 towards Glengolly for approximately 2km before turning east across land where the grid connection corridor would connect to the Thurso South Substation, crossing the Far North Railway line and the River Thurso. The potential grid connection corridor is presented in Figure 10.2.

10.3.69 As noted above, outwith the site boundary the potential grid connection corridor follows the local road network with the exception of a short section where it leaves the B874 to connect to the Thurso South Sub Station. The local road network is predominantly made up of narrow, single lane, tracks with passing places allowing two-way travel. The B874 is wide enough to accommodate two vehicles traveling in each direction and also has a pedestrian walkway alongside one carriageway for a section.

10.3.70 Although no traffic counts are publicly available for the potential grid connection corridor (with the exception of the U2144 which was initially being considered as a temporary access but later discounted), it is considered that all roads would be lightly trafficked with the majority of Thurso traffic using the A9(T) and A836.

Construction Impacts

10.3.71 It is anticipated that construction vehicles for the potential grid connection will travel to site using the A9(T) and the A836 rather than following the potential grid connection corridor. As such there is an increase in traffic anticipated on these roads in addition to roads on the potential grid connection corridor (B874 and U2144 roads at Viewfield and Janetstown).

10.3.72 Construction traffic associated with the potential grid connection corridor would likely involve a small number of construction vehicles each day to deliver equipment and materials for the connection cable routing to site and carry excavated material. Staff are anticipated to travel to site via the A9(T) or A836 and would be of a limited number each day. Whilst no quantative traffic appraisal has been undertaken as part of this study into the potential grid connection corridor, it is envisaged that there would be sufficient capacity on the road network to accommodate traffic associated with construction; on the considered basis that the local road network (U2144, C1001 and B874) is currently lightly trafficked, there is spare capacity on the A9(T) and A836 and that the level of construction traffic required for grid connection would be negligible in comparison to that required to construct the proposed development.

10.3.73 It is possible that some road closures may be required particularly on sections of the potential grid connection corridor where underground cabling is to be utilised, or where construction vehicles require to occupy the road and there is insufficient spare width for vehicles to pass. If required, whilst roads are fully closed (except for local access), diversionary routes would be implemented. Road closures to facilitate laying of underground cables are likely to be required for short periods at a time based upon the assumption that an average of 30m of underground cabling can be laid within normal working hours.

Operational Impacts

10.3.74 Operational impacts in terms of traffic and transport would be limited to occasional trips associated with maintenance and repair. This would generally be restricted to one LGV trip per day as repairs and maintenance occur. As such the operational impact in terms of Traffic and Transport can be classed as negligible.

Mitigation

10.3.75 A construction traffic management plan will likely be required as part of any future planning application for the grid connection. This would likely include mitigation measures such as plans for temporary traffic management during construction periods, acceptable hours of work during the construction period and good practice measures for construction such as wheel cleaning stations when leaving site to join the local road network.

Residual Impacts

10.3.76 It is considered that with the adoption of the proposed mitigation, no significant residual impacts are anticipated to occur.

Noise

Baseline Characteristics

10.3.77 The noise character of the area is typical of a rural environment with some traffic noise from nearby roads and is described in more detail in ES Chapter 9: Noise.

Construction Impacts

10.3.78 Noise would arise during construction of the grid connection due to the operation of plant and any associated traffic. Construction noise levels at residential properties would depend on their distance from the final grid connection route but would be temporary in nature and could be mitigated if necessary.

Operational Impacts

10.3.79 Corona noise can be emitted from overhead lines in certain conditions and has two components: a low frequency hum and broadband noise. They type of sound emitted can be characterised as a 'crackling' or 'buzzing' that is at its maximum in wet weather conditions such as fog or rain. Corona noise is more associated with higher voltage transmission lines and would only be expected to be audible infrequently at short distances from the overhead line sections of the grid connection. No significant impacts due to operational noise are therefore expected due to the potential grid connection corridor.

Mitigation

10.3.80 Any noise emitted during the construction period would be temporary. 'Best practicable means' would be used to reduce noise levels with due regard to practicality and cost in line with the Control of Pollution Act (COPA)[11].

10.3.81 The guidance provided by BS 5228-1: 2009[12] would also be utilised to identify appropriate mitigation. The final mitigation measures to be adopted would be agreed as part of the CEMP.

10.3.82 The levels of corona noise due to the operation of the overhead line sections of the grid connection are not predicted to be great enough to require mitigation due to the voltages involved, the separation from nearby properties and the masking provided by background noise. The use of underground cabling along some of the route mitigates corona noise from these sections.

Residual Impacts

10.3.83 No significant residual impacts are anticipated due to either the construction or operation of the grid connection.

[11] Control of Pollution Act, published by Her Majesty's Stationary Office, 1974.

[12] 'Code of Practice for Noise and vibration control on construction and open sites – Part 1: Noise', British Standards Institution, 2009

10.4 Summary

Table 10.1: Likely Secondary and Indirect Impacts of the proposed Development resulting from the Potential Grid Connection					
Impact Type	**Construction Impacts**	**Operational Impacts**	**Mitigation**	**Residual Effects**	**Means by which Mitigation would be Delivered**
Landscape and Visual	Indirect impacts on Landscape Character arising from presence of site clearance and excavation activities, movement of people and machinery/ plant, removal of vegetation to facilitate construction Impacts on views and visual amenity arising from presence of site clearance and excavation activities, movement of people and machinery/ plant, removal of vegetation to facilitate construction.	Potential for indirect operational impacts would only exist where the grid connection comprises overhead line. These would include presence of new above ground infrastructure impacting upon the character of the landscape and on the views and visual amenity of receptors in proximity to the proposed OHL. Indirect impacts on Landscape Character and on views and visual amenity arising from the proposed cable route would only arise should maintenance activities be required.	Embedded mitigation, including suitable construction methods/controls, and rapid reinstatement/restoration of the affected landscape.	Minor/Not significant.	Design, construction management and monitoring.
Non-Avian Ecology	Disturbance/displacement of protected species (otter, water vole, badger, bats). Direct and indirect habitat loss of any potential sensitive habitats identified.	Disturbance/displacement of protected species (otter, water vole, badger, bats). Indirect habitat loss of any potential sensitive habitats identified.	Appropriate good practice guidance will be applied. Should any likely significant effects on ecological features be identified, measures to prevent, reduce and/or offset these effects would be proposed.	With avoidance and appropriate mitigation there would be no significant effects. The design and proposed mitigation would aim to reduce the significance of effect on any ecological features, though the final significance would	Design and construction management/monitoring.

Table 10.1: Likely Secondary and Indirect Impacts of the proposed Development resulting from the Potential Grid Connection					
Impact Type	**Construction Impacts**	**Operational Impacts**	**Mitigation**	**Residual Effects**	**Means by which Mitigation would be Delivered**
				be based on the sensitivity of the feature and magnitude of effect.	
Ornithology	Disturbance/displacement of breeding waders, raptors and/or owls. Disturbance/displacement of foraging geese and swans. Collision risk for migratory geese and swans.	Potential for operational effects would only exist where the grid connection comprises overhead line and are likely to consist of: ▪ Disturbance/displacement of breeding waders, raptors and/or owls. ▪ Disturbance/displacement of foraging geese and swans. ▪ Collision risk to wildfowl moving between foraging and roosting areas.	SNH (2015[8]) good practice guidance will be applied. Should any likely significant effects on IOFs be identified, measures to prevent, reduce and/or offset these effects would be proposed. For example: a BBPP for construction and decommissioning, bird deflectors attached to any overhead section of the route.	With avoidance and appropriate mitigation there would be no significant effects. The design and proposed mitigation would aim to reduce the significance of effect on any IOFs, though the final significance would be based on the sensitivity of the feature and magnitude of effect.	Design and construction management/monitoring.
Archaeology and Cultural Heritage	Potential direct impact on burnt mound (MHG1200). Potential direct impact on buried archaeological remains.	Potential impact on setting of Tulloch of Shalmstry, Broch 275m SE of Shalmstry (SM594).	None.	Negligible.	Planning condition; CEMP.
Hydrology	Surface water runoff and pollution events. Effects on GWDTE. Effects on public or private water supplies.	No further effects.	Surface water runoff and pollution prevention would be managed through adherence to the CEMP and any CAR requirements. Avoidance of GWDTE and water supplies would be applied as the first	With avoidance there would be no significant affect. The design and proposed mitigation will aim to reduce the significance of effect on any hydrological receptors, though the	CEMP and (if required) CAR licensing.

Table 10.1: Likely Secondary and Indirect Impacts of the proposed Development resulting from the Potential Grid Connection					
Impact Type	**Construction Impacts**	**Operational Impacts**	**Mitigation**	**Residual Effects**	**Means by which Mitigation would be Delivered**
			principle of the detailed alignment selection. The design of the cable alignment should allow shallow subsurface flows to reach GWDTE as per baseline conditions. Any mitigation required to prevent deterioration of a private water supply would need to be agreed with SEPA and THC, and the landowner dependent on the assessed risk.	final significance would be based on the sensitivity of the receptor and magnitude of effect.	
Traffic and Transport	Impact confined to A9(T), A836, B874 and U2144 and C1001 on the local road network. Levels of construction traffic is likely to be lower than that associated with construction of the proposed development and therefore no capacity issues are anticipated.	Operational trips to site would include maintenance and repairs only. The impact of these are considered to be negligible.	A construction traffic management plan would likely be required to be put in place. This would include plans for Temporary Traffic Management and any diversionary routes required during construction.	Negligible assuming mitigation is carried out.	Construction Traffic Management Plan.
Noise	Some temporary construction noise impact at properties close to the connection route.	No significant operational noise impact due to low voltages, separation distances and masking.	Construction noise mitigation measures in accordance with the CoPA and BS 5228-1.	Minor/Not significant.	CEMP.

11 Schedule of Mitigation

11.1 Introduction

11.1.1 The purpose of this chapter is to summarise the mitigation measures proposed in each of the technical chapters to avoid, reduce, or offset impacts which would otherwise give rise to significant residual environmental effects.

11.1.2 The main aim of the design process was to 'design out' potential for environmental effects as far as possible. This chapter does not summarise 'mitigation by design'; this is summarised in Chapter 3: Design Evolution and Alternatives.

11.1.3 The majority of the pre-construction and construction phase mitigation would be delivered through the proposed Construction Environmental Management Plan (CEMP). The outline content of the proposed CEMP is provided in Technical Appendix 2.1: Outline CEMP. Further detail on specific mitigation measures to be included in the CEMP is contained in each of the technical chapters, where relevant.

11.2 Summary of Mitigation and Residual Effects

11.2.1 The predicted effects and mitigation measures have been compiled into Table 11.1. They are presented in the order in which they appear within this ES.

- Landscape and Visual Amenity;
- Non-Avian Ecology;
- Ornithology;
- Archaeology and Cultural Heritage;
- Traffic and Transport;
- Noise; and
- Hydrology.

Table 11.1: Summary of Mitigation and Residual Effects					
Topic	**Potential Likely Significant Effect (without mitigation)**	**Mitigation Measures**	**Effect**	**Timing**	**Residual Effect**
Landscape and Visual	**Construction:** Long term change or loss of characteristic vegetation with consequent effects on the character and amenity of the site and adjoining area. **Operation:** Effects on receptors from the visibility of the proposed turbines, access tracks and hardstanding areas, any retained off-site highway improvements established during the construction phase of the proposed development and substation/ site control building / battery energy storage facility. **Decommissioning:** Temporary disturbance of landscape fabric. Temporary effects on landscape character. Temporary effects on visual amenity.	**Construction:** Mitigation through development design was implemented to avoid or minimise potential significant landscape and visual effects. It is anticipated that a condition of any planning consent would secure the implementation of the proposed outline CEMP in Technical Appendix 2.1. No further mitigation measures have been identified. **Operation:** The principle source of mitigation of operational landscape and visual effects relates to the siting and design of the proposed development. Chapter 3: Design Evolution and Alternatives provides a summary of the process and findings of the design approach that was informed, amongst other environmental and technical considerations, by detailed landscape and visual analysis. **Decommissioning:** Mitigation measures adopted during the construction of the proposed development are likely to form at least part of the basis of the decommissioning of the site. Mitigation measures associated with decommissioning would be agreed during the preparation of the final decommissioning plan, that would require approval of The Highland Council (THC).	Reduction and/or avoidance of significant effects.	Pre-Construction, Construction, Post-Construction and Decommissioning.	Significant Residual and cumulative effects were identified for LCT 140 Sandy Beaches and Dunes (THC CT7: Sandy Beaches and Dunes Sandside Bay, Melvich Bay, Dunnet Bay); LCT 143 Farmed Lowland Plain (THC C9: Farmed Lowland Plain – North Caithness) and North Caithness and Pentland Firth (Seascape Unit 8). Significant in-combination effects are predicted at LCTs 141, 142 and Seascape Unit 8. Significant residual effects on visual amenity were predicted at Settlements: Thurso and Dunnet; Roads: A9 northbound receptors approaching Thurso, A836 between Forss and Thurso and as far as Portskerra and Melvich Bay, and between Dunnet Bay and Thurso and B870 between Achscrabster and Thurso; the Orkney Ferry (Stromness to Thurso); and Recreational Routes: NCR1, Core Paths CA09.01, CA13.06, CA13.07 and CA13.10 . Significant residual effects were predicted at seven viewpoints and significant residual cumulative effects were predicted at five viewpoints.

Table 11.1: Summary of Mitigation and Residual Effects

Topic	Potential Likely Significant Effect (without mitigation)	Mitigation Measures	Effect	Timing	Residual Effect
Non-Avian Ecology	Following the baseline study, potential effects on pine marten, wildcat, red squirrel, great-crested newt, otter, water vole, badger, bats, reptiles and certain habitats of local importance at the site or of low nature conservation value have been scoped out on the basis that there is no potential for significant effects on these receptors. Potential effects on wet dwarf shrub heath habitat were considered, taking account of the following potential impacts: ▪ Direct habitat loss; and ▪ Indirect habitat loss due to drainage effects. The pre-mitigation assessment found: ▪ No likely significant adverse effects for wet dwarf shrub heath habitat in relation to the construction and operation of the proposed development.	**Construction:** No significant effects are predicted and, consequently, no mitigation is required. Mitigation through development design and micro-siting was implemented to avoid or minimise potential significant ecological effects. Pollution prevention measures, best practice construction methods and a CEMP will be agreed with stakeholders prior to construction. The provision of a CEMP would be required as condition of consent. An ECoW would oversee the construction process and would be required as condition of consent. Habitat enhancement should be agreed in advance of construction as part of a condition to the planning consent. **Operation and Decommissioning:** No significant effects are predicted and, consequently, no mitigation is required.	Reduction and/or avoidance of non-significant effects.	Pre-Construction, Construction and Post-Construction.	No significant effect on wet dwarf shrub heath habitat is predicted.
Ornithology	In total, 18 target species for further assessment based on previous studies/SNH guidance with regard to species likely to be affected by wind farm developments were recorded during flight activity surveys, with seven species identified for further assessment following the baseline study. The assessment considers the potential for significant effects associated with:	**Construction and Operation:** Mitigation through development design and micro-siting was implemented to avoid or minimise potential significant ornithological effects. It is anticipated that a condition of any consent would secure the implementation of the proposed outline CEMP. This would include the production of a Breeding Birds Protection Plan (BBPP) which would be approved by the planning authority in consultation with	Reduction and/or avoidance of non-significant effects.	Pre-Construction, Construction and Post-Construction.	No significant adverse effects. Potential beneficial effects for breeding/wintering waders through the implementation of measures described in Chapter 6: Ornithology.

Table 11.1: Summary of Mitigation and Residual Effects

Topic	Potential Likely Significant Effect (without mitigation)	Mitigation Measures	Effect	Timing	Residual Effect
	▪ Direct and indirect loss of foraging habitat and/or breeding habitat; ▪ Disturbance to birds due to construction activity; ▪ Impacts on commuting routes due to 'barrier effects'; ▪ Death or injury of birds through collision with turbine blades; and ▪ Cumulative impacts of the proposed development in the context of other nearby wind farms (operational and consented). The pre-mitigation assessment found: ▪ No likely significant adverse effects for any of the target species assessed. ▪ No significant cumulative effects were identified.	SNH prior to implementation. In addition, an ECoW would be appointed prior to the commencement of construction to ensure all reasonable precautions are taken to avoid negative effects on ornithological interests. During the operational phase in order to maintain/improve habitat suitability for breeding/wintering waders within the site, it would be proposed to retain boggy ground and create new wet areas (including scrapes and small areas of shallow open water) within the site, but away from turbines, by measures such as blocking any active drains and ditches in selected areas. In addition, controlled grazing would be used to create a variable sward length to maintain areas of shorter vegetation for foraging whilst retaining taller vegetation for nesting.			
Archaeology and Cultural Heritage	The assessment considers the potential for significant effects as a result of: ▪ Potential direct effects during construction on known or unknown buried archaeological remains. ▪ Potential long term indirect 'setting' effects on assets including scheduled monuments, listed buildings, Inventoried GDL and conservation areas.	**Construction:** No significant effects are predicted and, consequently, no mitigation is required. However, the following mitigation is suggested: ▪ Marking out surviving remains of a former small croft (1) using high visibility marker posts for the duration of the construction work phase; ▪ If required under the terms of a planning condition, the scope of any required archaeological watching	Reduction and/or avoidance of non-significant effects,	Pre-Construction, Construction and Decommissioning,	Significant Residual effects were identified for Thing's Va broch (SM587) and Scrabster Mains broch (SM579). Potential beneficial effect of a low magnitude for restoration of an old sheepfold as described in Chapter 7: Archaeology and Cultural Heritage.

Table 11.1: Summary of Mitigation and Residual Effects

Topic	Potential Likely Significant Effect (without mitigation)	Mitigation Measures	Effect	Timing	Residual Effect
	The pre-mitigation assessment found: ▪ No significant direct adverse effects during construction; ▪ Potential significant indirect 'setting' effects during operation on Thing's Va broch (SM587) and on Scrabster Mains broch (SM579); and ▪ No significant adverse cumulative effects to a baseline including other operational, consented or proposed wind farm developments.	brief(s) would be agreed through consultation with THC Historic Environment Team (HET) in advance of development works commencing; and ▪ The old sheepfold (8) near turbine T4 to be restored and reused to provide a viewpoint and information point, offering general information on the cultural heritage of the local area Mitigation through development design was implemented to avoid or minimise potential significant cultural heritage effects. It is anticipated that a condition of any consent would secure the implementation of the proposed outline CEMP. All works would be conducted by a professional archaeological organisation, and the scope of works would be detailed in one or more Written Scheme(s) of Investigation (WSI) developed in consultation with HET, acting on behalf of THC. **Operation:** The layout of the proposed development has been designed to avoid or reduce as far as possible adverse effects on the settings of heritage assets, by retaining a stand-off from important heritage assets such as Thing's Va broch and using the topography to provide a degree of visual screening of the on-site infrastructure. Excluding mitigation			

Table 11.1: Summary of Mitigation and Residual Effects

Topic	Potential Likely Significant Effect (without mitigation)	Mitigation Measures	Effect	Timing	Residual Effect
		suggested above under construction, no further mitigation is proposed. **Decommissioning:** Mitigation measures to ensure the preservation in situ of any heritage assets in close proximity to the as built layout of the proposed development will be adopted during any future decommissioning works. Mitigation suggested under construction to remain the same with the addition of marking out heritage assets within 30 m of any access track or crane hardstanding, using high visibility marker posts for the duration of the decommissioning work.			
Traffic and Transport	**Construction and Decommissioning:** No significant effects of severance, driver delay, pedestrian delay and amenity, accidents and safety, or dust and dirt have been identified. **Operation:** No significant effects of operational traffic on the road network have been identified.	**Construction:** A Construction Traffic Management Plan (CTMP) is proposed to include measures to mitigate traffic impacts and effects associated with the proposed development. A Liaison Officer would be appointed by the Applicant with responsibility for the CTMP. The Liaison Officer would be responsible for the implementation of the mitigation measures and would be a key point of contact with the local community and other stakeholders. With regards to the movement of AIL, the following mitigation measures would be put in place: ▪ All AIL vehicles would be restricted out-with the peak hours when existing traffic flows along the route would be lower;	Reduction and/or avoidance of non-significant effects.	Pre-Construction, Construction and Post-Construction.	No significant effects.

Table 11.1: Summary of Mitigation and Residual Effects					
Topic	**Potential Likely Significant Effect (without mitigation)**	**Mitigation Measures**	**Effect**	**Timing**	**Residual Effect**
		▪ Information on the movement of AIL would be provided to the local press to help inform the public and those directly affected by the proposed development; ▪ An escort would accompany all AIL vehicles; and ▪ Appropriate warning and information signs would be provided along the AIL delivery route. The Liaison Officer would consult and work with other developers of wind farm proposals to mitigate impacts and effects through the appropriate scheduling and control of vehicle access, where appropriate. It is important to recognise that the peak periods associated with wind farm developments are not likely to overlap due to the output capacities of quarries. Scheduling of AIL deliveries would also be discussed with the Scrabster Harbour Master to mitigate impacts, where appropriate.			
Noise	**Construction:** Significant effects of increased traffic flows and activities associated with the peak of construction activities on daytime noise level criteria at one residential property is predicted, and significant effects on weekend noise level criteria at four residential properties are predicted. **Operation:** None.	**Construction:** All works would be carried out in accordance with relevant EU Directives and UK Statutory Instruments that limit noise emissions from a variety of construction plant, the guidance set out in BS5228-1: 2009, and Section 72 of the Control of Pollution Act 1974. In addition: ▪ Consideration would be given to noise emissions when selecting plant and equipment to be used on site;	Reduction and/or avoidance of significant effects.	Pre-Construction, Construction and Post-Construction.	No significant effects.

Table 11.1: Summary of Mitigation and Residual Effects

Topic	Potential Likely Significant Effect (without mitigation)	Mitigation Measures	Effect	Timing	Residual Effect
		▪ All equipment would be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable; ▪ Stationary noise sources would be sited as far away as reasonably possible from residential properties and where necessary and appropriate, acoustic barriers could be used to screen them; and ▪ The movement of vehicles to and from the site would be controlled and employees instructed to ensure compliance with the noise control measures adopted. Site operations would be limited to 0700-1900 Monday to Saturday except during turbine erection and commissioning or periods of emergency work. The number of activities occurring simultaneously, the location of activities or the amount of construction traffic could be controlled on Saturdays between 1300 and 1900, if necessary, to ensure that the relevant criterion of 55 dB(A) is met. Construction noise would be further mitigated by the installation of acoustic barriers if required. **Operation:** Mitigation through development design was implemented to avoid or minimise potential significant noise effects. Implementation of a noise management strategy to ensure that the operation of the wind turbines can be altered by			

Table 11.1: Summary of Mitigation and Residual Effects					
Topic	**Potential Likely Significant Effect (without mitigation)**	**Mitigation Measures**	**Effect**	**Timing**	**Residual Effect**
		changing the pitch of the wind turbine blades resulting in a trade-off between power production and noise reduction. This would provide a potential mechanism for further reducing the level of noise experienced at nearby residential properties although the acoustic assessment demonstrates that this is not required. **Decommissioning:** No specific mitigation measures are anticipated to be necessary during the decommissioning phase although general best practice methods of reducing noise, as employed during the construction phase, should be adopted as a precaution.			
Hydrology	**Construction, Operation and Decommissioning:** Through successful mitigation by design and industry good practice measures it is considered that there are no likely significant hydrological effects associated with the proposed development.	Mitigation through development design and micro-siting would be implemented to avoid or minimise potential significant effects. This includes implementing hydromorphology improvements to the drain that T2 crosses and the drain that runs southwest to northeast directly north of the T6, by moving it further away from the area to give more space for micrositing, and, ensuring that all T6 infrastructure will be located at least 25 m from the watercourses. It is anticipated that a condition of any consent would secure the implementation of the proposed outline CEMP. Mitigation will be required to maintain shallow localised flow paths around infrastructure, indicated by the presence of M10 and M23 GWDTE habitats.	Reduction and/or avoidance of non-significant effects.	Pre-Construction, Construction and Post-Construction.	No significant effects.

Table 11.1: Summary of Mitigation and Residual Effects

Topic	Potential Likely Significant Effect (without mitigation)	Mitigation Measures	Effect	Timing	Residual Effect
		A drainage management plan will be submitted to SEPA as part of the CAR licence application which will detail measures for both sediment management and attenuation of runoff which require different drainage designs and will recognise the site-specific sensitivities of the site and its existing drainage network. No further mitigation measures have been identified. Implementation of additional good practice measures including those listed in Technical Appendices 2.2: draft Peat Management Plan and 2.3: Peat Landslide Hazard and Risk Assessment.			

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