Chapter 15
Other Issues

SCOTTISHPOWER RENEWABLES

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Chapter 15
Other Issues

15.1 Introduction

1. This Chapter of the Hollandmey Renewable Energy Development (RED) (hereafter the 'proposed Development') Environmental Impact Assessment (EIA) Report describes and assesses the potential effects of the construction and operation of the proposed Development on the following issues:

- infrastructure;
- forestry;
- telecommunications;
- shadow flicker;
- carbon balance;
- aviation; and
- waste and environmental management.

2. The following issues have been scoped out based on professional judgment and the response to scoping consultation:

- glint and glare;
- television reception;
- air quality;
- population and human health; and
- vulnerability of the development to risks of major accidents and disasters.

15.2 Issues Scoped Out

15.2.1 Glint and Glare

3. Solar panels have varying reflectivity properties; however, no solar panel absorbs 100% of incoming light. As a result, solar panels have the potential to produce solar reflection in the form of solar glint (a momentary flash of bright light) and solar glare (a continuous source of bright light).

4. UK National Planning Practice Guidance: 'Planning practice guidance for renewable and low carbon energy' states that in some instances a glint and glare assessment may be required. However, there is no specific guidance with respect to the methodology for assessing the impacts of glint and glare upon a receptor.

5. The guidance states that common receptors of solar glint and glare effects are residents, road users, railway users and aviation operations. In this way, residents who have a view of solar panels may experience solar reflection which could impact upon residential amenity. The possibility of glint and glare effects from a proposed solar development can also lead to concerns with respect to the possible impact upon road and rail safety especially if the solar development is to be located next to a road with fast moving and/ or busy traffic or a railway line. In terms of aviation, concerns are most likely for aircraft that are approaching or departing an airport, where solar reflections could be mistaken for aviation lighting.

6. It should be noted that significance of solar reflection decreases with distance, as the observer's field of vision that is taken up by the reflection area diminishes as the separation distance increases. Terrain and vegetation also obstruct an observer's view at longer distances for ground-based reflectors.

7. In relation to the guidance, a major effect is one where a solar reflection is geometrically possible and visible under conditions that will produce a significant impact.

8. Based on a review of guidance, current studies and consultee responses from the pre-application consultation undertaken in March 2019 and scoping exercise undertaken in July 2020, the following study areas were used to identify the receptors of concern:

- Dwellings (also taken to incorporate nearby recreational users) – all properties/public paths within 1km that could have a direct view of the solar panels;
- Road users – all roads within 1 km that may have a view of the solar panels;
- Railway users – railway lines within 100 m which may have a direct view of the solar panels; and
- Aviation (air traffic controllers and pilots) – Air Traffic Control (ATC) towers and approach paths out to 30 km.

9. As the solar array will be oriented towards the sun, only potential receptors to the south of the proposed solar area were considered. It was found that there were no receptors of concern within the buffers.

10. Based on the results of this analysis it is considered that there is no potential for a significant glint and glare effect, so this topic has been scoped out of the EIA. Potential aviation effects have been assessed in **Section 15.8**.

15.2.2 Television Reception

11. Wind turbines have the potential to adversely affect analogue television reception through either physical blocking of the transmitted signal or, more commonly, by introducing multi-path interference where some of the signal is reflected through different routes. However, the proposed Development is located in an area now served by a digital transmitter. Therefore, television reception is unlikely to be affected by the proposed Development as digital signals are rarely affected. In the unlikely event that television signals are affected by the proposed Development, reasonable mitigation measures would be considered by the Applicant.

15.2.3 Air Quality

12. The main source of impact on air quality would be increased traffic flows on local roads during construction and emissions from construction activities including exhaust fumes and dust generated from disturbance to or tracking across unmade ground and access tracks in dry conditions.

13. It is considered that the air emissions associated with these activities would be transient, localised and highly unlikely to have a significant effect upon local air quality given the lack of sensitive receptors close enough to experience these effects. In addition, there are well established best practice measures applied to construction that would form an integral part of the development process (e.g., speed control, optimising deliveries to Site, dust control, restrictions on idling plant/vehicles, etc.). These controls and measures will form an integral part of the Construction Environmental Management Plan (CEMP) (**Technical Appendix 3.1: Outline Construction Environmental Management Plan**) for the proposed Development.

14. There would be no emissions to air during operation, with the only source being occasional vehicles accessing the Site for maintenance purposes. For the reasons cited above Air Quality was scoped out from further assessment.

15.2.4 Population and Human Health

15. The RenewableUK Onshore Wind Health and Safety Guidelines (2015) note that wind turbine development and operation can give rise to a range of risks to public safety including:

- traffic (especially lorries during construction, and abnormal loads for the transport of wind turbine components; including beyond the application boundary);
- construction site hazards (particularly to any people entering the Site without the knowledge or consent of the site management);
- effects of catastrophic wind turbine failures, which may on rare occasions result in blade throw, tower topple or fire; and
- ice throw if the wind turbine is operated with ice build-up on the blades.

16. The RenewableUK guidance (2015) states:

"*Developers should ensure that risks to public safety are considered and managed effectively over the project lifecycle and should be prepared to share their plans for managing these risks with stakeholders and regulators*".

17. It is considered that limited interactions with human health are possible. In addition, properly designed and maintained wind turbines are an established and safe technology. Sensitive site design and inbuilt buffers from sensitive receptors and incorporating health and safety best practice would minimise any risk to human health resulting from the construction and operation of the turbines. The construction works for the proposed Development would be undertaken in accordance with primary health and safety legislation, including the Health and Safety at Work Act 1974 and the Construction (Design and Management) (CDM) Regulations 2015, which include a requirement for inclusion of emergency procedures in a Construction Phase (Health and Safety) Plan.

18. Site security and access during the construction period would be governed under Health and Safety at Work Act 1974 and associated legislation. There would be no public access to the Site during construction. During operation, the Land Reform (Scotland) Act (2003) gives members of the public general access rights over most land and there would be no special restrictions on access. Although the landowners have indicated that they are unaware of members of the public exercising their general access rights on the Site currently, informal recreational access within the Site would benefit from the presence of the proposed Development by providing a feature of interest and enhancing access through site infrastructure. Appropriate warning signs would be installed concerning restricted areas such as the substation compound, transformers, switchgear and metering systems. All on-site electrical cables included in the proposed Development would be buried underground with relevant signage.

19. The potential for risk to human health associated with ice build-up is reduced through inbuilt turbine mechanisms in modern machines. Wind turbines can continue to operate with a very thin accumulation of snow or ice but will shut down automatically as soon as there is a sufficient build up to cause aerodynamic or physical imbalance of the rotor assembly. There are monitoring systems and protocols in place to ensure that turbines that have been stationary during icing conditions are restarted in a controlled manner to ensure public safety. Potential icing conditions affecting turbines can be expected two to seven days per year (light icing) in Scotland (WECO, 1999). The risk to public safety is considered to be very low due to the few likely occurrences of these conditions along with the particular circumstances that can cause ice throw.

20. It was considered unlikely that there would be any significant adverse population and human health effects, so this issue was scoped out from further assessment.

21. Population and human health effects relating to traffic and transportation (**Chapter 12: Access, Traffic and Transport**), noise (**Chapter 13: Noise**), and residential amenity (**Chapter 7: Landscape and Visual Impact Assessment**) will be assessed in full elsewhere within the EIA Report.

15.2.5 Vulnerability of the Development to Risks of Major Accidents and Disasters

22. The vulnerability of the proposed Development to major accidents and natural disasters, such as flooding, sea level rise, or earthquakes, is considered to be low due to its geographical location.

23. In addition, the nature of the proposals and remoteness of the Site means there would be negligible risks on the factors identified by the EIA Regulations. For example:

- population and human health – the Site is remote with low population density and the required safety clearances around turbines has been a key consideration throughout the design process;
- biodiversity – receptors and resources would be unaffected as there would be little risk of polluting substances released or loss of habitat in a turbine failure scenario (highly unlikely);
- land, soil, water, air and climate – there would be little risk of polluting substances released or loss of habitat in a turbine failure scenario (highly unlikely); and
- material assets, cultural heritage and the landscape – there would be no adverse effects on these features in a turbine failure scenario (highly unlikely).

24. Nonetheless, the risk of accidents and other disasters is covered where relevant in individual topic chapters, for instance, the potential for environmental incidents and accidents such as spillages are considered in **Chapter 8: Ecology and Biodiversity**, **Chapter 9: Ornithology** and **Chapter 10: Hydrology, Hydrogeology, Geology and Soils**. Flood risk is also assessed within **Chapter 10: Hydrology, Hydrogeology, Geology and Soils**.

15.2.5.1 Climate Change

25. None of the following climate trends identified in UKCP18 (Met Office, 2018) could significantly affect the proposed Development:

- increased temperature;
- changes in the frequency, intensity, and distribution of rainfall events (e.g., an increase in the contribution to winter rainfall from heavy precipitation events and decreases in summer rainfall); and
- sea level rise and associated coastal flood risk.

15.2.5.2 Extreme Weather

26. The possibility that the proposed Development would be exposed to windstorms could represent a risk; however, braking mechanisms installed on turbines allow them to be operated only under specific wind speeds and should severe windstorms be experienced, then the turbines would be shut down. The ground-mounted solar array would also be designed to withstand high winds. As published mapping confirms that most of the Site is not located in an area identified as being at risk of flooding it is considered unlikely that flooding will pose a significant risk to the operation of the proposed Development nor would the construction of the proposed Development contribute to flooding elsewhere.

27. Wind turbines can be susceptible to lightning strike due to their height. Appropriate measures are taken into account in the design of turbines to conduct lightning strikes down to earth and minimise the risk of damage to turbines. Modern wind turbine blades are manufactured from a glass-fibre or wood-epoxy composite in a mould, such that the reinforcement runs predominantly along the length of the blade. This means that blades will usually stay attached to the turbine if damaged by lightning. In all cases turbines will automatically shut down if damaged by lightning. Solar panels can also be susceptible to lightning strikes and they would be installed with lightning protection systems to reduce risks of lightning damage.

15.2.5.3 Earthquakes

28. There are no geological faults within the Site, although there are records of inferred faults within the surrounding area, and no records of any earthquakes occurring in the vicinity of the Site within the last 130 years (British Geological Survey GeoIndex, viewed 30/09/2020). Earthquakes in Scotland are typically no greater than 3 on the Richter Scale and, therefore, minor and unlikely to cause significant damage to buildings and infrastructure. Should a wind turbine or solar array be damaged, the risk to public safety is considered to be negligible due to the remote location and careful design layout of the infrastructure.

15.3 Infrastructure

29. Site access from the local road network would be taken from an unclassified public road running parallel to the A836 at a point north west of Phillips Mains. There is an existing access from the unclassified road into the Site and this track is included within the application boundary. The Site only bounds with the local road network at the point where the access track meets the unclassified public road, and there are no public access roads on the Site.

30. There are no public rights of way or any paths that might meet the criteria but have yet to be catalogued.

31. There are no overhead power lines on the Site; however, there is a buried distribution cable that connects to Lochend Windfarm to the south of the Site and north of Turbine 4 (T4), which is approximately 96 m away. The proposed access track would cross the Lochend cable on its approach to T4. There are existing cable crossing points and the proposed access track would cross the cable at one of these points. The design of the track in this location would consider the loadings of the vehicles to protect the cable. Permission has also been granted, but construction has not begun, for a buried 132 kV cable to the north of the Site, which would be approximate 151 m from the nearest turbine. A desktop utility survey was undertaken and no other utilities were identified on the Site.

15.4 Forestry

15.4.1 Introduction

32. This Section of the Chapter provides a summary of the forestry assessment of the potential effects of the proposed Development on the existing forest resource. The proposed Development lies within existing commercial forestry plantations which is privately owned. The full assessment is detailed within **Technical Appendix 15.1: Forestry**.

33. The forestry assessment describes the plans as a result of the proposed Development for felling, restocking and forest management practices; the process by which these plans were derived; and the changes to the physical structure of the forest. TA 14.4 identifies the areas of forest which are to be removed for the construction and operation of the proposed Development.

15.4.2 Legislation, Policies and Guidance

34. The following legislation, policy and guidance have been considered in the assessment and are detailed further in **Technical Appendix 15.1**:

- Scottish Forestry Strategy 2019-2029
- The Land Use Strategy for Scotland 2016-2021
- Scottish Planning Policy (2014)
- National Planning Framework for Scotland (2014)
- Scotland's Fourth National Planning Framework Position Statement
- Forestry and Land Management (Scotland) Act (2018)
- Control of Woodland Removal Policy (CWR) (2009)
- UK Forestry Standard
- UKWAS 4 2018
- Forestry Commission (1996) Technical Paper 16: Designing Forest Edges to Improve Wind Stability
- Forestry Commission (2016) Forest Yield: A handbook for forest growth and yield tables for British forestry
- The Highland Council (2018) Highland Forest and Woodland Strategy
- The Highland Council (2013) Trees, Woodlands and Development supplementary guidance

15.4.3 Consultation

35. The relevant forestry stakeholders were consulted regarding the potential effects of the proposed Development as part of the scoping process. A summary of consultation is provided in **Table 15.1**.

Table 15.1: Summary of scoping responses in relation to woodland management and felling

Consultee	Response	Comment
The Highland Council Scoping Response 17 September 2020	Key-holing must be used wherever possible as "*large-scale felling can result in large amounts of waste material and in a peak release of nutrients which can affect local water supply*". They also state that "*clear felling may be acceptable only in cases where planting took place on deep peat and it is proposed through a habitat management plan to reinstate peat-forming habitats*". The pre-application advice provided by THC also states that "*We would expect forestry removal to enable peatland restoration by reinstating forestry to bog habitat where appropriate*"	The main objective in relation to tree felling has been to fell the absolute minimum area of trees to accommodate the proposed Development. Keyhole felling will be employed for all wind turbines and the solar area was selected as it is comprised mainly of open ground and the felling would only involve clearing scattered small areas of conifers. Where possible infrastructure has been sited to avoid felling that would create new woodland edges that would be at risk of windblow. The areas of felling, felling volume, and compensatory planting requirement have been calculated and presented in **Section 15.4.5.**
Scottish Forestry (SF) Pre-Application Consultation 20 June 2020	SF were consulted regarding compensatory planting. They confirmed that if felled areas were restored to peatland this would negate the need for compensatory planting for that area. This is provided that it is discussed with SF in advance and supported by a restoration plan.	
SF Scoping Response 28 August 2020	SF has generally agreed with the proposed methodology and scope of the forestry assessment, but requested the following information: • forestry baseline; • clear distinction of felling required to accommodate the proposed Development's infrastructure (ha) – permanent woodland loss – and felling required to allow for construction and operation of the proposed Development (ha) – temporary woodland loss; • clear commitment on timing of producing the compensatory planting plan; • information on the area and timing of felling required; and information on the area and timing of the restocking.	A full baseline study has been undertaken and full details are contained in **Technical Appendix 15.1**.
Scottish Environment Protection Agency (SEPA) Scoping Response 26 August 2020	We presume that your plan is being prepared as part of or to support a Forest Grant Scheme application or similar process. If this is the case then you should ensure that the relevant Scottish Government and Forestry Commission Scotland guidance is followed. The Plan should state that the proposals will comply with the UK Forestry Standard The Plan should provide information on how protecting the water environment has been considered when deciding on the location, layout and design of the planting and felling proposals (for example in relation to the timing of	The Site is currently covered by a Long Term Forest Plan approved by SF. The changes to the Plan will be discussed with SF and it is expected that a plan amendment would need to be submitted to SF for approval. All forestry plans and associated work would comply with the UK Forestry Standard. All watercourses and water bodies would be protected in accordance with Table 6.7.2 of the UK Forestry Standard. All watercourses were identified as constraints during the design process as shown on Figure 2.3. All development work is at least 50 m away from watercourses and waterbodies, except where crossings

Consultee	Response	Comment
	works or size of areas felled at the same time). All watercourses and water bodies should be identified as constraints and be protected from forestry operations by open space or suitable riparian planting in line with Table 6.7.2 of the Forestry Standard. Identifying and establishing an effective buffer area is fundamental to the protection of the riparian zone and aquatic habitat. These areas should all be clearly marked on the proposal maps. Information should also be provided on whether the existing forest drainage meets current best practice. Where possible the proposal map should identify all areas where existing drains need to be realigned to ensure they do not discharge directly into watercourses. Proposals to make use of any waste wood on the site should be outlined in the plan. The proposals should comply with our SEPA Guidance: Management of Forestry Waste. There must be a clear beneficial use identified for any material left onsite.	are required and Turbine 8 (T8) where a reduced buffer of 10 m was agreed with SEPA. All the timber would be removed from the Site. It is not intended to use any waste wood onsite.

15.4.4 Baseline

15.4.4.1 Study Area

44. The Site extends to 1149 ha and is comprised largely of mid-rotation commercial forestry plantations. There is also a considerable amount of open moorland intermixed with the plantations.

45. The forestry plantations are managed by RDS Forestry and are currently covered by a Long Term Forest Plan, re: 17GS18237, approved by Scottish Forestry (SF) on 10 July 2019. The current baseline species, planting year, and felling plans are shown on **Figures 15.1**, **15.2** and **15,3** respectively. The plantations are also within the UKWAS. The following historical Woodland Grant Scheme (WGS) applications were made in relation to the Site:

- WGS2 Application made in 1993 on behalf of Phillips Mains covering the northern section. This application was approved for woodland establishment;
- WGS2 Application made in 1994 on behalf of Phillips Mains (property name) covering the north east section that surrounds the SSSI. This application was for "*approved re-stocking and/or management*"; and
- WGS3 Application made in 1995 on behalf of Phillips Mains covering the southern section. This application was also for woodland establishment.

46. There is only a small amount of windblow evidenced throughout the Site and the predicted windblow risk for the Site assessed as low using the ForestGALES software. A detailed baseline study is included in **Technical Appendix 15.1**, including baseline age class structure, species composition and felling and restocking plans.

15.4.5 Assessment of Effects

15.4.5.1 Effects

Felling

47. In relation to forestry, the key objective of the proposed Development has been to minimise the amount of tree felling and ensure that all felling for the wind turbines would be based on keyhole felling. A circular buffer area with a radius of 101.6 m would be felled for each wind turbine; this is the minimum area required for both ecological and turbine efficiency reasons. A buffer of 10 m has been applied to all other site infrastructure to provide clear areas and to enable delivery of turbines.

48. **Figure 15.4** shows the areas required to be felled to accommodate the proposed Development and **Technical Appendix 15.1** provides a windfarm felling plan. The total felling area would be 24.3 ha and all felling would be permanent.

The volume of the timber to be felled for each sub compartment has been obtained from Yield Class tables**.** The total timber volume to be felled is estimated to be 3,496m**^{3}**. Using a conversion factor of 1.08 m^3 to a tonne, this equates to 3,237 tonnes. It has been assumed that all plantations are fully stocked, so the total volume is the absolute maximum that will be felled.

Habitat Management Plan (HMP)

49. The Applicant has identified opportunities to restore some areas of the Site which have been affected by historical land use (e.g., forestry and land drainage). An area of 168 ha surrounding the Philip Mains SSSI has been identified for habitat management with the aim of felling all of the existing forestry and restoring the area to bog habitat. This would require the felling of 88.4 ha of forestry. See **Technical Appendix 8.6: Draft Habitat Management Plan** for more details.

15.4.6 Mitigation

15.4.6.1 Embedded Mitigation

50. The following mitigation measures have been incorporated into the design of the proposed Development or constitute best practicable measures that would be incorporated into construction and operation.

- the design of the site layout has tried to retain wind firm edges as far as possible;
- all forestry plans and operations would fully comply with the UKFS;
- use of keyhole felling for turbines to minimise the amount of felling required;
- the layout of the solar area and access tracks have been designed to minimise the amount of tree felling;
- the extraction of the felled timber would be carried out after the access roads have been installed to minimise any damage to the soil caused by transporting felled timber over bare ground;
- the felling method will be based on a short wood felling system and all timber would be removed from the Site;
- site refuelling and maintenance areas would be sited outside the watercourse buffer areas and best practice measures would be taken to mitigate risks of spillages (the buffer areas are further defined in **Table 15.2**);
- protection measures laid out in British Standard 5837 (2012), including measures such as forming a construction exclusion zone around retained trees/woodlands using specific barrier configurations, would be adopted to protect retained forestry during construction; and
- guidance in the UKFS regarding minimum buffers (shown in **Table 15.2**) from watercourses would be followed in relation to the planned felling operations.

Table 15.2 UKFS watercourse buffers

Buffer width	Situation
10 m	Along permanent watercourses with a channel less than 2 m wide (narrower widths of buffer area may be allowable along minor watercourses with a channel less than 1 m wide, especially on steep ground)
20 m	Along watercourses with a channel more than 2 m wide and along the edge of lakes, reservoirs, large ponds and wetland
50 m	Around abstraction points for public or private water supply, such as springs, wells, boreholes and surface water intakes

15.4.6.2 Compensatory Planting

51. As this project involves the permanent removal of woodland for the purposes of conversion to another type of land use, the CWR has been fully considered. The proposed Development would meet the acceptability criteria for woodland removal as the

change of land use with compensatory planting would contribute significantly to "*helping Scotland to adapt to climate change*" by providing facilities appropriate for the development of renewable energy projects and significantly reduce net greenhouse gas (GHG) emissions.

52. The maximum area of land that would need to be planted (the SF default position) is an area equivalent to the area being felled and left unplanted, which in this case is estimated to be 24.3 ha.

15.5 Telecommunications

15.5.1 Introduction

53. This Section of the Chapter describes the existing environment with respect to telecommunications.

54. During construction, cranes have the potential to block or reflect radio signals, however, these impacts would be temporary minor adverse impacts so there would be '**No Significant**' effect and have been scoped out.

55. During operation, a windfarm has the potential to cause an impact on telecommunications infrastructure by introducing new physical structures (turbines) into an area that can block and/or reflection of radio signals.

56. This Chapter is based on work completed by Pager Power Limited and should be read in conjunction with **Technical Appendix 15.2: Telecommunications Impact Assessment** where the specific impact assessment is presented.

15.5.2 Legislation, Policies and Guidance

57. The telecommunications assessment is carried out in accordance with the principles contained within the following publications:

- International Telecommunications Union (1992), Assessment of impairment caused to television reception by a wind turbine, Recommendation ITU-R BT805;
- International Telecommunications Union (2010), ITU-R BT.2142-1;
- Bacon (2002), A proposed method for establishing an exclusion zone around a terrestrial fixed radio link outside of which a wind turbine will cause negligible degradation of the radio link performance; and
- Joint Radio Company (2014): Calculation of Wind Turbine clearance zones for JRC UHF (460MHz) Telemetry Systems when turbine sizes and locations are accurately known – Issue 4.2.

15.5.3 Consultation

58. The detailed methodology adopted by the assessment is contained in **Technical Appendix 15.2.**

59. Consultation was undertaken with the relevant telecommunication link operators[1] to inform the telecommunications links within the vicinity of the Site and to advise their position with respect to the proposed Development. A summary of the consultation is provided in **Table 15.3**.

Table 15.3: Link operator responses

Link operator	Consultation summary	Comment / action taken
Airwave	Airwave confirmed they have no objections.	No further action required.
Arqiva	No telecommunication links in the vicinity and therefore no objections to the proposed Development.	No further action required.
Atkins	No telecommunication links in the vicinity and therefore no objections to the proposed Development.	No further action required.
British Telecom (BT)	Confirmed that the proposed Development would not have an impact upon their infrastructure.	No further action required.
Ericsson	No telecommunication links in the vicinity and therefore no objections to the proposed Development.	No further action required.
Joint Radio Company (JRC)	The JRC has confirmed through their own internal analysis that the proposed Development has been cleared with respect to radio link infrastructure operated by the local electricity utility. No objection.	No further action required.
Telefonica	Confirmed that they have an objection to the proposed Development. Their preferred solution would be to move the turbine outside of the telecommunication link exclusion zone.	Further consultation was held to explore potential mitigation solutions. Following a review of alternative locations and input from technical specialists it was decided to relocate T8. Telefonica have confirmed the new location will not impact on their link.
Vodafone	Although Pager Power analysis has shown that T8 is within the Fresnel zone associated with a telecommunications link, Vodafone have confirmed that the proposed Development would not have an impact upon their infrastructure.	No further action required.

[1] Consultation with the Office for Communications (Ofcom) is no longer possible due to GDPR limitations.

15.5.4 Baseline

61. Telecommunications infrastructure was identified through consultation with the relevant telecommunications stakeholders. The search radius was therefore informed by the safeguarding criteria applied by each stakeholder. Only telecommunication links that crossed the Site were considered.

The relevant links identified through the consultation are listed in **Table 15.4** A full list is provided in **Technical Appendix 15.2**.

Table 15.4: Telecommunication links that cross the Site

Link ID	Operator
6000349 6000351 6000353 6000355 6000357 6000359 6000361 6000363	BT
1125009/1	Telefonica
0950728/1 0951034/1	Vodafone

Link ID	Operator
460M Hz Telemetry and Telecontrol: JESHCS1 to JESHCO18	JRC (The local electricity utility) – The JRC does not provide specific link details.

62. The links plotted in relation to the Site footprint are illustrated in **Technical Appendix 15.2**. The JRC does not provide specific link details and were therefore not plotted.

15.5.5 Assessment of Effects

63. A telecommunications impact assessment undertaken by Pager Power in June 2020 identified. Telecommunications links were mapped as constraints and exclusion zones were added. The initial assessment found that T8 would be located within the exclusion zones associated with the Telefonica 1125009/1 and Vodafone 0951034/1 links. The telecommunications impact assessment identified mitigation measures which were discussed during further consultation with Telefonica. Feasibility studies including a Line of Sight Assessment and consultation with BT regarding installation of fibre optic cables were undertaken to explore whether the link could be successfully mitigated. The findings of the feasibility studies showed that there was not a technical or commercially viable form of secondary mitigation, so it was decided to mitigate by design. An environmental appraisal was conducted to find an alternative location for T8 and subsequently T8 was moved c.50 m south. Telefonica have confirmed that this location is acceptable.

64. Although the analysis found that the proposed Development could potentially have an operational impact upon the Vodafone telecommunications link, Vodafone has confirmed that they have no objections to the proposed Development.

65. The remaining turbines are located outside of the associated exclusion zones associated with the identified telecommunications links and so there would be no concerns in relation to operational impact. This was confirmed by the link operators through the consultation in **Technical Appendix 15.2**.

66. The link operated by the JRC could not be included within the technical assessment as they do not provide specific link details due to breaches in confidentiality. The JRC undertook their own assessment and confirmed that the proposed Development would not have an impact upon their telecommunications links.

67. Therefore, the design evolution of the proposed Development has resulted in a site layout that would cause **'No Significant'** effects on any telecommunications links during operation.

68. No potential for cumulative effects has been identified based on the relevant links identified through the consultation. In conclusion, based on the assessment of the identified infrastructure and consultation with link operators, the proposed Development would have a no significant effects on telecommunications links.

15.6 Shadow Flicker

15.6.1 Introduction

69. This Chapter presents the findings and conclusions of the technical analysis for Shadow Flicker issues associated with the proposed Development.

70. Rotating wind turbine blades can cause brightness levels to vary periodically at locations where they obstruct the Sun's rays. This can result in a nuisance particularly when the Sun is low in the sky and the shadow is cast over the windows of residential dwellings. This intermittent shadow is described by the term 'Shadow Flicker' and it can be a cause of annoyance at residences near onshore wind developments if it occurs for a significant amount of time during the year. This is only an issue under specific circumstances whereby a significant effect is produced for extended periods of time.

71. This Chapter is based on work completed by Pager Power Limited and should be read in conjunction with **Technical Appendix 15.3 Shadow Flicker Impact Assessment** where the specific analysis is presented.

15.6.2 Legislation, Policies and Guidance

72. The Shadow Flicker assessment has been carried out in accordance with the principles contained within the following publications:

- Renewable and low carbon energy. Paragraph: 020 Reference ID: 5-020-20140306. Revision date: 06 03 2014;
- Parsons Brinckerhoff, 2011 – Update of UK Shadow Flicker Evidence Base, Department for Communities and Local Government, July 2013, Planning practice guidance for renewable and low carbon energy; and
- Department for Communities & Local Government (July 2013): Planning practice guidance for renewable and low carbon energy.

15.6.3 Consultation

73. In their scoping response, THC requested a shadow flicker assessment as part of the EIA, and that detailed assessment would be required if there were any receptors within 11 rotor diameters.

15.6.4 Study Area

74. It is common to use 10 rotor diameters as a maximum limit at which effects can occur. The validity of this limit is discussed at length within the relevant literature (Parsons Brinckeroff, 2011; DCAL, 2013). The guidance on this particular criterion varies in different documents and countries, with some stating that effects can only occur within this distance and others stating that this is a general rule or that the risk beyond this distance is low. In reality, there is no fixed cut off distance at which effects can occur, because this is sensitive to many parameters including the exact latitude and the terrain around the development location.

75. A primary study area of 10 rotor diameters was applied to the Development. An additional 50 m buffer zone was applied at the extend of the 10-rotor diameter zone to allow for micrositing of the wind turbines. However, a secondary study area of 11 rotor diameters was used in an addendum to the shadow flicker assessment (**Technical Appendix 15.4: Shadow Flicker Impact Assessment Addendum**) in accordance with the scoping response from THC.

15.6.5 Assessment of Effects

76. The detailed methodology adopted by the assessment is contained in **Technical Appendix 15.3**.

77. A shadow flicker zone was modelled using WindFarm Version 4.1.1.1 by ReSoft Ltd as recommended in the Parsons Brinckerhoff (2011) report. The following factors are taken into account in the calculation:

- turbine location, rotor diameter and hub height;
- topography (using OS Terrain 50 digital terrain data); and
- locations of dwellings.

78. **Figure 15.5** shows the 10- rotor diameter shadow flicker zone in relation to the nearest sensitive receptors. Sensitive receptors were identified using local dwelling data. Pager Power also completed a complementary desk-based search. All identified dwellings are outside of the 10- rotor diameter assessment zones relative to the wind turbines, indicating there would be no potential for shadow flicker effects.

79. As reported in **Technical Appendix 15.4**, there would be potential for some shadow flicker impacts on three properties within an 11-rotor diameter of the wind turbines. There is no formal limit on the amount of shadow flicker that is considered acceptable within the UK. For reference, a typical limit, which has been utilised in Northern Ireland, Republic of Ireland, Germany and Belgium, is 30 hours per year with a maximum of 30 minutes per day. For the purposes of this assessment, these limits are considered to be the criteria for a significant effect.

80. Detailed monitoring, as outlined in **Technical Appendix 15.4**, found that receptors 21, 26 and 27 would all receive shadow flicker effects for less than the reference limit of 30 minutes per day and 30 hours per year (**Table 15.5**). Therefore, the potential shadow flicker effect is **'Not Significant'** and would not require mitigation.

Table 15.5: Shadow flicker effects by receptor

Receptor	Days per year of shadow flicker	Maximum hours per day	Mean hours per day	Total hours per year
21	14	0.14	0.11	1.5
26	36	0.4	0.31	11.3
27	37	0.41	0.32	12

81. There are two windfarms (Lochend Windfarm and Slickly Windfarm) in the vicinity of the proposed Development. There is no realistic prospect of a cumulative impact because there is '**No Significant**' contribution from the proposed Development.

15.6.6 Assessment Limitations

82. It is assumed that all dwelling data supplied is accurate.

83. The assessment is limited to desk-based modelling. No site surveys have been undertaken which may provide more accurate dwelling data within the assessment.

15.7 Carbon Balance

15.7.1 Introduction

84. In addition to the value that renewable energy developments provide in terms of the electricity which they produce; renewable energy technologies such as wind turbines and solar panels further provide an important mechanism for the reduction of carbon dioxide (CO_2), and other GHG emissions, into the atmosphere. This offers a sustainable alternative to the emissions-intensive electricity generated from fossil fuels.

85. Renewable energy developments achieve emissions savings by reducing the consumption of fossil fuel generated mains electricity. However, during manufacture, construction and decommissioning of their assets, renewable energy developments can themselves result in the emission of CO_2 and other GHGs; particularly in such instances whereby natural carbon stores including trees and/or carbon rich soils such as peat are present and potentially impacted by the development.

86. For this reason, this Chapter provides an approximation of the tonnes of CO_2 equivalent (tCO_2e) GHG emissions associated with the manufacture, construction and decommissioning of the proposed Development. It further provides an estimate of the contribution which the proposed Development would make towards the reduction of emissions which would otherwise be produced by fossil fuel powered energy generation. This provides an indication of the whole life carbon balance of the proposed Development, together with an understanding of the emissions 'pay-back' period. Once emissions resulting from the manufacture, construction and decommissioning of the proposed Development have been paid back (offset), then each subsequent unit of renewable electricity would displace a unit of conventionally generated electricity, thereby contributing to the overall reduction in emissions into the atmosphere.

15.7.2 Characteristics of Peatland

87. Renewable energy developments in upland areas are often sited on areas of peatland which hold stocks of poorly protected carbon. If disturbed, these stocks have the potential to release carbon into the atmosphere in the form of CO_2. When flooded, peat soils emit less CO_2 but more methane (CH_4) than when they are drained. In flooded soils, CO_2 emissions are usually exceeded by plant fixation, so the net exchange of carbon within the atmosphere is negative and soil stocks increase. When soils are aerated, CO_2 emissions usually exceed plant fixation, so the net exchange of carbon within the atmosphere is positive.

88. To calculate the CO_2 emissions attributable to the removal or drainage of the peat, emissions occurring if the soil had remained in situ and undrained are subtracted from the emissions occurring after removal or drainage. The indirect loss of CO_2 uptake (fixation) by plants originally on the surface of the Site but eliminated by construction activity including the destruction of active bog plants and felling, is calculated using site-specific data collected as part of the EIA process and based upon blanket bog.

89. Emissions due to the indirect, long-term liberation of CO_2 from carbon stored in peat due to drying and oxidation processes caused by onsite construction can also be calculated from site-specific data for the proposed Development. The resultant figure is a reasonable worst-case scenario, as peat would be reused onsite to minimise carbon losses for restoration of the renewables project, and for habitat restoration including ditch blocking.

15.7.3 Turbine and Solar Panel Manufacture

90. Emissions arising from the fabrication of the turbines and the associated components of the proposed Development are based upon a full life analysis of a typical turbine and include CO_2 emissions resulting from transportation, erection, operation, dismantling and removal of turbines and foundations and transmission grid connection equipment from the existing electricity grid system.

91. With respect to turbines, emissions from material production are the dominant source of CO_2. Emissions arising from the construction (including transportation of components, stone extraction, building foundations, access tracks and hard standing) and commissioning are also included in the calculations. The assessment has used Nayak et al. (2008) default values for 'turbine life' emissions, calculated with respect to installed capacity.

92. A number of technical papers (detailed in Nayak et al., 2008) have reported a wide range of windfarm emissions values; these being between six and 34 tCO_2 GWh_{-1}. From these, additional CO_2 payback time can be calculated and compared due to production, transportation, erection and operation of the proposed Development.

93. These values are significant, so it is important that they are considered in relation to calculating the CO_2 payback period of the proposed Development. However, it should be noted that this may still compare very favourably with the life cycle analysis of other means of non-fossil fuel-based power generation, such as nuclear, particularly when the full energy costs of construction, operation, maintenance and decommissioning, uranium mining and transportation as well as long-term waste management are taken into account.

94. Emissions arising from the fabrication can be categorised into monocrystalline and polycrystalline. Monocrystalline panels are more efficient than polycrystalline panels and it is therefore assumed that the panels that will be chosen for the proposed Development will be monocrystalline. The average published embodied carbon of monocrystalline panels is 2,560 $kgCO_2e$ per kWp, though individual products may vary. A 10.3% yield/load factor has been assumed for solar PV as per the Scotland-specific load factors produced by the Department for Business, Energy and Industrial Strategy.

15.7.4 Characteristics of Forestry

95. The presence of extensive areas of forestry on, and/or in the vicinity of, wind turbines have the potential to significantly reduce their wind energy yield. For this reason, common practice has been to clear existing forestry from the surrounding area prior to the construction of the development. This practice often leaves open ground in its wake thus resulting in a loss in the CO_2 sequestration potential of the land.

96. The amount of carbon released into the atmosphere as a result of felling is dependent upon the type of tree being felled, the age of the crop, the use of the timber and how quickly the stored carbon is released into the atmosphere. Cannell (1999 in Nayak et al., 2008) estimates the carbon sequestration potential of a variety of fast-growing tree species as outlined in **Table 15.6.**

Table 15.6: Carbon sequestration potential of fast-growing tree species (Cannel, 1999)

	Poplar	Sitka	Beech
Yield Class (m 3 ha -1 yr -1)	12	16	6
Carbon sequestered, G forest (tCO_2 ha -1 yr -1)	26.8	13.2	8.8

	Poplar	Sitka	Beech
Crop rotation, t forest (years)	26	55	92
CO_2 sequestered per crop rotation (tCO_2 ha -1)	694.66	724.68	808.86

97. The area of forestry to be felled, coupled with average carbon sequestered per year and the lifetime of the wind turbines, is used to determine the potential loss of CO_2 due to forestry clearance.

15.7.5 Statutory and Planning Context

15.7.5.1 National Context

The Climate Change (Emissions Reductions Targets) (Scotland) Act 2019

98. The Climate Change (Scotland) Act 2009 set a target of reducing GHG emissions by at least 80% by 2050, relative to the baseline year of 1990, with an interim target of reducing emissions by at least 42% by 2020.

99. In October 2019, this was amended by the Climate Change (Emissions Reductions Targets) (Scotland) Act 2019 which sets a target of net-zero emissions by 2045 (in line with the recommendations of the Committee on Climate Change). The interim targets of the Act are:

- 56% reduction in emissions by 2020;
- 75% reduction in emissions by 2030; and
- 90% reduction in emissions by 2040.

Scottish Climate Change Plan

100. The Scottish Climate Change Plan (SCCP), which is presently being revised to reflect the updated targets of the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019, includes a target of 50% of Scotland's energy needs to be met by renewable energy by 2030. The SCCP also included a goal for 100% of Scotland's electricity to be generated by renewables by 2020. This has yet to be met.

Scottish Planning Policy

101. The SPP sets out how the Climate Change (Scotland) Act 2009 should be delivered on the ground. The SPP states that, "*by seizing opportunities to encourage mitigation and adaptation measures, planning can support the transformational change required to meet emission reduction targets and influence climate change*" (para 19, SPP, 2014).

102. The SPP states (para 205) that, where peat and other carbon rich soils are present, applicants should assess the likely effects of development on CO_2 emissions. Where peatland is drained or otherwise disturbed, there is liable to be a release of CO_2 into the atmosphere. Developments should aim to minimise this release.

Good Practice During Wind Farm Construction, NatureScot (2015)

103. NatureScot's Good Practice During Wind Farm Construction guidance recognises that one of the key aims of windfarm developments is to reduce GHG emissions, but that windfarm developments, through the materials used, the construction processes employed and the potential emissions from disturbed soils and habitats, do result in GHG emissions.

104. The guidance recognises that, in some circumstances, the carbon payback of windfarm developments could be significantly affected by the construction methods used and the degree of restoration of the Site. The guidance seeks to ensure that good practice is adopted to reduce the carbon and other GHG emissions associated with windfarm development.

105. The Good Practice approach to development on peat and emissions savings recommended by this guidance can be summarised as follows:

- conduct a detailed peat survey;
- where possible, position site infrastructure in areas of shallower peat or design appropriate engineering solutions to avoid and/or minimise excavation of peat (for example, floating roads and piling solutions);
- minimise the detriment to peat if excavation cannot be fully avoided;
- avoid or reduce peat displacement from the development of borrow pits;
- excavations should be prevented from drying out or desiccating as far as possible. Consideration should also be given to spraying with water;
- if stockpiling peat, assess the potential loading effects for peat slide risk;
- the peat should be restored as soon as possible after disturbance;
- consider cable trenching operations and timing;
- floating roads should be used in areas of deeper peat;
- minimise plant movements and haul distances in relation to any earthworks activities including peat management; and
- developers should take ancillary opportunities to improve habitats.

15.7.5.2 Local

Highland-Wide Local Development Plan (April 2012)

106. The Highland-Wide Local Development Plan (April 2012) recognises (para 20.27.2) the importance of the conservation of peatlands as carbon sinks, in addition to their nature conservation and archaeological interests.

107. Local Plan Policy 55 'Peat and Soils' states that "*development proposals should demonstrate how they have avoided unnecessary disturbance, degradation or erosion of peat and soils. Unacceptable disturbance of peat will not be permitted unless it is shown that the adverse effects of such disturbance are clearly outweighed by social, environmental or economic benefits arising from the development proposal. Where development on peat is clearly demonstrated to be unavoidable, the Council may ask for a peatland management plan to be submitted which clearly demonstrates how impacts have been minimised and mitigated. New areas of commercial peat extraction will not be supported unless it can be shown that it is an area of degraded peatland which is clearly demonstrated to have been significantly damaged by human activity and has low conservation value, and as a result restoration is not possible. Proposals must also demonstrate to the Council's satisfaction, that extraction would not adversely affect the integrity of nearby Natura sites containing areas of peatland*".

Onshore Wind Energy Supplementary Guidance

108. THC's Onshore Wind Energy Supplementary Guidance (November 2016) sets out how THC will manage onshore windfarm development proposals in line with Section 22 of the Town and Country Planning (Scotland) Act 1997, as amended by the Planning etc. (Scotland) Act 2006. It further sets out clear expectations as to how developments should safeguard peat resources (Section 4.34).

15.7.6 Consultation

109. No consultation has been undertaken in relation to potential climate change mitigation issues beyond Pre-Application Advice and the scoping process. EIA Topic Information Sheets were issued directly to consultees at scoping on the 31 July 2020. Those which concerned climate change mitigation are shown in **Table 15.7**.

Table 15.7: Carbon balance scoping consultation responses

Consultee	Response	Action
John Muir Trust 10 August 2020	The John Muir Trust noted the presence of carbon rich soils within the proposed Site and, in the interest of climate change mitigation, expressed its expectation that disturbance to these soils would be kept to a minimum through careful design and sensitive siting of turbines, tracks and associated infrastructure.	Peat depth surveys and a national vegetation classification survey were undertaken to identify areas of priority peatland habitat and inform site design to minimise potential effects on these areas. A peat management plan is included in the EIA Report (**Technical Appendix 10.2: Outline Peat Management Plan**), which outlines measures that will be taken to protect and reuse excavated peat onsite.
NatureScot 27 August 2020	NatureScot noted that there is Class 1 peatland on Site, though it is likely to be degraded due to the presence of the forestry plantation also on Site. Therefore, NatureScot suggested that	

Consultee	Response	Action
	should any priority peatland habitat be identified within the application Site, then efforts should be made to avoid impacting upon this habitat through siting, design and mitigation.	

15.7.7 Baseline

111. Baseline environment conditions in relation to potential climate change impacts from the proposed Development include existing stores in the Site (such as peat and forestry) that could be impacted by the proposed Development resulting in CO_2 and other GHG emissions.

112. The proposed Development is a Renewable Energy Development consisting of ten wind turbines, around 149.9 m tall (to horizontal turbine blade tip), and crane hardstandings, a solar array (with a land footprint of 17.4 ha), a control compound comprising a BESS and a substation, 12 km of access track, twelve watercourse crossings, three borrow pits, underground power cables, two temporary construction compounds and a met mast.

15.7.7.1 Peat

113. Much of the Site lies within an area identified as being peatland of national importance (Class 1) on the Scottish Natural Heritage (now NatureScot) Carbon and Peatland database, with the remainder of the Site mainly having the potential for peat with a mixture of peat soil and mineral soils from Classes 0 and 4. The Soils map of Scotland further identifies that the Site has mainly dystrophic blanket peat soils with some noncalcareous gleys and alluvial soils. The current land use is classified as agricultural/moorland/forestry.

114. A broad-scale peat depth survey on a 100 m grid was undertaken in May 2020. A subsequent phase of peat depth surveying was undertaken in September and November 2020, which focused on the proposed infrastructure layout. Additionally, a reconnaissance walkover survey was conducted on 25 August 2020. The combined peat depth data was used to generate a detailed map of peaty soil and peat depth for the Site (**Figure 10.4**). Measured peat and soil depths range from 0 (bedrock at surface) to 4.69 m. A total of 1,546 peat depth measurements were recorded for the Site and immediate surroundings (**Figures 10.1.6b** to **10.1.6p**).

115. The proposed locations for the turbines, solar array and associated infrastructure take account of peat depths (**Figure 10.4**), as the intention has been to avoid peatland areas where possible, and to minimise incursion into peatland where it has not been possible to avoid it altogether. Approximately 62% of the proposed Development infrastructure including drainage is underlain by peaty soil or topsoil no greater than 0.5 m deep.

15.7.7.2 Forestry

116. The current land use of the Site is predominantly commercial forestry and existing forestry management plans for felling and planting, across the Site have been considered in the design of the proposed Development. Forestry forms an integral part of the proposed Development as some trees would need to be felled, before planned plantation felling, around infrastructure positions to allow for construction of the proposed Development. A Development Forest Plan (see **Technical Appendix 15.3**) has been developed to show which woodlands would be felled to facilitate the proposed Development, which of the felled areas can be restocked and the plans for Compensatory Planting.

117. This Site is largely stocked with middle-aged conifers and the aim would be to carry out keyhole felling to accommodate the turbines wherever possible to avoid adverse environmental impacts; this would also minimise both the amount of felling and the area of Compensation Planting that may be required. Keyhole felling, as opposed to the alternative of clear felling, would not have as great an impact on the local environment. Keyhole felling aims to avoid woodland loss wherever possible and where this is not possible, to have the smallest area of felling within afforested areas. The size of the keyhole is dependent on a number of factors relating to the crop, turbine selection and other factors such as the presence of protected species, however as a minimum, keyholes are 100 m in diameter; this is the minimum area required for both ecological and turbine efficiency reasons. The circular buffers in relation to three of the turbines have been extended slightly to avoid partial felling of small sub-compartments which would have increased the risk of windblow in relation to the retained trees.

118. All ten of the proposed turbines, are located within the area of forestry; together with some areas of access tracks and the BESS. Existing access tracks have been utilised wherever possible but where it has not been possible to use existing tracks the shortest possible route has been chosen subject to avoiding watercourses or other environmentally sensitive areas. The width of the access routes has been kept to the minimum required for the transportation of the construction materials. It would however be necessary to carry out some additional felling for passing places and on bends as required. With regard to the BESS, there would be a relatively small amount of felling to provide clear areas for the BESS, compounds and crane pads etc. A total area of 24.3 ha would be felled to facilitate construction, with an additional 88.4 ha of felling associated with the HMP. Where required, however, sufficient land would be made available for compensatory planting. The solar area has been carefully chosen to minimise the amount of felling required. The area chosen is comprised of scattered small sub-compartments within a considerable area of open space.

15.7.7.3 Summary

119. Regarding the existing environment, the greatest potential for carbon and other GHG emissions would relate to direct and/or indirect impacts to the peat and forestry that are present during the installation of the wind turbines and associated infrastructure such as the solar array, BESS, foundations, access tracks, borrow pits and hardstanding areas.

15.7.8 Assessment of Effects

120. The results of the carbon balance assessment carried out for the proposed Development are presented below for each project stage.

15.7.8.1 Scope and Methodology

121. The assessment of the carbon balance of the proposed Development is based upon a detailed baseline description of the proposed Development and its location. Where possible, calculations are premised upon Site-specific data and in such instances as where this cannot be the case, then it is premised upon national/regional information.

122. The methodology used to calculate CO_2 and other GHG emissions which would result from the wind turbines is based upon ‘Calculating carbon savings from windfarms on Scottish peat lands – A New Approach’ (Nayak et al., 2008), prepared for the Scottish Government Science, Policy and Coordination Division. This was superseded in 2011, by the document ‘Calculating Carbon Savings from Windfarms on Scottish Peatlands – A New Approach’ (Nayak et al., 2008 and 2010, Smith et al., 2011) which applies the findings of Cannell (1999). These documents are incorporated into the latest version (V1.6.1) of the Scottish Government’s Carbon Calculator Tool. This tool enables carbon losses and carbon savings to be quantified across the project lifecycle stages (manufacture, construction, operation and decommissioning/site restoration), and these losses and savings are combined to establish the overall (net) carbon effect of the wind turbines, as well as their ‘carbon payback period’. It is noted that this methodology is specifically designed for windfarms and not renewable energy developments like the proposed Development. With this in mind, an assessment of the impact of the installation of solar PV on the climate has also been undertaken. This assessment, which applies the same fossil fuel electricity mix emission factor as the Carbon Calculator Tool to industry -based assumptions regarding yield and efficiency, considers the embodied emissions of the solar PV material in view of the fact that emissions associated with the construction of access tracks and hardstanding etc. have been considered as part of the Scottish Government’s tool and that the solar PV installation requires no disturbance of peat and/or forestry.

123. The proposed Development is seeking consent without a limit to operational lifetime, however in order to ensure a meaningful result is achieved from the application of the calculator, an operational lifespan of 40 years has been assumed with respect to the wind turbines to be implemented and an operational lifespan of 25 years has been assumed with respect to the solar PV to be implemented.

124. Results from the above assessments are reported in this Chapter of the EIA Report in accordance with the Institute of Environmental Management and Assessment’s Environmental Impact Assessment guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (2017).

15.7.9 Construction and Decommissioning

125. **Table 15.8** presents the results of the carbon balance assessment for the manufacture, construction and decommissioning stages of the proposed wind turbines. Any post-decommissioning site restoration and enhancement work, such as blocking of drainage ditches to promote re-wetting or tree planting will be agreed with NatureScot in due course (See **Technical Appendix 8.6**). These kinds of activities have the potential for ‘**Significant’** carbon savings by promoting the growth of natural carbon stores such as forestry and peat.

Table 15.8: Predicted GHG emission losses and savings from wind turbine construction and decommissioning

Source of GHG Emissions/Savings	GHG Emissions (tCO_2e)
Construction	
Turbine manufacture, construction and decommissioning	67,471
Back-up	39,420
Reduced carbon fixing potential	594
Loss of soil organic matter	13,047
Leaching of Dissolved Oxygen Content and Portable Oxygen Content	114
Forestry felling	59,031
Total	**179,677**

126. **Table 15.7** shows total GHG emissions of 179,677 tCO_2e are predicted from the manufacture, construction and decommissioning of the proposed wind turbines. The total embodied emissions of the solar array installation, assuming an 80% coverage of the total area available, is equal to approximately 367,043 tCO_2e.

127. The project is committed to undertaking compensatory planting (see **Section 15.4**) as required under the Forestry Commission Scotland Control of Woodland Removal Policy (2009) in order to achieve no net loss of forestry. The assessment has assumed 24.3 ha of compensatory planting will be required.

128. The project is also committed to undertaking post-construction habitat restoration and enhancement work (see **Technical Appendix 8.6**). Minimum, maximum and expected areas have been identified and included in the Carbon Calculator in Technical **Appendix 15.6: Carbon Calculator**).

129. **Table 15.9** shows the total CO_2 gains due to improvement of the Site (tCO_2e). These are predicted to equate to approximately 17,537 tCO_2e.

Table 15.9: Total CO_2 gains due to improvement of the Site (tCO_2e)

Improvement	GHG emissions (tCO_2e)
Change in emissions due to improvement of degraded bogs	-12,963
Change in emissions due to improvement of felled forestry	-4,667
Change in emissions due to restoration of peat from borrow pits	131
Change in emissions due to removal of drainage from foundations and hardstanding	-39
Total change in emissions due to improvements	-17,537

Operation

130. The operational stage of the proposed Development has the greatest potential for emissions savings, and therefore beneficial climate change impacts. At this stage, GHG emissions from construction activities have ceased and the operation of the turbines and solar would generate zero-carbon electricity for the remainder of their lifespan.

131. **Table 15.10** presents the annual emissions savings that are predicted for the proposed wind turbines, as measured against the fossil fuel mix of grid electricity. **Table 15.11** presents the annual emissions savings that are predicted from the proposed solar array against the same mix.

Table 15.10: Annual emissions savings against fossil fuel electricity generation mix (wind turbines)

Source of GHG savings	GHG savings (tCO_2e)		
Capacity Factor	20%	26.7%	30%
Onshore wind generation operation	39,420	52,626	59,130
Total CO_2 savings per year	39,420	52,626	59,130

Table 15.11: Annual emissions savings against fossil fuel electricity generation (solar array)

Source of GHG savings	GHG savings (tCO_2e)		
Capacity Factor	8%	10.3%	12%
Solar PV generation operation	30,049	38,688	45,073
Total CO_2 savings per year	**30,049**	**38,688**	**45,073**

Emissions Payback Period

132. Dividing the net GHG emissions predicted for the manufacture, construction and decommissioning stages of the wind turbines (162,140 tCO_2e) by the predicted annual carbon savings from windfarm operation (52,626 tCO_2e) gives a predicted emissions payback of 3.1 years. Therefore, net GHG emissions from the construction and decommissioning are predicted to be offset by emissions savings from the proposed Development within 3.1 years of it becoming operational.

133. The same calculation with respect to the embodied emissions of the solar array (367,043 divided by 38,688 tCO_2e) would result in a payback period of 8.1 years.

15.7.9.2 Net GHG Effect

134. The proposed Development is seeking consent without a limit to operational lifetime; however, in order to ensure a meaningful result is achieved from the application of the calculator, an operational lifespan of 40 years has been assumed for the wind farm element and 25 years for the solar array. With this in mind, total GHG emissions savings over the course of 40 years is expected to be approximately 2,862,673 tCO_2e. That is to say that the wind turbines would realise a total savings of 1,941,899 tCO_2e over 36.9 years and the solar array would realise a total savings of 920,774 tCO_2e over 23.8 years assuming that the solar array would be replaced following its 25-year lifecycle.

15.7.9.3 Cumulative Effects

135. The proposed Development is within an area which has multiple existing and proposed windfarm developments. These include the operational Lochend Windfarm (four turbines, 9.2 megawatt (MW) capacity) and Stroupster Windfarm (13 turbines, 24 MW capacity), as well as the proposed Slickly Windfarm (11 turbines, 39.6 MW capacity).

136. The cumulative effects from these existing and potential surrounding windfarm developments would be positive; contributing towards climate change mitigation. Although carbon rich peat would be lost from the area, the nature of the developments

sees a total emissions savings from offsetting of fossil fuel mix of grid electricity. Therefore, the GHG savings would outweigh losses from construction, including disturbance and removal of peat and forestry.

15.7.10 Mitigation

137. A key form of embedded mitigation is to avoid construction activities within areas of deep peat. A peat stability assessment and peat depth survey have been undertaken to identify the areas of deep and/or unstable peat (see **Technical Appendix 10.1: Peat Slide Risk Assessment**). The location of turbines and associated infrastructure (including solar array) take cognisance of these studies, resulting in appropriate positioning in areas of shallow or no peat where possible.

138. Management of excavated peat is also an important mitigation method. Any excavated peat would be carefully handled and treated in order to minimise drying and the loss of carbon into the atmosphere. Peat handling would comply with SEPA's Regulatory Position Statement for Developments on Peat (2010), as well as current good practice prepared by Scottish Renewables, NatureScot, Scottish Environment Protection Agency, Scottish forestry and Historic Environment Scotland (2015).

139. Beyond the compensatory tree planting committed to (see **Section 15.4**), further mitigation measures would also be incorporated as part of post-construction peatland habitat restoration and enhancement of the Site (see **Technical Appendix: 8.6**). These additional measures are to be developed and agreed with NatureScot in due course, meaning that they have not been factored into this carbon balance assessment.

140. The substantial carbon savings that are predicted from operating the proposed Development represent, in and of themselves, a method of climate change mitigation. This is one of the key benefits of the proposed Development.

15.7.10.1 Mitigating Cumulative Effects

141. The cumulative effects relating to climate change and GHG emissions would be positive over the medium and long-term. As such, cumulative effects do not require any additional mitigation.

15.7.11 Summary of Effects

142. GHG emissions are predicted to arise from the manufacture, construction and decommissioning activities. In particular, the principal sources of emissions include turbine and solar array manufacture, the loss of peat and the loss of forestry from construction activities and associated infrastructure.

143. GHG emissions savings are predicted from post-construction Site restoration, including the habitat restoration, the restoration of borrow pit three and compensatory planting; though the latter restoration method has not been taken into account in the carbon assessment as it is yet to be agreed, resulting in a highly conservative scenario being calculated in terms of emissions payback.

144. However, these GHG emissions are predicted to be offset 3.1 years after the proposed wind turbines become operational (against a fossil fuel mix of electricity) and 8.1 years after the implementation of the solar array. The proposed Development is predicted to deliver total GHG emissions savings of 2,862,673 tCO_2e over its lifespan.

145. The overall emissions impact is considered to represent a '**Significant**' beneficial and long-term climate change effect.

15.8 Aviation and Radar

15.8.1 Introduction

146. The potential impacts of wind turbines on aviation interests have been widely publicised and are outlined below:

- physical obstruction: turbines can present a physical obstruction at, or close to, an aerodrome or other aviation activity site; and
- radar / Air Traffic Services (ATS): turbines can produce spurious / false returns known as 'clutter', particularly from primary surveillance radar (PSR). Turbine clutter appearing on a radar display can affect the safe and efficient provision of ATS as it can mask unidentified aircraft from the air traffic controller and / or prevent them from accurately identifying aircraft under their control and / or cause the track of the aircraft under control to be incorrectly reported. In some cases, radar reflections from the turbines can affect the performance of the radar itself.

147. This Section provides an assessment of the potential impacts the proposed Development may have on aviation in the area. This study has included a review of the location, technical characteristics and operational activities of aviation interests and operations in the vicinity of the Site, along with an examination of how they may be affected by the proposed wind turbines.

15.8.2 Legislation, Policy and Guidance

148. The following guidance and industry standards on the potential effects of wind turbines on aviation have been considered in the assessment:

- Scottish Government Onshore Wind Policy Statement, 2017;
- Civil Aviation Authority (CAA), CAP 168: Licensing of Aerodromes, March 2019;
- CAA, CAP 393: Air Navigation Order 2016 and Regulations, March 2019;
- CAA, CAP 670: Air Traffic Services Safety Requirements, Part B, Section 4, June 2019;
- CAA, CAP 738: Safeguarding of Aerodromes, 2020;
- CAA, CAP 764: CAA Policy and Guidelines on Wind Turbines, February 2016;
- CAA, Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level, 2017
- NATS wind farm self-assessment maps available on the NATS website; and
- Planning Circular 2 2003: The Town and Country Planning (Safeguarded Aerodromes, Technical Sites and Military Explosives Storage Areas) (Scotland) Direction 2003.

149. Guidance establishes that if the development is within potential line of sight of an air defence, aerodrome or en-route radar, then an assessment of the effects is likely to be required.

150. Further consultation is also required if turbines are planned within:

- 30 kilometres (km) of an airfield with a surveillance radar;
- 17 km of a non-radar licensed aerodrome with a runway of more than 1,100 metres (m);
- 5 km of a non-radar licensed aerodrome with a runway of less than 1,100 m;
- 4 km of an unlicensed aerodrome with a runway of more than 800 m;
- 3 km of an unlicensed aerodrome with a runway of less than 800 m; and
- 3 km of any other unlicensed aviation land use.

151. The proposed turbine height, of up to 149.9 m to blade tip, does not require aviation lighting to be installed under Article 222 of the Air Navigation Order (ANO), 2016, as this only comes into effect for en route obstacles of 150 m or more above ground level.

15.8.3 Consultation

The relevant aviation stakeholders were consulted regarding the potential effects of the proposed Development as part of the scoping process in July 2020 and again at Gatecheck in August 2021. A summary of consultation is provided in **Table 15.122**.

Table 15.12: Consultee responses

Consultee	Summary of consultation	Comment/Action taken
Defence Infrastructure Organisation (DIO) (29/10/20)	The Ministry of Defence (MOD) has no concerns about this proposed Development. In the interests of air safety, the MOD would request that perimeter turbines be fitted with 25 candela omni-directional red or infrared lighting with an optimised flash pattern of 60 flashes per minute of 200ms to 500ms duration at the highest practicable point.	No further action required. The Applicant proposes installing MOD accredited IR lights on selected periphery turbines of the proposed Development, agreeing this with the MOD prior to commencement of construction

Consultee	Summary of consultation	Comment/Action taken
Edinburgh Airport (11/08/20)	The proposed Development is outwith the Safeguarding Consultation zone for Edinburgh Airport so did not make any comment.	No further action required.
Glasgow Airport (4/08/20)	The proposed Development is outwith the consultation zone so did not make any comment	No further action required.
Highlands and Islands Airports Ltd (HIAL) (26/08/20)	The move from Primary Surveillance Radar as the only surveillance solution, to consideration of ADS-B means the impact of a wind farm development on surveillance cannot be assessed. Therefore, surveillance cannot currently be considered in HIAL safeguarding criteria and they cannot object on this basis.	No further action required, however should a PSR be installed at Wick Airport it is highly likely that it would detect the proposed turbines. However, it would be expected that HIAL wold seek to deploy a windfarm tolerant PSR if it were to install one at Wick Airpor as turbines would be part of the baseline operating environment.
HIAL(20/10/20)	HIAL have no issues with the proposed Development.	
NATS Safeguarding (4/8/20)	The proposed Development has been examined from does not conflict with safeguarding criteria. Accordingly, NERL has no safeguarding objection to the proposal.	No further action required.
Glasgow Prestwick Airport (GPA) (6/08/20)	Hollandmey RED is outwith the windfarm safeguarding area for GPA – so GPA would be extremely unlikely to object to the proposed Development.	No further action required.

15.8.4 Baseline

153. The Site is in an area that is remote from military aviation infrastructure and is approximately 16 km to the north of Wick Airport. The Site is outside Wick Airport's Aerodrome Traffic Zone, but within the lateral boundary of the Instrument Flight Procedures (IFPs). Wick Airport does not currently have a radar facility. No other licensed or unlicensed aerodromes are within close proximity of the Site.

154. The nearest PSRs to the proposed Development are:

- Inverness Airport radar, 127 km to the south west;
- Royal Air Force Lossiemouth radar, 99 km to the south, and
- NATS (En Route) plc (NERL) radar at Allanshill, 123 km to the south east.

155. The airspace in the immediate area around the proposed Development consists of two types of airspace. The immediate airspace portion surrounding the Site is situated within Class G (uncontrolled) airspace which extends from the ground to Flight Level (FL) 75 (approximately 7,500 feet above mean sea level (amsl) and is predominantly used by General Aviation and military aircraft. In uncontrolled airspace the responsibility to see and avoid other traffic and obstacles rests with pilots – any ATS provided is essentially advisory. Above FL 75, and extending to FL 195 (approximately 19,500ft amsl), the airspace is marginally on the edge of the proposed Development and is classified as Class E controlled airspace where aircraft are under a Radar Control Service provided by Scottish Control based at Prestwick Centre.

156. The proposed Development is situated adjacent to a Helicopter Main Route (HMR X-RAY) with the closest turbine approximately 1.9NM from the HMR. The operational Lochend Windfarm is closer to the HMR at approximately 1.8NM. HMRs are routes utilised by civilian helicopters operating to and from offshore destinations. CAP 764 advise there should be no obstacles within a 2 nautical miles (NM) boundary either side of the HMR centreline. However,'. the effect of windfarms on HMRs depends on the degree of proliferation. CAP764 advises that a small number of individual turbines should cause minimal effect, whilst a large number of turbines beneath an HMR could result in significant difficulties

157. The Site lies within Low Flying Area 14 but is outside the Tactical Training Area. Therefore, military aircraft do not conduct tactical low flying training down to 100 ft minimum separation distance in this region.

15.8.5 Assessment of Effects

15.8.6 Approach to Assessment and Methods

158. The effects of the proposed Development have been assessed by modelling whether any of the wind turbines would be in the line of sight of any aviation radar facilities, and whether the Site is in an area of operational importance to those radars. Evaluation of these effects also took into account the response of radar operators to pre-application consultation.

15.8.6.1 Potential Effects

159. From the consultation undertaken, it is concluded that the proposed Development would not have an effect on aviation as a physical obstruction. Although the proposed Development is marginally inside the 2NM from HMR route centreline guidance issued by the UK CAA, the majority of turbines sited beyond the 2NM boundary. This coupled with the location of the operational Lochend Windfarm closer to HMR X-RAY evidence that the Proposed Development will not impact HMR X-RAY.

160. Radar modelling of the nearest PSR facilities to the proposed Development shows that there is no Radar Line of Sight (RLoS) to the turbines and therefore these radars are unlikely to detect the proposed Development.

161. An assessment of Wick Airport's IFPs found that the proposed turbines would have no impact.

162. Further details of the aviation impact assessment methodology and modelling is found in **Technical Appendix15.7: Aviation Impact Assessment**.

163. **'No significant'** effects have been identified in the assessment of aviation and radar issues and therefore aviation is not considered further.

15.9 Waste and Environmental Management

164. **Chapters 7** to **14** of this EIA Report **put** forward suggestions on how to mitigate any negative impacts from the proposed Development with regards to waste and environmental management. These are summarised in **Chapter 16: Schedule of Commitments**.

165. The outline CEMP (**Technical Appendix 3.1**) provides a general overview on how waste and other environmental issues would be managed during the construction phase. The Peat Management Plan (**Technical Appendix 10.2**) also details how excavated peat is controlled, stored, re-used and disposed of during the construction phase of the Proposed Development.

166. It is expected that a site-specific waste management plan for the control and disposal of waste generated onsite would be required by condition, should the proposed Development receive consent.

15.10 Statement of Significance

167. This Chapter has assessed the potential effects of the construction and operation of the proposed Development on the infrastructure, forestry, telecommunications, shadow flicker, carbon balance, aviation, and waste and environmental management. Predicted adverse effects on forestry, shadow flicker and waste and environmental management have been assessed as '**Not Significant'** during both the construction and operational phases. Additionally, a **'Significant'** beneficial effect has been predicted for carbon balance.

168. All effects and proposed mitigation measures are presented in **Table 15.13** below. In addition, infrastructure, telecommunications and aviation assessments found that there would be no potential for impact and therefore effects on receptors.

Table 15.13: Summary of effects

Description of effect	Significance of potential effects		Mitigation/Enhancement measure	Significance of residual effect	
	Significance	Beneficial / Adverse		Significance	Beneficial / Adverse
Permanent Felling	Not Significant	Adverse	• all forestry plans and operations would fully comply with the UKFS; • use of keyhole felling for turbines to minimise the amount of felling required; • the layout of the solar area and access tracks have been designed to minimise the amount of tree felling; and • Compensatory planting equalling the same area as the area felled would be completed	Not Significant	Adverse
Shadow Flicker	Not Significant	Adverse	N/A	Not Significant	Adverse
Carbon Balance	Significant	Beneficial	• the design has minimised siting of infrastructure in areas of deep peat; • avoidance of construction activities within areas of deep peat where practicable; and • any excavated peat would be carefully handled and treated in accordance with best practice measures to minimise drying and the loss of carbon into the atmosphere.	Significant	Beneficial
Waste and Environmental Management	Not Significant	Adverse	• adherence to the waste management plan, construction environmental managament plan and peat management plan, which would be agreed in advance with the relevant statutory consultees; • the extraction of the felled timber would be carried out after the access roads have been installed to minimise any damage to the soil caused by transporting felled timber over bare ground; • the felling method will be based on a short wood felling system utilisation and all timber would be removed from the Site; • site refuelling and maintenance areas would be sited outside the watercourse buffer areas and best practice measures would be taken to mitigate risks of spillages (the buffer areas are further defined in **Section 15.4.6**); • protection measures laid out in British Standard 5837 (2012), including measures such as forming a construction exclusion zone around retained trees/woodlands using specific barrier configurations, would be adopted to protect retained forestry during construction; and • Guidance in the UKFS regarding minimum buffers from watercourses would be followed in relation to the planned felling operations.	Not Significant	Adverse

15.11 References

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