Chapter 14: Other Issues

Chapter 14
Other Issues

Introduction

14.1 This chapter considers the potential effects of the Proposed Development on the following topics:

- Climate Change Mitigation (including carbon balance) and Adaptation; and
- Aviation and Defence.

14.2 These assessments have been undertaken by LUC (Climate Change Mitigation and Adaptation), supported by Fluid Environmental Consulting (Carbon Balance) and by Wind Power Aviation Consultants (WPAC) (Aviation and Defence). Further details on expertise are provided in **Appendix 1.1: Statement of Expertise**.

14.3 The assessment of effects is based on the proposed layout as outlined in **Chapter 4: Project Description**. Unless otherwise stated, potential effects identified are considered to be negative.

14.4 A number of additional potential effects have been scoped out of the assessment, including telecommunications and television, major accidents and disasters, human health and shadow flicker, as explained in **Chapter 2: Approach to EIA**.

14.5 The following appendices are also referred to in this chapter*:*

- **Appendix 14.1: Carbon Balance Assessment**
- **Appendix 14.2: Aviation Lighting Report**

Climate Change Mitigation and Adaptation

Introduction

14.6 This assessment considers the potential effects of the Proposed Development on climate change mitigation (including carbon balance) and adaptation and has been undertaken in accordance with the latest good practice guidance.

14.7 The impacts of climate change are widely recognised as being one of the greatest global economic, environmental and social challenges facing the world today. Consequently, climate change is also seen to be an important consideration in relation to project level assessment and decision-making. A major cause of climate change is a rise in the concentration and volume of Greenhouse Gases (GHGs) in the atmosphere, a significant contributor to which, is the use of fossil fuels to generate electricity. The purpose of the Proposed Development is to generate electricity from a renewable source of energy, offsetting the need for electrical generation from the combustion of fossil fuels. Consequently, the electricity that will be generated and distributed by the Proposed Development will result in a saving in emissions of Carbon Dioxide (CO_2) with associated environmental benefit. The climate change assessment therefore draws largely on this premise. However, no form of electricity generation is completely carbon free; for onshore there will be emissions resulting from the manufacture of components, as well as emissions from both construction and decommissioning activities and transport.

14.8 This assessment is informed by **Appendix 14.1: Carbon Balance Assessment**. This provides an estimate of the benefit of displacing conventionally generated electricity in the grid compared to the predicted direct and indirect emissions of carbon resulting from the construction and operation of the Proposed Development over its 40-year lifetime, including losses of stored carbon from felled forestry and affected peatland. The carbon calculator provides an estimate of the carbon payback time for the Proposed Development over its lifetime.

Scope of the Assessment

Effects Assessed in Full

14.9 The following effects have been considered in this assessment:

- Direct Carbon Dioxide (CO_2) and Nitrogen Oxide (NO_X) emissions during construction (including cumulatively).
- Other carbon emissions in the materials and systems which form temporary and permanent structures, arising as a result of the extraction and manufacture of materials, fabrication, transportation to Site, waste and the future demolition and potential re-use.
- The positive contribution that the Proposed Development will make to offsetting CO_2 emissions arising from construction and decommissioning (including peat and forestry loss) once operational (including cumulatively) (climate mitigation).
- The ability of receptors, such as species and habitats, to adapt to climate change (climate adaptation) during operation of the Proposed Development, and whether the effects of the Proposed Development on those receptors assessed under the current climate baseline will change with a future climate, i.e. in-combination effects.

Effects Scoped Out

14.10 On the basis of the desk-based work undertaken, the professional judgement of the Environmental Impact Assessment (EIA) team, experience from other relevant projects and policy guidance or standards, the following topic areas have been 'scoped out' of detailed assessment:

- Direct CO_2 and NO_X emissions from vehicles during operation (and cumulatively) as movements associated with turbine maintenance are considered to be minimal.
- The ability of receptors to adapt to climate change during construction of the Proposed Development as these effects are assessed long term, i.e. over the 40-year operational period.
- The ability of receptors to adapt to climate change during operation of the Proposed Development in-combination with other nearby wind farms as this is largely a project specific consideration, namely the resilience of the project in question to climate change and the extent to which projected climate change could alter the predicted effect judgements.
- Project resilience (or vulnerability) to climate change. The latest Institute of Environmental Management and Assessment (IEMA) guidance[1] states that *"The resilience of something is a measure of its ability to respond to changes it experiences. If a receptor or a project has good climate change resilience, it is able to respond to the changes in climate in a way that ensures it retains much of its original function and form. A receptor or project that has poor climate change resilience will lose much of its original function or form as the climate changes"* (page 49). The Proposed Development is designed to cope with changes in temperature and rainfall. Turbines will shut down if winds are too strong or if overheating occurs, and appropriate infrastructure design including maintaining up to a 50 metres (m) buffer around watercourses where possible[2] and the incorporation of standard good practice measures for site drainage (including Sustainable Drainage System (SuDS) principles and designing all watercourse crossings and infrastructure to withstand a 1:200 year flood event where appropriate[3]) will be achieved.
- Indirect emissions arising from the demand for energy produced using fossil fuels (e.g. electricity for heating, cooling and lighting).

[1] IEMA (2020) The Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation
[2] Locations where a 50m buffer cannot be achieved are described in the assessment and **Appendix 7.1**.
[3] Consultation with the flood risk and drainage office at ABC concluded that sizing crossings to pass the 1 in 200 year flow plus climate change allowance could potentially lead to large culverts/crossings, which are not necessarily applicable for peatland watercourses in rural upland areas and could potentially cause damage to morphology of channels and peatlands (e.g. due to increased scour by oversized culverts). In addition, flood risk in the rural upland area is not an issue, so crossings designed for smaller return period flows may be more applicable in this environment.

Assessment Methodology

Legislation and Guidance

Legislation and Policy

14.11 The climate change assessment has been undertaken in the context of the current key climate change legislation and policy and the targets and aspirations set out within these, including:

- The Climate Change (Scotland) Act 2009[4] as amended by The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019[5];
- Update to the Climate Change Plan 2018-2032: Securing a Green Recovery on a Path to Net Zero 2020[6];
- Onshore Wind Policy Statement 2022[7];
- Scotland's Energy Strategy Position Statement 2021[8]; and
- Draft Energy Strategy and Just Transition Plan 2023[9].

14.12 Further details of these key legislation and policy documents are set out in the Planning Statement which accompanies the application.

Guidance

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

- IEMA (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance (2nd Edition)[10];
- IEMA (2020) The Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation[11];
- SNH[12] (2016) Technical Guidance Note on Calculating Carbon Losses and Savings on Scottish Peatlands – Version 2.10.0[13]; and
- Scottish Renewables and Scottish Environment Protection Agency (SEPA) (2012) Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste[14].

Consultation

14.14 Table 14.1 below provides details of consultation that has been used to inform the assessment related to Climate Change Mitigation and Adaptation within this chapter.

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

Table 14.1: Consultation responses

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
	Scoping	With regards to forestry, if any felling is required this should be taken into account in	A limited amount of tree felling will be required to facilitate the access to the Site
Argyll and Bute Council (ABC)		calculating the carbon balance of the Proposed Development, and consideration should be given to any required replanting under the Scottish Government's Policy on Control of Woodland Removal.	and information on woodland management and felling, including mitigation, is provided in Technical **Appendix 4.1 Forestry** to the EIA Report. A carbon balance calculation is also provided in **Appendix 14.1**.
	Scoping	Confirmed satisfaction with the proposed approach for climate change, including carbon balance.	Noted.
Royal Society for the Protection of Birds (RSPB)	Scoping	Noted all proposed turbines are situated on Class 2 Peatland, therefore a full assessment of the carbon implications of the Proposed Development should be undertaken by using the latest version of the Scottish Government's Carbon Calculator.	Detailed peatland surveys have been undertaken with the findings outlined in **Chapter 7: Geology, Hydrology, Hydrogeology and Peat**. A carbon balance calculation is provided in **Appendix 14.1**.

Study Area

14.16 The assessment considers the effects of the Proposed Development on the global climate, with specific reference to the climate changes expected in the UK. These have been defined using the UK's climate change projections (UKCP18), which allow climate changes to be projected at the regional level; in this case, the west of Scotland. The effects of a changing climate on the Proposed Development have largely been assessed in relation to the Site and its immediate surroundings.

14.17 The study area for calculating stored soil carbon in **Appendix 14.1** has been the Site under existing conditions. For the carbon payback assessment, since greenhouse gas emissions and savings are both ultimately a global 'pool', this assessment is not restricted solely to those emissions or savings that occur within the Site. Land-based emissions from peat and habitat losses are based on the Proposed Development footprint, but other activities, for example, emissions resulting from the extraction and production of steel for turbines, are still attributable to the Proposed Development even though they are likely to occur in other parts of the world.

Desk Based Research and Data Sources

14.18 The following data sources have informed the assessment:

- UK Climate Projections (UKCP18)[15];
- Department for Business, Energy and Industrial Strategy (BEIS): National Statistics publication Energy Trends. Table 6.1. Renewable Electricity Capacity and Generation[16];
- Scottish Government Carbon Calculator Tool[17];
- RenewableUK Wind Energy Statistics[18]; and
- **Appendix 14.1: Carbon Balance Assessment**.

[4] UK Government (2009) Climate Change (Scotland) Act 2009 [online]. Available at: https://www.legislation.gov.uk/asp/2009/12/contents
[5] UK Government (2019) Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. Available at: https://www.legislation.gov.uk/asp/2019/15/enacted
[6] Scottish Government (2020) Securing a green recovery on a path to net zero: climate change plan 2018-2032 – update [online]. Available at: https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/documents/
[7] Scottish Government (2020) Onshore wind: policy statement 2022 [online]. Available at: https://www.gov.scot/publications/onshore-wind-policy-statement-2022/
[8] Scottish Government (2021) Energy strategy: position statement [online]. Available at: https://www.gov.scot/publications/scotlands-energy-strategy-position-statement/
[9] Scottish Government (2023) Draft Energy Strategy and Just Transition Plan [online]. Available at: https://www.gov.scot/publications/draft-energy-strategy-transition-plan/
[10] IEMA (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance (2nd Edition)
[11] IEMA (2020) The Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation
[12] Scottish Natural Heritage is now called NatureScot as of 24th August 2020.
[13] Scottish Natural Heritage (2016) Calculating Potential Carbon Losses and Savings from Wind Farms on Scottish Peatlands (Version 2.10.0)
[14] Scottish Renewables and SEPA (2012) Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste
[15] Met Office (2018) UK Climate Projections (UKCP18) [online]. Available at: http://ukclimateprojections.metoffice.gov.uk/
[16] Department for Business, Energy and Industrial Strategy (2021) Energy Trends (Table 6.1. Renewable electricity capacity and generation)
[17] Smith et al. (2011) Carbon Implications of Windfarms Located on Peatlands – Update of the Scottish Government Carbon Calculator Tool (Version 2) (as updated)
[18] Renewable UK (undated) Wind Energy Statistics [online]. Available at: https://www.renewableuk.com/page/UKWEDhome

Field Survey

14.19 The assessment has been desk based, drawing largely from published guidance and data. Peat depth probing was undertaken to inform the layout of the Proposed Development, and this data was also used to inform the carbon balance assessment (see **Appendix 7.2: Peat Survey Report**).

Assessing Significance

Climate Change Mitigation

14.20 All emissions contribute to climate change. However, specifically in the EIA context, the IEMA guidance provides relative significance descriptions to assist with assessments. A number of distinct levels of significance have been defined, which are not solely based on whether a project emits GHG emissions alone, but how the project makes a relative contribution towards achieving a science-based 1.5°C aligned transition towards net zero.

14.21 The UK has set a legally binding GHG emission reduction target for 2050 (2045 in Scotland) with interim five-yearly carbon budgets which define a trajectory towards net zero. The IEMA guidance states (in Section 6) *"The 2050 target (and interim budgets set to date) are… compatible with the required magnitude and rate of GHG emissions reductions required in the UK to meet the goals of the Paris Agreement, thereby limiting severe adverse effects… To meet the 2050 target and interim budgets, action is required to reduce GHG emissions from all sectors, including projects in the built and natural environment. EIA for any proposed project must therefore give proportionate consideration to whether and how that project will contribute or jeopardise the achievement of these targets"* (page 23).

14.22 Furthermore, the guidance also states the following *"The crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050"* (page 24).

14.23 For the purposes of this assessment, this guidance has been interpreted as outlined in **Table 14.2** and has been used to determine significance of effects.

Table 14.2: Significance criteria

Significance of Effect	Description
Adverse (Major or Moderate)	The Proposed Development is not compatible with the UK's budgeted science-based net zero trajectory. Further evaluation will be required to determine whether this is of Major or Moderate significance.
Adverse (Minor or Negligible)	The Proposed Development will be a net generator of GHG emissions but is compatible with the UK's budgeted science-based net zero trajectory. Further evaluation will be required to determine whether this is of Minor or Negligible significance.
Positive (Major, Moderate or Minor Significance)	The net GHG emissions associated with the Proposed Development will be negative. Further evaluation in the context of the UK's budgeted science-based net zero trajectory will be required to determine whether this is of Major, Moderate or Minor significance.

Climate Change Adaptation

14.24 The purpose of the 'in-combination climate assessment' is to determine whether the significance of effects of the Proposed Development on a given receptor (under the existing climate baseline) are likely to be changed by future climatic conditions and whether the Proposed Development is likely to affect a receptor's ability to adapt. Significance of effects are determined through the following steps:

- Receptors identified and assessed in the topic chapters of the EIA Report under the current climate baseline are evaluated to determine whether the susceptibility and vulnerability as well as their value/importance will change with the future climatic conditions defined. A high value receptor that has very little resilience to changes in climatic conditions should be considered more likely to be significantly affected than a high value receptor that is very resilient to changes in climatic conditions.
- The magnitude of the effects on the receptors under the existing climate baseline is evaluated to determine whether the probability and/or consequence of the effect changes with the future climatic conditions.

14.25 Building on the evaluation of sensitivity and magnitude of the effect, an assessment is undertaken to identify whether the additional effects of future climate impacts alter the sensitivity and/or magnitude of the effect so that the level of significance of the effects within other topics identified against baseline conditions changes. The assessment uses the significance criteria used by other topics assessed in the EIA Report i.e. if a Minor (adverse) effect on direct habitat loss is not likely to change under a future climatic scenario, then the in-combination effect (effect of the Proposed Development with future climate change) remains as Minor (adverse).

Assessment Assumptions and Limitations

Assumptions

14.26 In considering future climate change scenarios, IEMA guidance[19] recommends the use of the UK Climate Projections UKCP18 website[15]. 'Probabilistic' projections are provided for a range of variables including temperature, precipitation and sea level rise. Wind speed and storm frequency/intensity are considered separately as global modelling information is currently more limited.

14.27 The current projections, UKCP18, released on November 2018, are now the most up to date climate change projections available. The climate projections website states that UKCP18 provides a valid assessment of the UK's future climate over land, but that when considering decisions that are sensitive to projected future changes in summer rainfall, additional information should also be used.

14.28 The UKCP18 projections for temperature and precipitation are presented for the UK as a whole and also on a regional basis. The UK projections consider three variables:

- Timeframe: The projections are presented for four overlapping time periods (2020s, 2040s, 2060s and 2080s).
- Probability: The projections are provided as probability distributions rather than single values, with figures provided for 5, 10, 50, 90 and 95% probability.
- Representative Concentration Pathways (RCP): Four pathways have been adopted; RCP2.6, RCP4.5, RCP6.0 and RCP8.5. These pathways describe different greenhouse gas (GHG) and air pollutant emissions as well as their atmospheric concentrations and land use with each one resulting in a different range of global mean temperature increases over the 21st Century. RCP2.6 represents a scenario which aims to keep global warming likely below 2°C compared to pre-industrial temperatures. RCP4.5 and RCP6.0 represent intermediate scenarios while RCP8.5 is the highest impact emission scenario. All scenarios are considered to be equally plausible.

14.29 Table 14.3 below explains the assumptions made in applying the UKCP18 projections to the assessment of the Proposed Development. The IEMA guidance[19] states *"Recommended best practice is to use the higher emissions scenario (RCP 8.5 in the latest UKCP18 projections) at the 50th percentile, for the 2080s timelines, unless a substantiated case can be made for not doing this (e.g. anticipated lifespan of the project is shorter than 2080s)"* (page 44).

Table 14.3: Climate change assessment assumptions

Variable	Assumptions	Rationale
Timeframe	2060-2079	This is considered a realistic timeframe given the design life of the Proposed Development (40 years).
Probability	50th percentile used to establish what is projected as the central estimate with consideration given to lowest (5th) and highest (95th) percentiles to determine the lowest and highest projections that could happen within the timeframe.	By providing a range of results rather than single best estimate values, a clearer picture can be provided regarding the level of confidence in different outcomes.
RCP	RCP 8.5	RCP8.5 is selected as recommended in the IEMA guidance[19] and allows for a worst-case scenario future climate to be defined resulting in a conservative assessment.

[19] IEMA (2020) The Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation

14.30 All key assumptions made with input data for the carbon calculator are set out in **Appendix 14.1**.

Limitations

14.31 The key limitations to the assessment of effects in this chapter are as follows:

- Estimated carbon losses in the calculator are conservative, and it is assumed that all the carbon in excavated peat is lost, although it will all be used for restoration onsite as set out in **Appendix 7.3: Outline Peat Management Plan**.
- The peat restoration gains included in the calculator do not include future carbon sequestration from improved carbon fixing vegetation such as the planting proposals set out in EIA Report **Appendix 8.5: Outline Restoration and Enhancement Plan (OREP)**.
- The carbon calculator does not account for carbon emissions and direct CO_2 and NO_X emissions from Heavy Goods Vehicles (HGV) (including cumulatively) transporting components, materials and their production (including stone, concrete, solar panels and batteries) and staff to Site during construction, but rather only emissions associated with turbine life and emissions associated with their production, and so a qualitative approach has been used in regards to transport emissions in the assessment. This effect can therefore only be assessed qualitatively in the absence of a whole life cycle carbon assessment.
- The carbon calculator does not account for emissions associated with the working of machinery onsite such as excavators, generators, and forestry felling vehicles.
- It is beyond the scope of this assessment to quantitively assess the cumulative offsetting effects of other schemes, and so any other positive effects identified are qualitative and based on professional judgement.

Existing Conditions

14.32 Table 14.4 below outlines the projected changes in temperature, precipitation and wind speed and storms by 2060-2079, assuming a 50th percentile probability.

Table 14.4: Projected climate change

Climate Variable	Projected Change
Temperature	Temperatures in West Scotland are projected to increase, with projected increases in summer temperatures greatest. The central estimate of increase in winter mean temperature is 2.4ºC; it is very unlikely to be less than 0.4ºC and is very unlikely to be more than 4.6ºC. The central estimate of increase in summer mean temperature is 2.8ºC; it is very unlikely to be less than 0.6ºC and is very unlikely to be more than 5.1ºC.
Probability	Winter rainfall is projected to increase, and summer rainfall is most likely to decrease. The central estimate of change in winter mean precipitation is 22%; it is very unlikely to be less than -7% and is very unlikely to be more than 60%. The central estimate of change in summer mean precipitation is -15%; it is very unlikely to be less than -35% and is very unlikely to be more than 4%. The UKCP18 projections show a general trend towards warmer, wetter winters and hotter, drier summers. However, it should be noted that rainfall patterns across the UK are not consistent and will vary dependent on seasonal and regional scales and will continue to vary in the future.
Wind Speed and Storms	Changes in wind speeds are not currently available at the regional level and there remains considerable uncertainty in the projections, with respect to wind speed. However, there are small changes in projected wind speed (Defra, DECC and Met Office, 2010). Across the UK, near surface wind speeds are expected to increase in the second half of the 21st century with winter months experiencing more significant impacts of winds (Met Office, 2018). This is accompanied by an increase in frequency of winter storms over the UK. However, the increase in wind speeds is projected to be modest.

14.33 With respect to climate change adaptation, all specialist topic area authors were provided with a summary of the climate change projections above and were asked to consider the relevance of this for their baseline descriptions in order to determine those receptors which are susceptible to a changing climate.

14.34 For the following topics, it is not considered that baseline conditions, and therefore the susceptibility and vulnerability of receptors as well as their value/importance will change with the future climatic conditions defined, such that in-combination climate change adaptation effects are unlikely, and these topics are not considered further in the assessment:

- **Chapter 11: Noise and Vibration** – The consequences of the projected climate change scenario are unlikely to substantially affect baseline noise conditions for the purpose of the assessment in this EIA Report, given that periods of rainfall are excluded and the variation with wind speed was taken into account, in line with requirements of ETSU-R-97 and current good practice.
- **Chapter 12: Traffic and Transport** – It is considered that climate change projections will not have a discernible impact on the baseline conditions for road traffic within the timescales of the Proposed Development. It is assumed that, at a regional level, appropriate measures will be put in place to ensure flood risk is managed and does not have long term effects on transport infrastructure.
- **Chapter 13: Socio-economic** – It is not considered that the current baseline in relation to recreation, tourism, and land use will change notably from that assessed.

14.35 The following assessments provided more detailed consideration on baseline conditions that will be influenced by projected climate change:

- Chapter 6: Landscape and Visual Amenity;
- Chapter 7: Geology, Hydrology, Hydrogeology and Peat;
- Chapter 8: Ecology;
- Chapter 9: Ornithology; and
- Chapter 10: Cultural Heritage.

Future Baseline in the Absence of the Proposed Development

14.36 The UKCP18 projections show a general trend towards warmer, wetter winters and drier, hotter summers. However, it should be noted that both temperature and rainfall patterns across the UK are not consistent and will vary dependent on seasonal and regional scales and will continue to vary in the future.

Design Considerations

14.37 The purpose of the Proposed Development is to generate electricity from a renewable source of energy, avoiding the need for power generation from the combustion of fossil fuels. Consequently, the electricity that will be produced by the Proposed Development will result in a saving in emissions of CO_2 with associated environmental benefits. The overall design has at all stages tried to maximise the renewable energy production from the Site, with consideration of all of the environmental constraints.

14.38 The following modifications and design considerations have also been made during the iterative EIA process and relate to the issues considered in this assessment:

- Impacts upon deep peat (physical damage, excavation and transportation) have been minimised as far as possible;
- The creation of one temporary borrow pit for the extraction of stone, and the reopening/use of two existing borrow pits from which it is anticipated that all stone aggregate will be sourced for construction including stone for tracks (new and upgraded), hardstandings and the construction compounds, will reduce the theoretical volume of construction traffic calculated in **Chapter 12** and associated emissions;
- Concrete batching will be undertaken onsite thereby reducing traffic and associated emissions;
- New woodland planting proposals (set out in **Appendix 8.5**) will act as a means of absorbing carbon emissions and will help to intercept heavy rainfall and associated flooding;
- Peatland enhancement proposals, including hag re-profiling and ditch blocking will enhance peatland quality within the Site, enabling improvements in natural carbon sequestration potential of these habitats, and helping to offset any carbon loss through peat excavation; and

- Modern turbines are designed and constructed to withstand the forces likely to be exerted on them, often in remote environments which are regularly subject to high wind speeds. Adherence to relevant design and safety standards ensures that there is extremely limited risk of structural failure of turbines or foundations from wind or high temperatures.

Micrositing

14.39 A general micrositing allowance of 50m is being sought for the Proposed Development to allow a degree of flexibility in the layout of site components during construction should unfavourable ground conditions be encountered. The magnitude and resulting significance of effects identified in this chapter will not be affected by this allowance.

Assessment of Effects

14.40 The assessment of effects is based on the project description as outlined in **Chapter 4**. Unless otherwise stated, potential effects identified are considered to be negative.

Construction Effects

Carbon Emissions Including Direct CO_2 and NO_X Emissions from HGV Vehicles

14.41 Carbon dioxide emissions during the life of a wind turbine include those that occur during production, transportation, erection, concrete production, operation, dismantling and removal of turbines and foundations.

14.42 As stated in **Chapter 12**, the highest levels of vehicle movements associated with the Proposed Development will occur during its construction. A total of 33,412 construction vehicle journeys are estimated across the construction programme in total, including forestry removal. Whilst CO_2 and NO_x emissions have not been calculated for the felling and construction vehicle movements, it is considered that the opportunity to use onsite borrow pits for the majority of stone requirements will likely significantly reduce HGV traffic movements and the associated emissions. In addition, concrete batching will be undertaken onsite which will reduce concrete delivery requirements.

14.43 Overall, the Proposed Development will be a net generator of GHG emissions during construction. Based on qualitative consideration of the likely scale of emissions, and in accordance with the assessment methodology, a **Minor (negative)** effect is predicted which will be **Not Significant** under the EIA Regulations.

Proposed Mitigation

14.44 No specific mitigation measures are proposed in relation to climate change, although a Construction Traffic Management Plan (CTMP), as referenced in **Chapter 12**, will be implemented as good practice, with the intention that measures will be implemented to ensure traffic movements are undertaken efficiently during construction, and unnecessary journeys avoided.

Residual Construction Effects

14.45 All residual effects are considered to be **Not Significant** following the implementation of the mitigation measures identified above.

Operational Effects

Carbon Losses and Savings

14.46 As outlined in **Chapter 1: Introduction**, the purpose of the Proposed Development is to generate electricity from a renewable source of energy, avoiding the need for power generation from the combustion of fossil fuels and to add capacity to the electrical generating potential to facilitate a decarbonisation of heat and transport networks. Consequently, the electricity that will be produced.by the Proposed Development will result in an overall saving in emissions of CO_2 during its operational life. At this stage based on the candidate turbine, the wind farm will have a maximum installed capacity of up to 85.8 megawatts (MW). It is estimated that the number of households that can be potentially powered by the Proposed Development is 95,872 per annum[20].

14.47 One of the key aims of **Appendix 14.1** was to calculate the 'payback time' of CO_2 emissions for the Proposed Development. The payback time is defined as the length of time (in years) required for the Proposed Development to be considered a net avoider of emissions rather than a net emitter and is calculated by dividing the net emissions of carbon (total of carbon losses and gains) by the annual estimated carbon savings.

> The expected carbon payback period, assuming that the Proposed Development will offset the emissions associated with a grid mix of electricity generation, is calculated to be in the region of 0.7 years (or approximately **8 months**) – see **Table 14.10** of **Appendix 14.1**.

14.48 Assuming a 40-year operational life and based on an overall expected annual carbon saving of 40,000 tCO_2e and a total carbon loss (during both construction and operation) of just over 116,000 tCO_2e, this equates to a total saving of approximately 1.48 million tCO_2e[21] (40,000 x 40 minus the emissions emitted) over the Proposed Development's operational lifetime as well as over 120,000 tonnes of CO_2e gains estimated from the restoration of a large area of degraded bog on the Site is estimated to produce significant gains over the lifetime of the windfarm through blocking of drains and re-wetting of peat.

14.49 Whilst it has not been possible to calculate construction traffic emissions for HGVs and personnel, overall, it is considered that these will be offset during the Proposed Development's operational life along with any backup generation if required, and that a **moderate (positive)** effect is likely on balance. The Proposed Development's carbon saving potential will contribute positively to meeting Scotland's net zero greenhouse gas emissions targets.

Adaptation

14.50 Taking account of those receptors identified above, under 'baseline conditions', as potentially susceptible to a changing climate, this section gives further consideration as to whether or not the introduction of the Proposed Development is likely to affect judgements of effects and/or the ability of the receptors within or close to the Site to adapt to climate change. Topics considered are:

- Landscape and visual amenity;
- Geology, hydrology, hydrogeology and peat;
- Ecology;
- Ornithology; and
- Cultural heritage.

14.51 Chapter 6: Landscape and Visual Amenity – For West Scotland, the UK Climate Change Projections 2018 (UKCP18) projects that temperatures are projected to increase, particularly in summer, and winter rainfall is projected to increase whilst summer rainfall is most likely to decrease. The Landscape Institute's *"Landscape for 2030"*[22] acknowledges that changes in average temperatures, precipitation and extreme weather events will have an effect on the landscape. However, whilst a change in rainfall and rising temperatures are anticipated, it is unlikely that the susceptibility/vulnerability and value/importance of the receptors will materially change, neither will the magnitude of the predicted effects of the Proposed Development under the existing baseline, such that the in-combination climate effects are considered to remain as those set out in **Chapter 6**.

14.52 Chapter 7: Hydrology, Geology, Hydrogeology and Peat – In April 2022, SEPA published new guidance[23] on climate change in Scotland which provides a regional based approach to estimate uplift in future river flows in Scotland. For large river catchments (over 50 square kilometres (km^2)), the peak (200-year) design flow should be increased by 59% in the Argyll River Basin to account for projected climate change increases to the year 2100. In addition, the peak rainfall intensity allowance for the Argyll region of Scotland is 46% to the year 2080. Thus, this part of Scotland is likely to get wetter with higher peak flows in the rivers in the future. Appropriate infrastructure design (including maintaining up to a 50m buffer around watercourses[24]) and the incorporation of standard good practice measures for site drainage into the infrastructure design (including SuDS principles) will limit any increases in

[20] This figure was calculated using the RUK assumption using the number of megawatts installed, multiplied by wind load factor expressed as a fraction of 1, multiplied by number of hours in a year, divided by average annual domestic electricity consumption expressed in MWh.
[21] The results of the Carbon Calculator for the Proposed Development show that the Proposed Development is estimated to produce annual carbon savings of approximately 40,000 tCO_2 per year, through the displacement of grid electricity, based on the current average grid mix.

[22] Landscape Institute (2021) Landscape for 2030 – How landscape practice can respond to the climate crisis [pdf]. Available at: https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2021/04/12510-LANDSCAPE-2030_v6.pdf
[23] SEPA (2019) Climate change allowances for flood risk assessment in land use planning, Land Use Planning System SEPA Guidance (Version 1)
[24] Locations where a 50m buffer cannot be achieved are described in the assessment and **Appendix 7.1**.

flows and runoff rates to pre-development levels. All watercourse crossings will be designed to meet required flood exceedance standards. These measures will help to ensure that the Proposed Development has no significant effects on the ability of potential flood risk receptors to adapt to climate change. It is also unlikely that the susceptibility/vulnerability and value/importance of the receptors assessed will materially change neither will the magnitude of the predicted effects of the Proposed Development under the existing baseline, such that the in-combination climate effects are considered to remain as those set out in **Chapter 7**.

14.53 Chapter 8: Ecology – The projected effects of climate change are likely to have a bearing on the future ecological status of the Site. The UK Climate Projections generally suggest hotter, drier summers and milder, wetter winters, with an increase in the number of heavy rain days and in the frequency of winter storms. These predicted changes in climate may result in changes to vegetation assemblages; however, it is unlikely that climate change will have a significant bearing on the structure and function of the upland habitats present within the Proposed Development and surrounding area. However, individual species may be adversely affected by the predicted changes in climate if conditions affect the survival rate of the animals at a critical life stage (such as at hibernation or during breeding). For example, water vole may be affected by either periods of drought or episodic heavy rain affecting success during the breeding season[25]. The distribution of species in the uplands may therefore be altered as a result of projected climate change. Although the exact nature of the effects are difficult to predict due to the complex nature of interactions between species and their resources, in-combination climate effects are not considered to vary markedly from the effects set out in **Chapter 8**.

14.54 Chapter 9: Ornithology – The projected climate change is likely to result in an extended breeding bird season with earlier in the year (and likely more) nesting attempts, which has potential to increase breeding productivity, although this will be dependent on prey availability. However, contrary to this, the increased rainfall is likely to result in higher rates of fledgling mortality. The opposing potential effects of climatic change on ornithology receptors makes predicting future likely outcomes difficult. However, on balance, there is no reason to consider that the breeding bird assemblage using the Site will change substantially. Potential effects on ornithology receptors detailed in **Chapter 9** are therefore not predicted to substantively change as a consequence of climate change over the lifespan of the Proposed Development.

14.55 Chapter 10: Cultural Heritage – Increased hot weather may potentially affect the preservation of waterlogged deposits, causing them to dry and desiccate. Increased rainfall will change groundwater and soil conditions, potentially affecting the preservation of below-ground archaeology and eroding/ flooding above ground assets. However, no significant in-combination effects are considered likely.

Proposed Mitigation

14.56 No additional mitigation measures are proposed to address in-combination effects of the Proposed Development in respect to climate change adaptation for the receptors assessed.

Residual Operational Effects

14.57 All effects remain as discussed above.

Cumulative Effects During Construction

Carbon Emissions Including Direct CO_2 and NO_X Emissions from HGV Vehicles

14.58 Climate change is, in essence, a cumulative effect due to emissions from multiple sources including new development. All wind farms will involve the generation of direct and embodied greenhouse gas emissions during construction. It is assumed, however, that any other applications that are consented and built will include reasonable measures to avoid, reduce and/or avoid the generation of greenhouse gas emissions, particularly from construction traffic. Overall, a **Minor (negative)** cumulative construction effect is therefore predicted which will be **Not Significant**.

Proposed Mitigation

14.59 No mitigation measures are proposed in relation to cumulative climate change effects during construction of the Proposed Development.

Residual Cumulative Effects During Construction

14.60 As no mitigation is proposed, the effect remains as **Minor (negative)** and **Not Significant**.

Cumulative Effects During Operation

Carbon Losses and Offsetting

14.61 The Proposed Development, in combination with other onshore wind developments, will have a positive effect on offsetting emissions released from the burning of fossil fuels and will play an integral part in helping Scotland meet its climate change and energy targets. A **Major (positive)** and **Significant** effect is therefore identified, given the importance of this collective role of onshore wind generation to addressing the global climate emergency.

Adaptation

14.62 With respect to in-combination climate effects, this is largely a project specific consideration, namely the ability of assessed receptors to adapt to future climatic conditions, and the extent to which projected climate change could alter the predicted effect judgements. Effects are considered to be **Not Significant**.

Proposed Mitigation

14.63 No mitigation is proposed in relation to cumulative effects on climate change during the operation of the Proposed Development.

Residual Cumulative Effects During Operation

14.64 As no mitigation is proposed, the effects remain as noted above, i.e. **Major Significant (positive)** for carbon reductions, and **Not Significant** in relation to climate change adaptation.

Summary of Significant Effects

14.65 Table 14.7 below summarises the predicted significant effects of the of the Proposed Development on climate change mitigation and adaptation.

Table 14.5: Summary of significant effects

Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Operation			
Carbon Losses and Carbon Offsetting (climate change mitigation)	Moderate (positive)	None	Moderate (positive)
Cumulative Operation			
Carbon Losses and Carbon Offsetting (climate change mitigation)	Major (positive)	None	Major (positive)

[25] National Trust (2019) 2019 wildlife and weather review

Aviation and Defence

Introduction

14.66 This assessment considers the potential effects of the proposed An Càrr Dubh Wind Farm (hereinafter referred to as 'the Proposed Development') in relation to aviation and defence. It considers potential effects on the aviation and air defence activities of the Ministry of Defence (MOD) as safeguarded by the Defence Infrastructure Organisation (DIO). It also considers the possible effects of wind turbines upon the National Air Traffic Services En Route Ltd (NERL) communications, navigation and surveillance (CNS) systems which consist of a network of primary and secondary radars and navigation facilities around the country.

14.67 As well as examining the technical impact of wind turbines on Air Traffic Control (ATC) facilities, it is also necessary to consider the physical safeguarding of ATC operations to determine whether a development will breach obstacle clearance criteria.

14.68 This assessment should be read in conjunction with **Appendix 14.2**.

Scope of the Assessment

14.69 Potential effects on the following have been assessed in full:

- MOD Low Flying; and
- Licensed airfields with a surveillance radar.

Effects Scoped Out

14.70 On the basis of the desk-based work undertaken, and feedback received from consultees, potential effects on the following have been scoped out of detailed assessment:

- MOD Air Traffic Control Radars (none affected);
- MOD Air Defence Radars (none affected);
- NATS En Route Radars (none affected);
- Met Office Radars (none affected); and
- Unlicensed aerodromes, glider, parachute and microlight sites (none affected).

Assessment Methodology

Legislation and Guidance

14.71 There are a number of aviation publications relevant to the interaction of wind turbines and aviation containing guidance and legislation, which cover the complete spectrum of aviation activity in the UK as shown below:

- Civil Aviation Authority (2016) Policy and Guidance on Wind Turbines Version 6 CAP764 CAA
- Civil Aviation Authority (2020) Policy and Guidance on Wind Turbines Version 7 Draft for Consultation CAP764 CAA
- Civil Aviation Authority (2019) Licensing of Aerodromes, Version 11 CAP 168 CAA
- Civil Aviation Authority (2019) Air Traffic Services Safety Requirements Version 3 CAP 670 CAA
- Civil Aviation Authority (2017) UK Flight Information Services, Ed 3 CAP 774 CAA
- Civil Aviation Authority (2020) Safeguarding of Aerodromes Version 3 CAP7384 CAA
- Civil Aviation Authority (2010) Safe Operating Practices at Unlicensed Aerodromes Ed 1 CAP 783 CAA
- Civil Aviation Authority (2017) Manual of Air Traffic Services Part 1 Ed 7.0 CAP 493 CAA
- Civil Aviation Authority (2020) Parachuting Ed 5 CAP660 CAA
- Ministry of Defence (2022) Military Aviation Authority Regulatory Article 2330 (Low Flying) MOD
- Civil Aviation Authority (2017) 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 CAA.

Consultation

14.72 In undertaking the assessment, consideration has been given to the Scoping responses and other consultation which has been undertaken as detailed in **Table 14.6**. Aviation stakeholders were consulted during Scoping, however their responses are based on a considerably larger scheme (see **Chapter 3: Site Selection and Design Strategy**).

Table 14.6: Consultation responses

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
MOD DIO Ref 10051475 dated 25th May 2021	Scoping	Military Low Flying Training: MOD Safeguarding wishes to be consulted and notified about the progress of planning applications and submissions relating to this proposal to verify that it will not adversely affect defence interests.	MOD DIO have been reconsulted and been informed that MOD specification Infra-Red lighting will be installed on each turbine.
NERL SG31485	Scoping	The Proposed Development has been examined from a technical safeguarding aspect and does not conflict with safeguarding criteria. Accordingly, NATS (En Route Public Limited Company (NERL)) has no safeguarding objection to the proposal.	Issue scoped out.
Glasgow Airport Ref GLA3978 dated 2nd June 2021	Scoping	The Site is located outwith the obstacle limitation surfaces and radar safeguarding area for Glasgow Airport. It is located within the instrument flight procedure safeguarding area and this should be considered as part of the EIA. Glasgow Airport's position with regard to this proposal will only be confirmed once the turbine details are finalised and they have been consulted on a full planning application. At that time, they will carry out a full safeguarding impact assessment and will consider their position in light of, inter alia, operational impact and cumulative effects.	The instrument flight procedure safeguarding area is discussed further below under 'Assessment of Effects'. Glasgow Airport will respond further when the application is submitted.
Glasgow Prestwick Airport (GPA) Undated email response	Scoping	GPA would be unlikely to object to this Proposed Development should it come to a full section 36 planning application. GPA however remain interested in how the Developer proposes to address the issue of aviation warning obstruction lighting scheme as required by the UK CAA for obstacles greater than 150m in height above local ground level in accordance with Article 222 of the UK Air Navigation Order (ANO) 2016. GPA respectfully request that they are consulted with, should this Proposed Development be submitted as a formal Section 36 Planning application.	Aviation lighting issues are addressed in the Aviation Lighting and Mitigation Report at **Appendix 14.2** and CAA approval for the lighting layout has been applied for. GPA will be consulted further when the application is submitted.
MOD DIO Ref 10051475 dated 21st February 2023	Other	The MOD confirmed that subject to the two conditions detailed in Appendix A of the consultation the MOD has no objection to the Proposed Development.	Noted. No action required.

Study Area

14.73 The assessment of effects of the proposed turbines is based upon the guidance laid down in CAA Publication CAP 764 Policy and Guidelines on Wind Turbines Version 6th dated February 2016. Consultation criteria for aviation stakeholders are defined in Chapter 4 of this guidance. These include distances that inform the size of the study area including:

- Airfield with a surveillance radar – 30km;
- Non radar licensed aerodrome with a runway of more than 1.1km-17km;
- Non radar licensed aerodrome with a runway of less than 1.1km-5km;
- Licensed aerodromes where the turbines will lie within airspace coincidental with any published Instrument Flight Procedure (IFP);
- Unlicensed aerodromes with runways of more than 800m-4km;
- Unlicensed aerodromes with runways of less than 800m-3km;
- Gliding sites – 10km; and
- Other aviation activity such as parachute sites and microlight sites within 3km – in such instances, developers are referred to appropriate organisations.

14.74 CAP 764 further states that these distances are for guidance purposes only and do not represent ranges beyond which all wind turbine developments will be approved or within which they will always be objected to. These ranges are intended as a prompt for further discussion between developers and aviation stakeholders.

Field Survey

14.75 The assessment has been desk based, drawing largely from published guidance and data.

Data Sources

14.76 The following data sources have informed the assessment:

- WPAC 'Rview' Version 5 Radar Modelling Software; and
- NATS Aeronautical Information Publication (AIP) Published 22nd September 2022 Effective from 03rd November 2022.

Assessing Significance

14.77 There is no agreed definition for assessing significance in an aviation context. This is due to the fact that whilst technical effects on communications, navigation and surveillance (CNS) systems are simple to identify and evaluate, operational and flight safety effects can be subjective and are often challenged by third parties. It is enough in this context to identify any technical effects and then, taking into account the statements in CAP 764 regarding the status of aviation stakeholders, in general to accept the judgement of those stakeholders in assessing the significance of the effects. For example, CAP 764 states *"Where an Air Navigation Service Provider (ANSP) determines that it is likely that a planned wind turbine development would result in any of the above effects on their CNS infrastructure, this may not, in itself, be sufficient reason to justify grounds for rejection of the planning application. The ANSP must determine whether the effect on the CNS infrastructure has a negative impact on the provision of the ATS. The developer should pay for an assessment of appropriate mitigating actions that could be taken by the ANSP and/or wind energy developer to deal with the negative impact. The position of an ANSP at inquiry would be significantly degraded if they had not considered all potentially appropriate mitigations"*.

14.78 It is not, taking the above into account, considered appropriate for the Applicant to be making an assessment of significance of an effect. It is also the case that different Air Navigation Service Providers (ANSP) can take a different view of the same scenario.

Existing Conditions

14.79 The Proposed Development is located in an area relatively remote from any significant aviation facilities. It is 65km to the north-west of Glasgow Airport, 90km to the north of Glasgow Prestwick Airport and 25km to the south of the small non-radar equipped licensed aerodrome at Oban. It is also located within Class G unregulated airspace and over 8km to the north of Airway L602, Class E regulated airspace that takes traffic from Glasgow to Tiree and beyond. There are no MOD aviation facilities in the area.

Assessment of Effects

Ministry of Defence Low Flying

14.80 The Proposed Development is within MOD Low Flying Area (LFA) 14 which is the largest of the MOD LFAs. At night this area converts to Night Allocated Region (NAR) 1A, an area primarily reserved for fast-jet low flying in the hours of darkness. Within the study area for this assessment, fast jet and tactical transport aircraft routinely operate down to 250 feet (ft) (75m) above ground level (agl), and helicopters down to 30ft, (9m) and occasionally, down to ground level.

14.81 Because of its size and utility, LFA14 is regularly used for multi-nation exercises and operational training. Accordingly, the Site is in an important MOD/NATO training area and will require a comprehensive lighting arrangement that includes both visible and infra-red obstruction lights. Each turbine will be fitted with infra-red lights to satisfy the MOD requirement. The proposal for visible lighting is discussed further in **Appendix 14.2**.

Glasgow Airport

14.82 As the Site layout has changed since Scoping, further radar modelling has been undertaken to assess the effect on the Glasgow Airport radar facilities. The results are shown in **Table 14.7** below.

Table 14.7: Radar line of sight Glasgow Airport Primary Surveillance Radar (PSR)

Turbine	Radar Line of Sight (metres AGL)	Turbine	Radar Line of Sight (metres AGL)
1	528.8	8	530.4
2	541.7	9	579.8
3	453	10	595.8
4	499.9	11	772.3
5	546.8	12	790.2
6	574.2	13	764
7	604.5		

14.83 The results confirm that every turbine will be completely screened by terrain and will have no effect on the performance of the Glasgow Airport PSR.

14.84 As stated in their Scoping response, Glasgow Airport may wish to undertake an Instrument Flight Procedure check to ensure the turbines will not affect any safety margins for the airport's procedures; however, at a distance of over 65km it is very unlikely that any procedures will be affected. As an example, the highest turbine tip height is 620 metres (2024ft) above mean sea level (AMSL). The ATC Surveillance Minimum Altitude Chart (ATCSMAC) (as published in the NATS UK AIP dated 22nd September 2022) shows that in this area, the minimum altitude is 5,500ft AMSL. Taking into account the requirement for a minimum obstacle clearance of 900m or 1,000ft between the ATCSMAC minima and any obstruction, this shows that the highest turbine will still be more than 2,000ft below the limit.

Glasgow Prestwick Airport

14.85 As the Site layout has changed since Scoping, further radar modelling has been undertaken to assess the effect on the Glasgow Prestwick Airport radar facilities. The results are shown in **Table 14.8** below.

Table 14.8: Radar line of sight Glasgow Prestwick Airport Primary Surveillance Radar

Turbine	Radar Line of Sight (metres AGL)	Turbine	Radar Line of Sight (metres AGL)
1	901.2	8	921.1
2	880.9	9	1021.4
3	891.9	10	1032.2
4	940.1	11	1049
5	991.4	12	1060.1
6	997.8	13	1053.7
7	956.2		

14.86 The results confirm that at a distance of over 90km, every turbine is completely screened by terrain and will have no effect on the performance of the GPA PSR.

Proposed Mitigation

14.87 Turbines with a tip height in excess of 150m are considered to be 'en route navigation hazards' and require aviation lighting in accordance with national and international requirements. A detailed lighting report has been produced which provides a lighting design to minimise the number of lit turbines whilst maintaining flight safety. It addresses both CAA and MOD requirements. The lighting report is provided in **Appendix 14.2**.

Summary of Significant Effects

14.88 The turbines will not be visible to any civil or military radars or impinge upon any airport physical safeguarded surfaces. Aviation lighting will be provided, but there is no requirement for any other aviation mitigation.