9. ORNITHOLOGY

Executive Summary

This chapter reports on the potential impacts on the baseline ornithological conditions recorded within and around the proposed development resulting from the introduction of the proposed development and presents an assessment of likely significant effects on identified target species' populations.

Baseline surveys recorded a range of target species: barnacle goose, black grouse, common sandpiper, curlew, goldeneye, Greenland white-fronted goose, greylag goose, hen harrier, herring gull, merlin, osprey, oystercatcher, peregrine falcon, red-throated diver, short-eared owl, snipe, whooper swan and woodcock (records detailed per species in Section 9.4). Each of these species was considered as part of the Environmental Impact Assessment, however based on the assessment methodology detailed in Section 9.3, the level of activity recorded for each species and the results of the collision risk modelling, Greenland white-fronted goose was the only Important Ornithological Feature (IOF) identified at risk of potential significant effects that was taken forward into the Environmental Impact Assessment (with the remaining species scoped out of the assessment). Due to the proximity of the Kintyre Goose Roosts Special Protection Area (SPA) and the potential for connectivity, Greenland white-fronted goose was also assessed under the Habitats Regulations.

For Greenland white-fronted goose, effects related to direct and indirect habitat loss, construction disturbance and displacement, operational displacement, collision risk and cumulative effects were all considered as part of the assessment. The assessment concluded that **No Significant effects** (under EIA) or Adverse Effects on Integrity (under HRA) were found as a result of the project alone, cumulatively or in-combination with other projects.

Although no adverse impacts were predicted for the Greenland white-fronted goose (SPA population), mitigation is proposed to ensure all reasonable measures to avoid disturbance to roosting geese at Lussa Loch and Tangy Loch will be taken. This mitigation may include (but is not limited to) restrictions to vehicular movements and works with the potential to cause disturbance in the hour before dawn and the hour after dusk between 30th September and 30th April inclusive.

9.1 Introduction

9.1.1 This chapter considers the potential effects on ornithology associated with the construction, operation and decommissioning of the proposed development. The specific objectives of the chapter are to:

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

9.1.2 The assessment has been carried out by MacArthur Green.

9.1.3 Effects on flora and non-avian fauna are addressed separately in Chapter 8: Ecology.

9.1.4 This chapter is supported by:

- Appendix 9.1: Ornithology:
  - Annex A: Ornithological Legal Protection;
  - Annex B: Ornithological Survey Methodology;
  - Annex C: Ornithological Survey Effort and General Information;
  - Annex D: Ornithological Survey Results;
  - Annex E: Collision Risk Assessments;
  - Annex F: Review of the Effects of Artificial Light on Birds in Relation to Deployment of Obstruction Lighting on Wind Turbines;
  - Annex G: Tangy I and Tangy II Wind Farms Historical Information and Data.

9.1.5 Figures 9.1 – 9.27 are referenced in the text where relevant.

9.2 Scope of Assessment

Project Interactions

9.2.1 The footprint of the proposed development stretches across the operational Tangy I and Tangy II Wind Farm plus additional forested land to the north (Figure 9.2). Therefore, whilst the proposed development could be considered as a 'repowering' of Tangy I and Tangy II, the additional land to the north of the current operational wind farm could be considered as a 'new' project and overall, could be considered to fall within both SNH (2014, 2017) *Recommended bird survey methods to inform impact assessment of onshore wind*, and SNH (2014b[1]) *Repowering onshore wind farms: bird survey requirements*. Consequently, in addition to using the baseline data gathered for the consented Tangy III Wind Farm proposals (April 2012 to March 2014), additional ornithology surveys were undertaken for Tangy IV (September 2016 to November 2017) across the same survey areas as the baseline surveys for Tangy III to ensure a robust dataset. This approach was detailed in the Modified Tangy III Scoping Report (Table 6.1)[2] with additional flight activity surveys also undertaken. In their scoping response (dated 26th June 2017, Table 9.1), SNH stated that, *"We are content with the updates that are proposed for the bird survey. The extensive previous surveys of much of this area do provide supporting context."*.

[1] A new version of this guidance was recently released as a consultation draft in June 2018: *Assessing the impact of repowered wind farms on nature.*

[2] Modified Tangy III wind farm scoping report, April 2017, Section 6.2.

Study Area

9.2.2 The study area was defined as the site boundary/turbine layout plus the relevant survey buffer[3] (which reflects the survey undertaken), within which both desk-based and field surveys were undertaken. Details of the spatial and temporal extent of each survey are described in Section 9.4 of this chapter, Appendix 9.1 and associated Annexes (A to G) and Figures (9.1 to 9.27).

9.2.3 Following the completion of field surveys, the Collision Risk Analysis Area (CRAA) was defined for the purpose of estimating possible collisions with turbines. The CRAA was created by using Delaunay triangulation[4] to create a wind farm area which was then buffered by 500 m (Figure 9.3). Using a larger area around the turbines accounts for possible inaccuracies in the recording of flightlines and ensures the assessment is precautionary.

Scoping and Consultation

9.2.4 Table 9.1 details relevant scoping and consultation issues. Full details on the consultation responses can be reviewed in Appendix 2.1: Consultation Register.

Table 9.1: Consultation Responses

Consultee and Date	Summary of Response	Comment/Action Taken
Argyll and Bute Council 4th July 2017	Accepted proposed assessment approach and recommended views of SNH and RSPB are sought.	SNH and RSPB responses detailed below.
Scottish Natural Heritage (SNH) 26th June 2017	Content with the proposed additional bird surveys and the inclusion of the Tangy III baseline data. Requested further detail on how the reanalysis of the Tangy III data for collision modelling will deal with the larger turbines of Tangy IV and commented that if it proved difficult to reanalyse the data that further flight activity surveys may be required.	The assessment includes the Tangy III baseline data (April 2012 to March 2014) in the updated collision risk modelling. As noted by SNH, these original baseline data were collected using height bands 0-20m, 21-125m and >126m. In order to account for the increase in upper tip height to 150m the revised collision risk modelling makes the precautionary assumption that all flights recorded in the >126m height band were below 150m (i.e. all the flights recorded in the upper band have been considered at potential collision height). An additional year of flight activity surveys (September 2016 to November 2017) was also gathered using the same agreed vantage point locations. Flights were recorded using revised height bands in order to account for the higher turbine heights (0-20m, 21-40m, 41-100m, 101-150m, >151m). In addition to estimating collision risk, these data will be compared with the original baseline data to provide context for the precautionary assumption about flights recorded above 125m in the original data.

[3] Buffers for field surveys are based on SNH (2014) guidance.

[4] Delaunay triangulation is a form of mathematical/computational geometry where a given set of points (in this case the turbine locations) are all joined to create discrete triangles. Further information is available here: https://uk.mathworks.com/help/matlab/math/delaunay-triangulation.html

Table 9.1: Consultation Responses		
Consultee and Date	**Summary of Response**	**Comment/Action Taken**
Royal Society for the Protection of Birds (RSPB) 26th May 2017	Advised updated breeding bird surveys for hen harrier and red-throated diver should be undertaken in line with SNH 2014 guidance.	Surveys during the 2017 breeding season included updated surveys for breeding waders and scarce breeding birds (including but not limited to hen harrier and red-throated diver). Surveys followed SNH 2014 guidance in addition to survey methodology detailed by Gilbert *et al*. (1998) and Hardey *et al*. (2013).
	Advise increased precautionary approach to turbine set back around Tangy Loch of 1 km for roosting Greenland white-fronted geese.	As with the Tangy III design, the closest turbine to Tangy Loch (Turbine 5 for the Tangy IV proposed development), is 1 km away.
	Advise the EIA should assess the potential future use of the restructured forest and open ground by hen harrier.	Considered in paragraphs 9.4.43 to 9.4.53.
	Advise that turbines should not be located within 400 m of black grouse lek sites.	No turbines are within 400 m of the two black grouse leks located (paragraph 9.4.11).
	Due to the proximity of the Kintyre Goose Roosts SPA and potential for overflying Greenland white-fronted geese, sufficient information must be provided in the assessment to enable a Habitats Regulations Assessment (HRA) to be undertaken.	Sufficient information has been included in the assessment (Section 9.5) to allow for an HRA to be undertaken.
	Expect mitigation during the construction period to include timing constraints within sensitive breeding periods and during the period where Tangy Loch may be in use as a roost by Greenland white-fronted geese.	Refer to paragraph 9.5.23.
	Expect mitigation during the operational period to consider lighting issues related to attracting night-flying geese/birds.	Refer to paragraph 9.5.23, bullet point three. Refer also to Appendix 9.1 Annex F for a review by Prof. Bob Furness of artificial lighting and the potential impacts on birds.
	Cumulative assessment to be undertaken in line with SNH 2012 cumulative guidance.	Cumulative assessment undertaken in line with SNH 2012 guidance (paragraphs 9.5.63 to 9.5.77).

Effects to be Assessed

9.2.5 The following effects have been assessed in full in relation to construction, operation and decommissioning of the proposed development; and decommissioning of the existing Tangy I and Tangy II Wind Farms during the construction period of the proposed development:

9.2.6 Direct habitat loss for birds through construction of the proposed infrastructure.

9.2.7 Displacement of birds through indirect loss of habitat where birds avoid the proposed development and its surrounding area due to construction, turbine operation and maintenance and visitor disturbance. Displacement can also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds.

9.2.8 Habitat modification due to change in land cover (e.g. deforestation or effects on hydrology), and consequent effects on bird populations.

9.2.9 Death or injury of birds through collision with turbine blades, overhead wires (if any), anemometer masts, or fences (if any) associated with the proposed development.

9.2.10 Cumulative effects of the proposed development in the context of other nearby regulated projects or activities.

Effects Scoped Out of Assessment

9.2.11 No effects were scoped out prior to commencement of surveys.

9.2.12 On the basis and findings of the survey work undertaken, the professional judgement of MacArthur Green, experience from other relevant projects and policy guidance or standards, effects on a number of target species have been scoped out. A total of 73 bird species were recorded at, or within respective survey buffers, to the proposed development site during the ornithological surveys (Appendix 9.1 Annex D). Following recommendations in SNH (2018), effects on all target species of Low Nature Conservation Importance (as defined by Table 9.2 below) have been scoped out.

9.3 Methodology

Legislation, Policy and Guidance

9.3.1 The legislation and policies which are directly relevant to the assessment of ornithological effects have been summarised below. Refer to Chapter 6 (Planning Policy Context), for detailed planning policies relevant to the proposed development.

9.3.2 The assessment has been undertaken in line with the following European legislation and guidance:

- Directive 2009/147/EC on the Conservation of Wild Birds (Birds Directive);
- Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) (Habitats Directive);
- Environmental Impact Assessment Directive 85/337/EEC (as amended); and
- Wind energy developments and Natura 2000 (EC 2011).

9.3.3 The following national legislation, policy and guidance has been considered as part of the assessment:

- Birds of Conservation Concern 4 (Eaton *et al*. 2015);
- Chartered Institute of Ecology and Environmental Management (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. CIEEM, Winchester;
- Circular 1/2017; The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017;
- Policy Advice Note PAN 1/2013 – Environmental Impact Assessment (Scottish Government 2013);
- Scottish Natural Heritage (2000) Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action. SNH Guidance Note. SNH;
- Scottish Natural Heritage (2005, revised 2010) Survey methods for use in assessing the impacts of onshore windfarms on bird communities;
- Scottish Natural Heritage (2009) Environmental Statements and Annexes of Environmentally Sensitive Bird Information; Guidance for Developers, Consultants and Consultees;
- Scottish Natural Heritage (2011) Dealing with Construction and Breeding Birds;

- Scottish Natural Heritage (2012a) Assessing the Cumulative Impact of Onshore Wind Energy Developments;
- Scottish Natural Heritage (2012b) Post-construction management of windfarms on clear-felled forestry sites; reducing the collision risk for Hen Harrier, Merlin and Short-eared Owl from Special Protection Areas;
- Scottish Natural Heritage (March 2013) Avoidance Rates for Wintering Species of Geese In Scotland At Onshore Wind Farms;
- Scottish Natural Heritage (May 2013) Geese and wind farms in Scotland: new information;
- Scottish Natural Heritage (August 2013, revised 2014a) Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms;
- Scottish Natural Heritage (2014b, consultation draft released June 2018) Guidance Note, Repowering onshore wind farms: bird survey requirements;
- Scottish Natural Heritage (2016) Assessing connectivity with Special Protection Areas (SPAs);
- Scottish Natural Heritage (February 2018) Assessing Significance of Impacts from Onshore Wind Farms Out-with Designated Areas;
- SERAD (Scottish Executive Rural Affairs Department) 2000. Habitats and Birds Directives, Nature Conservation; Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and of Wild Flora and Fauna and the Conservation of Wild Birds ('the Habitats and Birds Directives'). Revised Guidance Updating Scottish Office Circular No 6/1995;
- The Argyll and Bute Local Biodiversity Action Plan;
- The Nature Conservation (Scotland) Act 2004 (as amended);
- The Scottish Biodiversity List; and
- The Wildlife and Countryside Act 1981 (as amended).

Method of Baseline Characterisation

Desk based research and data sources

9.3.4 The following data sources were considered as part of the assessment:

- SNH Sitelink (https://gateway/snh.gov.uk/sitelink/);
- Argyll Raptor Study Group; and
- Tangy I Wind Farm and Tangy II Wind Farm Environmental Statements, associated ES data, and subsequent ornithological monitoring reports.

Field survey techniques

9.3.5 As detailed in paragraph 9.2.1, in addition to the baseline surveys undertaken for Tangy III (April 2012 to March 2014), further surveys were undertaken between September 2016 and November 2017. The data from both blocks of surveys is considered as one data set below.

9.3.6 Ornithological surveys were undertaken to establish the baseline ornithological conditions at the proposed development site (plus appropriate buffers). Fieldwork commenced in April 2012 and was completed in November 2017. Within this period, surveys were undertaken between April 2012 to March 2014 and October 2016 to November 2017. These provided data covering three breeding seasons (2012, 2013 and 2017) and four non-breeding seasons (2012/2013, 2013/2014, 2016/2017 and 2017/2018[5]).

9.3.7 The following surveys were undertaken within the relevant survey areas (see Appendix 9.1, Annexes C and D for details):

[5] 2017/18 survey did not cover the entire breeding season (Sept-Nov only).

- Flight activity surveys – April 2012 to March 2014 and October 2016 to November 2017 (Figure 9.3 details viewshed areas);
- Scarce Breeding Bird Surveys (SBBS), survey area within the site boundary plus a 2 km buffer (Figure 9.2) – spring/summer 2012, 2013 and 2017;
- Black grouse surveys, survey area within the site boundary plus a 1.5 km buffer (Figure 9.2) – spring 2012, 2013 and 2017;
- Breeding Bird Surveys (BBS), survey area within the site boundary plus a 500 m buffer (Figure 9.2) – spring/summer 2012 and 2017;
- Winter Walkover (WWO) surveys, survey area within the site boundary plus a 500 m buffer (Figure 9.2) – winter 2012/2013 and 2016/2017;
- Goose Roost Surveys, survey area within the site boundary plus a 500 m buffer (Figure 9.2) – winter 2012/2013 and 2013/2014; and
- Woodland Point Count Surveys, survey area within the site boundary (Figure 9.4) – spring/summer 2012 and winter 2012/2013.

9.3.8 Field surveys were conducted following the relevant recommended SNH (2014a) Guidance as detailed above. Appendix 9.1, Annex B provides details of the survey methodologies.

Effects Evaluation Methodology

9.3.9 The assessment method follows the process set out in the relevant provisions of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 and The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (together, 'the EIA Regulations') and guidance on implementation of the Birds and Habitats Directive (SERAD, 2000).

9.3.10 The ways in which birds may be affected (directly or indirectly) by the construction and operation of the proposed development are:

- Direct habitat loss through construction of the wind farm (e.g. turbine bases, etc.).
- Indirect habitat loss due to birds avoiding the wind farm and its surrounding area. This may occur as a result of disturbance during construction, operation and maintenance and also due to increased visitor disturbance.
- Habitat modification due to associated changes in land cover (e.g. tree felling or effects on hydrology leading to altered suitability for foraging, breeding, etc).
- Barrier effects in which birds avoid the wind farm and are therefore forced to take alternative routes to feeding or roosting grounds.
- Death or injury through collision with turbine blades, overhead wires (if any), met masts, or fences (if any) associated with the wind farm.
- Any of the above effects acting cumulatively with those from other wind farm plans and projects (i.e. operational developments and those currently in the planning process).

Methodology for assessing likely significant effects on a Special Protection Area (SPA)

9.3.11 As detailed in paragraph 9.4.3, the Kintyre Goose Roosts SPA and the Arran Moors SPA are within 20 km (Figure 9.1) of the proposed development, however connectivity is only considered to potentially exist between the proposed development and the Kintyre Goose Roosts SPA (paragraph 9.4.6).

9.3.12 The method for assessing the significance of a likely effect on an SPA is different from that employed for wider-countryside ornithological interests (detailed below). The Habitats Directive is transposed into domestic legislation by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland). Regulation 48 includes a number of steps to be taken by the competent authority before granting consent (these are referred to here as a Habitats Regulations Appraisal, HRA). In order of application, the first four are:

- Step 1. Consider whether the proposal is directly connected to or necessary for the management of the SPA (Regulation 48(1)(b)).
- If not, Step 2. Consider whether the proposal, alone or in combination, is likely to have a significant effect on the SPA (Regulation 48(1)(a)).
- If so, Step 3. Make an Appropriate Assessment of the implications for the SPA in view of that SPA's conservation objectives (Regulation 48(1)(a)).
- Step 4. Consider whether it can be ascertained that the proposal will not adversely affect the integrity of the SPA ("Integrity Test") having regard to the manner in which it is proposed to be carried out or to any conditions or restrictions subject to which they propose that the consent, permission or other authorisation should be given (Regulation 48(5) and 48(6)).

9.3.13 It has already been established that the proposed development does not meet the criteria for Step 1. The assessment on the integrity of the SPA in relation to the proposed development is presented in this chapter. The results of baseline surveys and scientific conclusions presented in this chapter are used to inform the appraisal process, and potentially for the competent authority to conduct an Appropriate Assessment, if required.

9.3.14 The Kintyre Goose Roosts SPA conservation objectives are detailed below:

"*(1) To avoid deterioration of the habitats of the qualifying species (Greenland white-fronted goose) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and*

(2) To ensure for the qualifying species that the following are maintained in the long term:

(a) Population of the species as a viable component of the SPA;

(b) Distribution of species within the site;

(c) Distribution and extent of habitats supporting the species;

(d) Structure, function and supporting processes of habitats supporting the species; and

(e) No significant disturbance of the species."

Methodology for assessing wider-countryside ornithological interests

9.3.15 The evaluation for wider-countryside interests (interests unrelated to SPAs, but including SSSIs) involves the following process:

- Identifying the potential effects of the proposed development;
- Considering the likelihood of occurrence of potential effects where appropriate;
- Defining the sensitivity of a feature to effects via the Nature Conservation Importance (NCI) of the bird populations present and establishing each population's Conservation Status;
- Establishing the Magnitude of the likely effect (both spatial and temporal);
- Based on the above information, making a judgement as to whether or not the identified effect is significant with respect to the EIA Regulations;
- If a potential effect is determined to be significant, suggesting measures to mitigate or compensate the effect where required; and
- Considering residual effects after mitigation, compensation or enhancement.

Sensitivity

9.3.16 Determination of the level of sensitivity of a feature is based on a combination of the feature's NCI and Conservation Status, described in the sections below.

Methods used to evaluate the NCI of bird populations

9.3.17 There are three levels of NCI as detailed below in Table 9.2 – 'Important Ornithological Features (IOFs)' (CIEEM 2016) are those target species with High or Moderate NCI.

Table 9.2: Determining Factors of an Important Ornithological Feature's NCI	
Importance	**Definition**
High	Populations receiving protection due to inclusion as features of an SPA, proposed SPA, Ramsar Site, SSSI or which would otherwise qualify under selection guidelines. Species present in nationally important numbers (>1% national breeding population).
Moderate	The presence of target species listed in Annex 1 of the Birds Directive (but population does not meet the designation criteria under selection guidelines). The presence of breeding species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The presence of species noted on the latest Birds of Conservation Concern (BoCC) 'Red' list (Eaton *et al*. 2015). Regularly occurring migratory species, which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the windfarm. Species present in regionally important numbers (>1% regional breeding population).
Low	All other species' populations not covered by the above categories.

Methods used to evaluate conservation status of bird populations

9.3.18 As defined by SNH, the Conservation Status of a species is, "the sum of the influences acting on it which may affect its long-term distribution and abundance, within the geographical area of interest (which for the purposes of the Birds Directive is the EU)" (SNH 2018).

9.3.19 Conservation Status is considered favourable under the following circumstances (SNH 2018):

- "*Population dynamics indicate that the species is maintaining itself on a long-term basis as a viable component of its habitats";*
- *"The natural range of the species is not being reduced, nor is it likely to be reduced for the foreseeable future"; and*
- *"There is (and probably will continue to be) a sufficiently large habitat to maintain its population on a long-term basis*".

9.3.20 SNH states that "*an impact should therefore be judged as of concern where it would adversely affect the existing favourable conservation status of a species or prevent a species from recovering to favourable conservation status, in Scotland*" (SNH 2018).

9.3.21 The relevant scale for breeding species is considered to be the appropriate Natural Heritage Zone (NHZ), in this case the Argyll West and Islands (NHZ 14). However, for some populations, insufficient information on the NHZ population may exist. In these circumstances the regional or national population estimate is used. For wintering or migratory species, the national population is often considered to be the relevant scale for determining effects on the Conservation Status (SNH 2018) and this approach is used in this assessment.

Impact Magnitude

9.3.22 An impact is defined as a change to the abundance and/or distribution of a population as a result of the wind farm. Effects can be adverse, neutral or beneficial.

9.3.23 In determining the magnitude of impacts, the resilience of a population to recover from temporary adverse conditions is considered in respect of each potentially affected population.

9.3.24 The sensitivity of individual species to disturbance during relevant behaviours is considered when determining spatial and temporal magnitude of effect and is assessed using guidance including Bright *et al*. (2006), Hill *et al*. (1997) and Ruddock and Whitfield (2007).

9.3.25 Impacts are judged in terms of magnitude in space and time. There are five levels of spatial and temporal impacts as detailed in Table 9.3 and Table 9.4 below respectively.

Table 9.3: Spatial Magnitude of Impact	
Spatial Magnitude	**Definition**
Very High	Total/near total loss of a bird population due to mortality or displacement. Total/near total loss of productivity in a bird population due to disturbance. Guide: >80% of population lost through additive mortality.
High	Major reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 21-80% of population lost through additive mortality.
Moderate	Partial reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 6-20% of population lost through additive mortality.
Low	Small but discernible reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 1-5% of population lost through additive mortality.
Negligible	Very slight reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Reduction barely discernible, approximating to the "no change" situation. Guide: <1% population lost through additive mortality.

Table 9.4: Temporal Magnitude of Impact	
Temporal Magnitude	**Definition**
Permanent	Effect continuing indefinitely beyond the span of one human generation (taken as approximately 30 years), except where there is likely to be substantial improvement after this period. Where in this case, Long Term may be more appropriate.
Long Term	Approximately 15-30 years or longer (see above).
Medium Term	Approximately 5-15 years.
Short Term	Up to approximately 5 years.
Negligible	Very minor (<6 months) or no temporal effect.

Effects Significance

9.3.26 The predicted significance of the effect has been determined through a standard method of assessment based on professional judgement, considering both sensitivity (i.e. each bird species' relative sensitivity to a particular effect) and magnitude of impact. The significance criteria used in this assessment are listed in Table 9.5.

Table 9.5: Determining Significance of Effects	
Significance of Effect	**Definition**
Major	The impact is likely to result in a long term significant adverse effect on the integrity of a feature.
Moderate	The impact is likely to result in a medium term or partially significant adverse effect on the integrity of a feature.
Minor	The impact is likely to adversely affect a feature at an insignificant level by virtue of its limitations in terms of duration or extent, but there will probably be no effect on its integrity.

Table 9.5: Determining Significance of Effects	
Significance of Effect	**Definition**
Negligible	No impact.

9.3.27 'Major' and 'Moderate' impacts are considered to be Significant in accordance with the EIA Regulations.

9.3.28 'Minor' and 'Negligible' impacts are considered to be Not Significant in accordance with the EIA Regulations.

Assessing Cumulative/In-combination Effects

9.3.29 The significance of cumulative and/or in-combination effects is assessed following the same methodology as detailed above for the proposed development alone (paragraphs 9.3.9 to 9.3.28). The assessment follows SNH (2012a) guidance for cumulative assessment.

Limitations of Assessment

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

9.4 Baseline Conditions

Current Baseline

Context

9.4.1 This section describes the existing conditions within the ornithological study area comprising:

- Statutory nature conservation designated sites for birds within 20km of the proposed development;
- Birds recorded during baseline ornithology surveys (refer to Appendix 9.1 for full details);
- Data available from Tangy I (1993-94) and Tangy II (1994/95 to 2003/04) Environmental Statements and associated post-construction monitoring (2005/06) is referenced where relevant below; and
- Historic breeding records provided by the Argyll Raptor Study Group (ARSG).

9.4.2 The baseline data recorded for each target species is detailed per species below and the rationale for scoping each species in or out of the assessment is also included at this point.

Designations

9.4.3 Information gathered from the consultation exercise revealed that there are no statutory conservation designations within the proposed development but the proposed development is within 20 km of two SPAs (Figure 9.1):

- Kintyre Goose Roosts SPA (Table 9.6) (underpinned by Kintyre Goose Roosts Ramsar, Tangy Loch SSSI, Kintyre Goose Lochs SSSI and Rhunahaorine Point SSSI) – various distances to the north, east and south east (Table 9.8); and
- Arran Moors SPA (Table 9.7) (underpinned by Arran Moors SSSI) – 19.4 km to the east.

Table 9.6: Summary of Qualifying Features of the Kintyre Goose Roosts SPA/Ramsar (and Tangy Loch SSSI[a], Kintyre Goose Lochs SSSI[b] and Rhunahaorine Point SSSI[c])			
Feature	**Qualifying Feature Category**	**Status6**	**Description**
Greenland white-fronted goose *Anser albifrons flavirostris* Non-breeding	SPA, SSSI[a], SSSI[b], SSSI[c]	Favourable Maintained: April 2014	Wintering population of international importance: winter peak mean (1991/92 – 1995/96) of 2,300 representing 8% of the world population and 16% of the GB population. The SPA comprises two main populations which roost and feed within different sections of the SPA: • To the north, birds that use Rhunahaorine Point, Loch an Fhraoich and Loch Garasdale roosts and which feed on improved agricultural land around Rhunahaorine Point; and • To the south, birds that use Loch Lussa, Tangy Loch and Black Loch roosts and which feed on improved agricultural land around Laggan.
Little tern *Sternula albifrons* *Breeding*	SSSI[c]	Unfavourable Declining: May 2017	Largest little tern breeding colony in Kintyre, nine to 25 pairs present between 2006 and 2009. Previously this population was assessed as Favourable Maintained in July 2010. However, no little terns are known to have nested at this site in any year since 2013 (annual Argyll Bird Reports and Argyll Bird Club database).

Table 9.7: Summary of Qualifying Features of the Arran Moors SPA (and SSSI)			
Feature	**Qualifying Feature Category**	**Status7**	**Description**
Hen harrier *Circus cyaneus* Breeding	SPA, SSSI	Favourable Maintained: July 2009	Breeding population of European importance: annual average of 21 breeding females (1994-1998) representing 4% of the GB population.
Breeding bird assemblage	SSSI	Favourable Maintained: July 2013	Moorland that provides a diverse range of breeding and foraging habitats for a nationally important breeding bird assemblage including red-throated diver *Gavia stellata*, golden eagle *Aquila chrysaetos*, peregrine falcon *Falco peregrinus* and short-eared owl *Asio flammeus*.

Table 9.8: Distances between the proposed development[8] and the Composite Parts of the Kintyre Goose Roosts SPA, Ramsar and underpinning SSSIs		
Section	**Compass Direction**	**Distance**
Tangy Loch	South east	500 m
Lussa Loch	East	1.5 km
Black Loch	South east	6.1 km
Loch an Fhraoich	North	18.0 km
Rhunahaorine Point	North west	19.2 km
Loch Garasdale	North	22.2 km

[6] According to http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8614
[7] According to http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8614
[8] Distances measured from nearest turbine to nearest section of SPA site boundary.

9.4.4 SNH (2016) lists hen harrier foraging distances from a nest site during the breeding season as between 2 km (core range) and 10 km (maximum range). Based on these distances, connectivity for hen harrier can be discounted between the proposed development and the Arran Moors SPA (19.4 km).

9.4.5 SNH (2016) also details goose winter foraging ranges and Greenland white-fronted geese are considered to range 5-8 km from their night roosts. Based on these distances and considering the distances to the various designated components of the Kintyre Goose Roosts SPA (Table 9.8), connectivity for Greenland white-fronted goose can be discounted between the proposed development and the Loch an Fhraoich, Rhunahaorine Point and Loch Garasdale components of the Kintyre Goose Roosts SPA. However, connectivity must be considered for the Tangy Loch, Lussa Loch and Black Loch components of the Kintyre Goose Roosts SPA.

9.4.6 Based on the above considerations, Arran Moors SPA has been scoped out of the assessment. Due to the connectivity of the proposed development to Tangy Loch, Lussa Loch and Black Loch, the Kintyre Goose Roosts SPA is scoped into the assessment.

Barnacle Goose

9.4.7 Flight activity surveys recorded one flight of six individuals (Figure 9.12, detailed in Appendix 9.1 Annex D Table D-1) across the entire flight activity survey period (three breeding and four non-breeding seasons). Annual collision risk for the worst case turbines (across the five candidate models) was 0.0021 (equivalent to one bird every 475 years).

9.4.8 One flock of five barnacle geese was also recorded on Lussa Loch in July 2017. The timing of this record suggests that these may have been feral or escapee birds, since the migratory populations normally are on their Arctic breeding grounds between April and September.

9.4.9 Migratory populations of barnacle goose are listed in Annex 1 of the EU Birds Directive and as Amber in the BoCC list and the species is therefore of Moderate NCI. Considering this species' low on-site activity and negligible predicted risk of collision, **barnacle goose is scoped out of the assessment**.

Black Grouse

9.4.10 Four black grouse were noted in the wider area in spring 1994 as part of baseline surveys for Tangy I Wind Farm.

9.4.11 Targeted black grouse surveys undertaken during the 2012 and 2013 breeding seasons located no lekking grouse within 1.5 km of the proposed development, however surveys within the same survey area located two small leks during 2017 surveys (Figure 9.24). Lek 1 recorded a maximum of two males and one female and is approximately 930 m from the nearest proposed turbine and 825 m from the nearest infrastructure (track). Lek 2 recorded a maximum of three males (and no females) and is over 2.5 km from the nearest proposed turbine or infrastructure.

9.4.12 Black grouse is listed as Red in the BoCC list and is therefore of Moderate NCI. Considering this species' low onsite activity and that no leks are within 750 m of the proposed development[9], **black grouse is scoped out of the assessment**.

Common Sandpiper

9.4.13 Flight activity surveys recorded nine flights (Figure 9.15, detailed in Appendix 9.1 Annex D Table D-1) across the entire flight activity survey period (three breeding and four non-breeding seasons), however none of these flights were considered to be 'at-risk'[10] and consequently no collisions were predicted.

[9] Recommended construction disturbance buffer for black grouse, operational disturbance buffer is 500 m.

[10] 'At-risk' is defined as – a flight having at least part of its duration (i) at Potential Collision Height (PCH) ; (ii) within the CRAA; and (iii) recorded within the 2 km viewshed of the associated VP.

9.4.14 Breeding bird surveys in 2012 and 2017 identified one and two territories respectively however no territories were located within the 500 m study area (Figure 9.20), with common sandpiper activity focused on the edges of Tangy Loch and Lussa Loch. This mirrored breeding bird survey results from 1993 which recorded breeding common sandpiper concentrated around Tangy Loch.

9.4.15 Common sandpiper is listed as Amber in the BoCC list and is therefore of Low NCI. Considering this species' low on-site activity, zero predicted risk of collision and Low NCI, **common sandpiper is scoped out of the assessment.**

Curlew

9.4.16 Flight activity surveys recorded 22 flights (Figure 9.5, detailed in Appendix 9.1 Annex D Table D-1) across the entire flight activity survey period (three breeding and four non-breeding seasons). Of these, 17 were included in the collision risk modelling as they were within the appropriate viewshed and the CRAA (refer to Appendix 9.1, Section 4.1.1 for further detail). The annual collision rate for the worst case turbine (of the five under consideration) was 0.0674 (equivalent to one bird every 14.8 years, or 1.69 birds across a 25-year lifespan of the wind farm).

9.4.17 Wilson *et al*. (2015) estimate there were 207 breeding pairs of curlew within NHZ 14. At an annual adult mortality of 0.264 (BTO BirdFacts) there will be a loss of 109.3 birds per year from the NHZ population. The additional predicted loss of 0.0674 birds a year due to collision would therefore equate to an additional mortality of 0.06% which is considered to be of **negligible** magnitude (Table 9.3).

9.4.18 Breeding bird surveys in 2012 and 2017 identified three and two territories respectively with two territories each year located within the 500 m study area (Figure 9.16 and Figure 9.17). Of these territories within the 500 m study area, one nest in both 2012 and 2017 was located under 50 m from an installed turbine. Whilst it has been suggested that curlew nest densities may be reduced within 800 m of wind turbines (Pearce-Higgins *et al.* 2008), more recent evidence (Whitfield *et al.* 2010) offers little support to the hypothesis that breeding curlew are displaced by operational turbines (even at 200 m). In addition, more recent research suggests that breeding curlew are not sensitive to disturbance and that there is no correlation between nesting success and turbine proximity (Whitfield *et al*. 2010). There is direct evidence of this at Tangy I and Tangy II where one curlew territory has been recorded within 50 m of a turbine during the 2012 and 2017 baseline surveys, indicating that curlew at the proposed development have continued to breed within the vicinity of operational turbines further supporting the apparent insensitivity to disturbance in this species, and possibly indicating habituation to the presence of turbines.

9.4.19 Breeding bird surveys in 1993 recorded breeding curlew concentrated around Tangy Loch.

9.4.20 Curlew is listed as Red in the BoCC list and is therefore of Moderate NCI. Considering this species' breeding activity levels within the 500 m study area and the available information regarding breeding disturbance, the additional suitable habitat available outwith the proposed development, and negligible predicted risk of collision, **curlew is scoped out of the assessment**.

Goldeneye

9.4.21 Goldeneye were recorded in low numbers on Tangy Loch during the 2012/2013 and 2016/2017 winter walkover surveys.

9.4.22 Goldeneye is listed in Schedule 1 of the Wildlife and Countryside Act and as Amber in the BoCC list and is therefore of Moderate NCI. Considering this species' very low on-site activity and no predicted risk of collision, **goldeneye is scoped out of the assessment**.

Golden Eagle

9.4.23 Flight activity surveys recorded one flight of a juvenile across the entire flight activity survey period (three breeding and four non-breeding seasons; Figure 9.16, detailed in Appendix 9.1 Annex D Table D-1), however this flight was not considered to be 'at-risk'[10] and consequently no collisions were predicted.

9.4.24 No other golden eagles were recorded across the whole survey period (April 2012 to March 2014 and October 2016 to November 2017) and there are no known territories within 6 km of the proposed development[11].

9.4.25 Golden eagle is listed in Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside Act, as Green in the BoCC list and is therefore of Moderate NCI. Considering this species' low on-site activity, no breeding activity within 6 km and no predicted risk of collision, **golden eagle is scoped out of the assessment**.

Greenland White-fronted Goose

9.4.26 Flight activity surveys recorded 132 flights[12] across the entire flight activity survey period (three breeding and four non-breeding seasons; Figure 9.6, detailed in Appendix 9.1 Annex D Table D-1). Of these, nine were included in the collision risk modelling as they were within the appropriate viewshed and the CRAA (refer to Appendix 9.1, Section 4.1.1 for further detail). The mean annual nonbreeding collision rate for the worst case turbine (of the five candidate models) was 0.0382 (equivalent to one bird every 26.2 years).

9.4.27 Comparing flight activity gathered from all surveys, flight activity levels were comparable between the 2012/2013 and 2016/2017 non-breeding seasons (Table 9.9), however there was a slight increase in flight activity between the operational wind farm and Tangy Loch and Lussa Loch (i.e. closer to the operational Tangy I and Tangy II wind farm and the proposed development, Figure 9.6 and Figure 9.26) during the 2016/2017 non-breeding season (six of the nine flights included in the collision modelling were recorded during the 2016/2017 non-breeding season).

9.4.28 Of the nine flights included in the collision modelling, two were recorded crossing over the operational Tangy I and Tangy II Wind Farms, however of the combined total recorded flight time of 170 seconds, only nine were spent flying within rotor swept heights (between 100 m – 150 m) with the rest of the time flying above 150 m. No other surveys recorded Greenland white-fronted goose flights crossing the operational Tangy I and Tangy II Wind Farm (Figure 9.6 and Figure 9.26).

Table 9.9: All Greenland White-Fronted Goose[13] Flight Records per Season

Season	Number of Flights	Average Flock Size	Flock size Range
2012/2013 Recorded between September 2012 and mid-May 2013	67	146	7 – 1000
2013/2014 Recorded between September 2013 and March 2014	36	77	6 – 230
2016/2017 Recorded between October 2016 and mid-May 2017	68	126	3 – 810
2017/2018 Recorded between September and November 2017	3	15	1 – 24

9.4.29 Figure 9.26 details all recorded goose activity (Greenland white-fronted goose, greylag goose, barnacle goose and grey goose, the latter for birds which could only be identified as either greylag or Greenland white-fronted goose), and it is clear that the majority of flight activity was focussed around Tangy Loch and Lussa Loch, with flights predominantly located between the two lochs and heading south west away from Tangy and Lussa Lochs.

[11] Nearest known eyries are 10-15 km to the south and 10km to the north.

[12] Of these, 57 were only recorded as grey goose (i.e. it was not possible to distinguish to species). As a precautionary measure, these have been considered as both greylag and Greenland white-fronted geese for the purposes of the collision modelling – only one of the nine flights considered in the collision modelling was of a 'grey goose'.

[13] NB: this includes birds recorded only as grey goose (refer to footnote 7).

9.4.30 Many of the goose flights recorded in the 2012/2013 non-breeding season were of large flocks numbering several hundred birds flying along the same flight path within minutes of each other as they commuted to or from the Lussa Loch roost. The largest observations were of approximately 1,000 geese leaving Lussa Loch and heading south towards the Laggan (a large lowland area favoured for grazing located between Campbeltown and Machrihanish) on the morning of 11th December 2012, and at dusk on the 6th February 2013 when approximately 1,320 grey geese bypassed the proposed development to the east and south-east on their way into Lussa Loch. During the 2013/2014 non-breeding season, no flights passed over the proposed development and all were travelling to or from Lussa Loch.

9.4.31 Goose roost surveys near Tangy Loch (south-east of the proposed development) during the 2012/2013 non-breeding season recorded a further 11 flights totalling 520 birds. Two records of Greenland white-fronted geese over Tangy Loch as shown were recorded on 7th January 2013 when a total of 70 birds spent time circling over the loch in dense mist, apparently disorientated. Goose roost surveys during the 2013/2014 non-breeding season recorded a further 21 flights totalling 1,670 birds, again mainly oriented south/north and passing to the east of the proposed development.

9.4.32 The only other flight records of Greenland white-fronted (or grey geese) were two incidental observations; on the 4th November 2013 when 480 birds (comprising six groups following the same flight path) flew into Tangy Loch, and on 10th January 2014 120 birds were observed flying towards Lussa Loch along the established flight path to the east of the proposed development.

9.4.33 Greenland white-fronted geese were recorded roosting and loafing on Tangy Loch on only four occasions; 150 birds landed on Tangy Loch on 26th November 2012, 480 birds landed on Tangy Loch on 4th November 2013, 12 birds were recorded on Tangy Loch on 26th October 2016 during flight activity surveys and 24 birds were recorded on Tangy Loch on 9th October 2017 during flight activity surveys.

9.4.34 In summary, 144 records of Greenland white-fronted geese (including those records of grey goose) were recorded across the baseline survey period (April 2012 to March 2014 and October 2016 to November 2017). Nine flights were within 500 m (i.e. the CRAA) of the proposed development and two overflew the operational Tangy I and Tangy II wind farm. This closely mirrors the data collected for Tangy I and Tangy II Wind Farms and from post-construction monitoring which indicates an established flight path to the east with very few flights over the proposed development or into Tangy Loch.

9.4.35 As also found by previous studies for Tangy I and II, it would appear that Lussa Loch is the main roosting loch for this sub-population of geese as virtually all goose flights recorded were either coming from, or heading into, Lussa Loch. These flights also all seem to take the same general and established flight path taking a line south or south-west along the valley to the south of, and over, Tangy Loch and by Skeroblin Hill and Skeroblin Cruach. Figure 9.26 details all the goose flight data collected across the baseline surveys (April 2011 to March 2014 and October 2016 to November 2017) and these observations indicate that goose flights are almost all located outside the collision risk area.

9.4.36 Tangy Loch was seldom used and this corresponds with the Site Management Statement (SNH, undated a) for Tangy Loch SSSI which notes that "*Greenland white-fronted geese do not, at present, use Tangy Loch as a regular roost site. For reasons not clearly understood, it appears that the geese now use the nearby Lussa Loch as their preferred roost site, with Tangy Loch as an infrequently used satellite roost. No on-site factors can currently be linked to the decrease in goose usage of Tangy Loch. There is no evidence that the recently constructed Tangy Wind Farm and associated power lines have affected goose usage of Tangy Loch*".

9.4.37 The Kintyre Goose Roosts SPA and Ramsar had a 1991/92 - 1995/96 winter peak mean of 2,300 Greenland white-fronted geese, 8% of total world population; 16% of GB and was last assessed in 2014 as Favourable Maintained. The condition of the notified natural feature of Kintyre Goose

Lochs SSSI was monitored between November 2000 and March 2004. Numbers of Greenland white-fronted geese at the site have been maintained. The average of the international field counts, 2000-01 to 2003-04 was 2,208, an increase of 0.36% on the baseline figure (1990/01 – 1994/95 winter peak mean). Crabtree *et al.* (2010) however estimated from winter counts that the peak Kintyre population of Greenland white-fronted goose in the winter of 2009/2010 was 3,360 individuals, and the population was stable.

9.4.38 Greenland white-fronted goose is listed in Annex 1 of the EU Birds Directive, as Red in the BoCC list and is the designated feature of the Kintyre Goose Roosts SPA (Table 9.6) and is therefore of High NCI. Given this species' High NCI, the proximity of the Tangy Loch, Lussa Loch and Black Loch components of the Kintyre Goose Roosts SPA, and (on the basis of the Habitats Regulations) that a Likely Significant Effect cannot be ruled out, **Greenland white-fronted goose is scoped in to the assessment.**

Greylag Goose

9.4.39 Flight activity surveys recorded 100 flights[14] (Figure 9.7, detailed in Appendix 9.1 Annex D Table D-1) across the entire flight activity survey period (three breeding and four non-breeding seasons). Of these, 21 were included in the collision risk modelling as they were within the appropriate viewshed and the CRAA (refer to Appendix 9.1, Section 4.1.1 for further detail). The mean non-breeding season[15] collision rate for the worst case turbine was of 0.4642 (equivalent to one bird every 2.2 non-breeding seasons).

9.4.40 Whilst the Icelandic and resident greylag geese are indistinguishable in the field, the Icelandic greylag goose population is now considered to overwinter almost exclusively in Orkney (Mitchell *et al.* 2010) and it is therefore appropriate to assume that greylag geese recorded in Argyll are part of the resident Scottish breeding population. Mitchell et *al.* (2010) estimated a north and west Scottish greylag goose population of 34,500 birds. At an annual adult mortality of 0.17 (BTO BirdFacts) the natural mortality is around 5,865 birds per year from the north and west Scottish population. The additional predicted loss of 0.4642 birds a year due to collisions would therefore equate to an additional mortality of 0.008% which is considered to be of **negligible** magnitude (Table 9.3).

9.4.41 Winter walkovers during the 2012/2013 non-breeding season recorded 24 greylag geese in flight to the west of the proposed development (Figure 9.21) and targeted surveys to monitor goose roosting behaviour at Tangy Loch recorded three flocks of greylag geese (totalling 45, six and eight birds, Figure 9.25).

9.4.42 Two populations of greylag goose can be found in Scotland, of which the relevant one for this assessment is the resident population (listed as Amber in the BoCC list and therefore of Low NCI). Considering this species' low on-site activity, low NCI and negligible predicted risk of collision, **greylag goose is scoped out of the assessment**.

Hen Harrier

9.4.43 Flight activity surveys recorded 24 flights (Figure 9.8, detailed in Appendix 9.1 Annex D Table D-1) across the entire flight activity survey period (three breeding and four non-breeding seasons). Of these, 14 were included in the collision risk modelling as they were within the appropriate viewshed and the CRAA (refer to Appendix 9.1, Section 4.1.1 for further detail). The mean annual collision rate for the worst case turbine model was 0.0008 (equivalent to one bird every 1,209 years).

[14] Of these, 57 were only recorded as grey goose (i.e. it was not possible to distinguish to species). As a precautionary measure, these have been considered as both greylag and Greenland white-fronted geese for the purposes of the collision modelling – only one of the 21 flights considered in the collision modelling was of a 'grey goose'.

[15] Flight activity surveys exclusively recorded greylag geese during the non-breeding season for geese (1st September to 14th May, SNH 2014).

9.4.44 Hen harriers were recorded infrequently within the 2 km study area during scarce breeding bird surveys, with one record in 2012, one record in 2013, and six records in 2017 (Figure 9.22). Winter walkover surveys also recorded hen harrier on one occasion in February 2013 (Figure 9.21). we found no evidence of breeding within 2 km of the proposed development and the ARSG have no records of breeding within 2 km of the proposed development.

9.4.45 There was no evidence of breeding hen harrier presented in historical data. Results from Tangy I Wind Farm indicated that hen harriers occasionally hunted over the area but did not breed there.

9.4.46 Hen harrier activity was focussed in three main areas around the proposed development; the open ground to the north west of the site boundary (east of the Killocraw and North Lagalgarve properties), the area around Tangy Loch as far west as the eastern side of the current operational Tangy I and Tangy II), and around the central section of Lussa Loch (along the open ground along the edges of the loch and adjacent areas of clear felled forest) (Figures 9.8, 9.21 and 9.22).

9.4.47 The proposed development is situated across open ground (i.e. the ground including and surrounding the operational Tangy I and Tangy II) and commercial conifer plantation (predominantly closed canopy). Felling is therefore planned for parts of the plantation within the site boundary (Figure 16.1). The forest will be clear felled and replanted to a key hole design to allow for the construction of tracks/turbine pads and clearance for the rotor swept areas (Figure 16.2). Of the 463.86 ha of woodland within the site boundary, 270.75 ha would be felled. Replanting on the site will include 196.35 ha of productive conifer plantation, with an additional 3.50 ha of native broadleaf planting. 31.7 ha is proposed to be retained as open ground around turbines/tracks, and 30.43 ha will be designed open ground[16].

9.4.48 SNH guidance (2012b) on post-construction management of wind farms on clear felled forest sites indicates that when the forest is removed, the ground between wind rows regenerates quickly to produce a sward dominated by rank grass, often with small self-seeded trees. This is ideal habitat for hen harrier prey such as short-tailed field vole and, in the earlier stages, meadow pipit. The rank vegetation on clear felled sites can therefore provide suitable foraging habitat for hen harrier and is likely to increase the attractiveness of the site to this species and, in turn, lead to a potential increased collision risk.

9.4.49 The existing habitat within the forest rides at the proposed development is generally a mix of wet modified bog, wet heath, dry heath and marshy grassland habitats (Figure 10.2) which may also support suitable foraging habitat for hen harrier. The felling of plantation could therefore open up the ride network (on a temporary basis until the restocked plantation matures) which could increase the attractiveness of the ride habitats to foraging hen harriers. It should be noted however that because the forest will be approximately 40 years old across most of its extent at the time of felling, much of the understory vegetation will have been shaded out and lost for a considerable period of time, thereby rendering the site to be of poor quality vole habitat and limiting the ability for quick regeneration of suitable habitat.

9.4.50 Whilst it is acknowledged that the felling associated with the proposed development could create additional suitable habitat for foraging hen harriers, the potential creation of relatively small additional areas of moderately suitable habitat is considered unlikely to generate substantial changes in the level of hen harrier activity at the proposed development (especially considering there have been no recorded nesting attempts within 2 km across the entire survey period).

9.4.51 SNH (2012b) also suggests two possible approaches to estimate the post-felling collision risk to hen harrier:

- Use flight activity data over non-forested area of the survey area as a surrogate for future use of the cleared area; or

[16] It should be noted that a reasonable portion of this is already open ground as it comprises of pre-existing forest rides and watercourse boundaries.

- Multiply pre-felling collision risk by a factor to take account of increased use of the site after felling.

9.4.52 As a collision risk was generated for hen harrier (0.0008, paragraph 9.4.43), the second approach has been considered. Approximately 31 % of the current forested habitat within the site boundary is proposed to be cleared for the proposed development (i.e. for tracks and turbine areas). As a precautionary approach it has been assumed that this will double the amount of open habitat available. Consequently, the hen harrier activity and collision risk may also be doubled. This would generate an adjusted predicted collision risk of 0.0016. Wilson *et al*. (2015) estimate that there were 125 breeding pairs of hen harrier within NHZ 14. At an annual adult mortality of 0.19 (BTO BirdFacts) there will be a loss of 47.5 birds per year from the NHZ population. This worst case predicted loss of 0.0016 birds a year due to collision would therefore equate to an additional mortality of 0.003% which is considered to be of **negligible** magnitude (Table 9.3).

9.4.53 Hen harrier is listed in Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside Act, as Red in the BoCC list and is therefore of Moderate NCI. Considering this species' low on-site activity, no recorded breeding activity, negligible predicted risk of collision, and the limited effects of the removal of areas of forest, **hen harrier is scoped out of the assessment**.

Herring Gull

9.4.54 Flight activity surveys recorded 42 flights (Figure 9.9, detailed in Appendix 9.1 Annex D Table D-1) across the entire flight activity survey period (three breeding and four non-breeding seasons). Of these, 14 were included in the collision risk modelling as they were within the appropriate viewshed and the CRAA (refer to Appendix 9.1, Section 4.1.1 for further detail). The mean annual collision rate for the worst case turbine model was 0.1869 (equivalent to one bird every 5.4 years).

9.4.55 Wilson *et al*. (2015) estimated that there may be 9,372 breeding pairs of herring gull within NHZ 14 and considering an annual adult mortality of 0.12 (BTO BirdFacts) this would equate to a loss of 2,249.3 birds per year from the NHZ population. The additional predicted loss of 0.1869 birds a year due to collision would therefore equate to an additional mortality of 0.008%.

9.4.56 Breeding bird surveys during the 2013 and 2017 breeding seasons incidentally recorded herring gull on Tangy Loch and foraging (often in mixed gull flocks) in fields that border the application boundary to the north west to south. No evidence of breeding was recorded. Winter walkover surveys during the 2012/2013 and 2016/2017 non-breeding seasons also recorded herring gull (Figure 9.21).

9.4.57 Herring gull is listed as Red in the BoCC list and is therefore of Moderate NCI. Considering this species' low on-site activity and low predicted risk of collision, **herring gull is scoped out of the assessment.**

Merlin

9.4.58 Flight activity surveys recorded eight flights (Figure 9.17, detailed in Appendix 9.1 Annex D Table D-1) across the entire flight activity survey period (three breeding and four non-breeding seasons). Of these, two were included in the collision risk modelling as they were within the appropriate viewshed and the CRAA (refer to Appendix 9.1, Section 4.1.1 for further detail). The mean annual collision rate for the worst case turbine model was 0.00001 (one bird every 75,129 years).

9.4.59 Merlin was only recorded on one occasion within the 2 km study area during scarce breeding bird surveys in 2013 (Figure 9.22). we found no evidence of breeding within 2 km of the proposed development and the ARSG have no records of breeding within 2 km of the proposed development.

9.4.60 Merlin activity was focussed on the open ground to the north west of the site boundary (east of the Killocraw and North Lagalgarve properties, Figure 9.17) with one flight also recorded on the open ground adjacent to the operational Tangy I and Tangy II. Merlins prefer to hunt in open ground or

along forest edges (SNH 2012b) and, like hen harrier, the currently forested nature of the northern half of the proposed development is considered to be of relatively low suitability for merlin.

9.4.61 As detailed in paragraphs 9.4.47 to 9.4.50 for hen harrier, the removal of forest for the proposed development could create additional suitable habitat for merlin (SNH 2012b). However, as detailed above for hen harrier, the fragmented and relatively small amount of potentially suitable additional habitat created for the proposed development is unlikely to generate substantial changes in the level of merlin activity at the proposed development (especially considering there have been no recorded nesting attempts within 2 km across the entire survey period).

9.4.62 As for hen harrier, SNH (2012b) suggests two possible approaches to estimate the post-felling collision risk to merlin:

- Use flight activity data over non-forested area of the survey area as a surrogate for future use of the cleared area; or
- Multiply pre-felling collision risk by a factor to take account of increased use of the site after felling.

9.4.63 As a collision risk was generated for merlin (0.00001, paragraph 9.4.58), the second approach has been considered. Approximately 31 % of the current forested habitat within the site boundary is proposed to be cleared for the proposed development (i.e. for tracks and turbine areas). As a precautionary approach it has been assumed that this will double the amount of open habitat available. Consequently, the merlin activity and collision risk may also be doubled. Wilson *et al*. (2015) estimate that there were 13 breeding pairs of merlin within NHZ 14. At an annual adult mortality of 0.38 (BTO BirdFacts) there will be a loss of 9.88 birds per year from the NHZ population. The additional worst case predicted loss of 0.00002 birds a year due to collision would therefore equate to an additional mortality of 0.0002% which is considered to be of **negligible** magnitude (Table 9.3).

9.4.64 Merlin is listed in Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside Act and as Red in the BoCC list and is therefore of Moderate NCI. Considering this species' low on-site activity, absence of breeding, negligible predicted risk of collision, and the limited effects of the removal of areas of forest, **merlin is scoped out of the assessment**.

Osprey

9.4.65 Ospreys were not recorded over the course of flight activity surveys between April 2011 to March 2014 and October 2016 to November 2017. Consequently, no collisions were predicted.

9.4.66 Scarce breeding bird surveys during the 2017 breeding season located an osprey nest to the north east of the proposed development (Confidential Figure 9.23) however the nest is over 2.5 km from the nearest proposed turbine. Ospreys were recorded fishing over Lussa Loch on two occasions during the 2017 breeding season surveys (Figure 9.22) with no records of osprey activity during 2012 and 2013 surveys.

9.4.67 Osprey is listed in Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside Act and as Amber in the BoCC list and is therefore of Moderate NCI. Considering this species' low on-site activity, no breeding activity within 2 km and zero predicted risk of collision, **osprey is scoped out of the assessment**.

Oystercatcher

9.4.68 Flight activity surveys recorded two flights (Figure 9.10 detailed in Appendix 9.1 Annex D Table D-1) across the entire flight activity survey period (three breeding and four non-breeding seasons). Of these, one was included in the collision risk modelling as they were within the appropriate viewshed and the CRAA (refer to Appendix 9.1, Section 4.1.1 for further detail). The mean annual collision rate for the worst case turbine model was 0.0027 (equivalent to one bird every 364 years).

9.4.69 Breeding bird surveys in 2012 and 2017 identified one territory during 2012 (Figure 9.20) and no breeding evidence in 2017. The territory identified during 2012 was located within the 500 m study area. The oystercatcher territory was relatively close (approximately 90 m) to an existing operational turbine (and 91 m from a proposed turbine).

9.4.70 Oystercatcher is listed as Amber in the BoCC list and is therefore of Moderate NCI. Considering the low level of breeding activity within the 500 m study area, the presence of additional suitable habitat available outwith the proposed development, and no predicted risk of collision, **oystercatcher is scoped out of the assessment**.

Peregrine Falcon

9.4.71 Flight activity surveys recorded five flights (Figure 9.11, detailed in Appendix 9.1 Annex D Table D-1) across the entire flight activity survey period (three breeding and four non-breeding seasons). Of these, four were included in the collision risk modelling. The mean annual collision risk for the worst case turbine model was 0.0154 (equivalent to one bird every 65 years).

9.4.72 Peregrine falcons were recorded infrequently within the 2 km study area during scarce breeding bird surveys, with no records in 2012, one record in 2013, and three records in 2017 (Figure 9.22). We found no evidence of breeding within 2 km of the proposed development and the ARSG have no records of breeding within 2 km of the proposed development.

9.4.73 Peregrine falcon is listed in Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside Act and as Green in the BoCC list and is therefore of Moderate NCI. Considering this species' low on-site activity, absence of breeding and negligible predicted risk of collision, **peregrine falcon is scoped out of the assessment.**

Red-throated Diver

9.4.74 Flight activity surveys recorded one flight of an individual (Figure 9.13, detailed in Appendix 9.1 Annex D Table D-1) across the entire flight activity survey period (three breeding and four non-breeding seasons), however this flight was not considered to be 'at-risk'[10] and consequently no collisions were predicted.

9.4.75 Red-throated divers were occasionally recorded fishing and loafing on Tangy Loch with three records during the 2013/2014 non-breeding season and two during the 2017 breeding season. No breeding behaviour or evidence of breeding was recorded during any surveys during the 2012, 2013 or 2017 breeding seasons.

9.4.76 Red-throated divers were recorded on Tangy Loch in March and April of 2002, 2003, and 2004. Pairs were present in 2002 and 2004 but there are no data on whether these birds were breeding and it is not known whether they bred on Tangy Loch, or (as is more likely) were using it for loafing or fishing.

9.4.77 Red-throated diver is listed in Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside Act and as Green in the BoCC list and is therefore of Moderate NCI. Considering this species' minimal on-site activity, absence of breeding and no predicted risk of collision, **red-throated diver is scoped out of the assessment.**

Short-eared Owl

9.4.78 Short-eared owl was not recorded over the course of flight activity surveys between April 2011 to March 2014 and October 2016 to November 2017. Consequently, there were no predicted collisions.

9.4.79 Short-eared owl was only recorded on one occasion within the 2 km study area during scarce breeding bird surveys in 2012 (Figure 9.22). We found no evidence of breeding within 2 km of the proposed development and the ARSG have no records of breeding within 2 km of the proposed development.

9.4.80 Short-eared owl is listed in Annex 1 of the EU Birds Directive and as Amber in the BoCC list and is therefore of Moderate NCI. Considering this species' minimal on-site activity, absence of breeding and no predicted risk of collision, **short-eared owl is scoped out of the assessment.**

Snipe

9.4.81 Flight activity surveys recorded three flights (Figure 9.18, detailed in Appendix 9.1 Annex D Table D-1) between October 2016 and November 2017. Prior to October 2016, snipe was only recorded in the secondary species flight activity summaries (2012/2013 surveys, one record of an individual; 2013/2014 surveys, four records totalling 11 birds) and consequently these flights could not be included in the collision modelling. For the three later flights considered at risk of collisions, the mean annual collision risk for the worst case turbine model was 0.0118 (equivalent to one bird every 85 years).

9.4.82 Wilson *et al*. (2015) estimated 1,289 breeding pairs of snipe within NHZ 14 and considering an annual adult mortality of 0.519 (BTO BirdFacts) this would equate to a loss of 1,337.9 birds per year from the NHZ population. The additional predicted loss of a worst case of 0.0118 birds a year due to collision would therefore equate to an additional mortality of 0.001%.

9.4.83 One potential breeding snipe territory was located during 2017 surveys, however it was on the edge of Tangy Loch and outwith the 500 m study area (bird flushed from stream, Figure 9.20). Three snipes were also recorded during the 2016/2017 non-breeding season surveys (Figure 9.21).

9.4.84 Breeding bird surveys related to the baseline surveys for Tangy I in 1993 recorded breeding snipe concentrated around Tangy Loch.

9.4.85 Snipe is listed as Amber in the BoCC list and is therefore of Moderate NCI. Considering this species' negligible collision risk and no breeding activity within 500 m of the proposed development, **snipe is scoped out of the assessment**.

Whooper Swan

9.4.86 Flight activity surveys recorded one flight of an individual bird (Figure 9.14, detailed in Appendix 9.1 Annex D Table D-1) across the entire flight activity survey period (three breeding and four non-breeding seasons). This flight was not at risk of collision (above rotor height) therefore no collisions were predicted.

9.4.87 Surveys for goose roosting activity during the 2013/2014 non-breeding season recorded 14 whooper swans leaving Tangy Loch in two groups, heading west (Figure 9.25).

9.4.88 Whooper swans were recorded infrequently during surveys for Tangy II over the winters of 2001/2002, 2002/2003, 2003/2004 and early 2007. A single bird was noted on Tangy Loch on 29th January 2002, and on 17th February 2004 three birds were recorded flying into Tangy Loch. In January 2007 two whooper swan flights were recorded (both of three birds), one group flew from Lussa Loch and landed on Tangy Loch (approaching from the east) and the second group approached from the west (destination was unconfirmed). In April 2007 a flight of two whooper swans was recorded north of the wind farm. There are no records of whooper swans overflying the proposed development in any of the historical data available.

9.4.89 Whooper swan is listed in Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside Act and Amber in the BoCC list and is therefore of Moderate NCI. Considering this species' low on-site activity and no predicted risk of collision, **whooper swan is scoped out of the assessment.**

Woodcock

9.4.90 Flight activity surveys recorded one flight of an individual (Figure 9.19, detailed in Appendix 9.1 Annex D Table D-1) across the entire flight activity survey period (three breeding and four non-breeding seasons). Woodcock was not identified to be 'at-risk' during collision risk modelling and consequently there were no predicted collisions.

9.4.91 Woodcocks were also recorded on one occasion (November 2012) during woodland point counts and on one occasion (two birds) during the 2012/2013 winter walkovers (Figure 9.21).

9.4.92 Woodcock is listed as Red in the BoCC list and is therefore of Moderate NCI. Considering this species' low on-site activity, no record of breeding and no predicted risk of collision, **woodcock is scoped out of the assessment.**

Future Baseline

9.4.93 In the absence of the proposed development, and the continuation of current land management in the wider area, the bird assemblage recorded during baseline surveys is likely to remain relatively consistent over the long-term, although with a continuation of commercial rotational forestry practices, abundances and distributions of species are likely to vary through time.

Summary

9.4.94 A summary of the IOFs identified as being sensitive to the proposed development and which have been 'scoped-in' to the assessment is given in Table 9.10, together with the justification for inclusion.

9.4.95 All other IOFs detailed in section 9.4 have been scoped out due to very low or zero predicted collision risks and/or breeding activity recorded during baseline surveys and lack of habitat suitability within the proposed development.

Table 9.10: Summary of Feature Sensitivity for species scoped in to the assessment

Feature	Sensitivity	Justification
Greenland white-fronted goose and Kintyre Goose Roosts SPA (Tangy Loch, Lussa Loch and Black Loch)	High NCI[17]	Designated feature of the Kintyre Goose Roosts SPA and recorded during baseline surveys. Lochs listed are within 8 km of the proposed development and connectivity cannot be ruled out.

9.5 Effects Evaluation

Basis of Assessment

9.5.1 This section provides an assessment of the likely effects of the proposed development on the IOFs identified through the baseline studies and scoped-in assessment. The assessment of effects is based on the project description outlined in Chapter 4: Project Description and is structured as follows:

- Construction effects – disturbance;
- Operational effects – collision risk;
- Operational effects – displacement;
- Decommissioning effects; and
- Cumulative/In Combination effects.

Project Assumptions

9.5.2 The assessment below also makes the following assumptions:

- All electrical cabling between the proposed turbines and the associated infrastructure will be underground in shallow trenches which would be reinstated post-construction and, in most cases, follow the proposed access tracks.
- Any disturbance areas around permanent infrastructure during construction will be temporary and areas will be reinstated or restored before the construction period ends. The only

[17] As defined in paragraph 9.4.38.

excavation in these areas will be for cabling as noted above and otherwise may only be periodically used for side-casting of spoil until reinstatement.

- To ensure all reasonable precautions are taken to avoid negative effects on ornithological interests during construction and decommissioning, the developer will appoint a suitably qualified Ecological Clerk of Works (ECoW) prior to the commencement of construction and decommissioning and they will advise the developer and the Principal Contractor on all ornithological matters (with the assistance of a suitably qualified/licenced ornithologist if required). The ECoW will be required to be present on the site during the construction and decommissioning periods and will carry out monitoring of works and briefings with regards to any ornithological sensitivities on the site to the relevant staff within the principal contractor and subcontractors.
- A Breeding Bird Protection Plan (BBPP) will be implemented during construction and decommissioning of the proposed development. The BBPP will detail measures to safeguard breeding birds known to be in the area. The BBPP shall include pre-construction surveys and good practice measures during construction. Pre-construction surveys will be undertaken to check for any new breeding bird activity in the vicinity of the construction/decommissioning works.
- Work on the proposed development, including tree clearance and construction of the site access tracks, turbine hard standings and site compound and erection of the turbines is predicted to last up to 22 months. The number of bird breeding seasons potentially disrupted would depend on the month in which construction commences and the breeding season of the potentially affected species. The breeding season of most birds at the proposed development extends from April to July (Forrester *et al.* 2007). For the purposes of this assessment it is assumed that, for any given species of bird, construction activities would commence during the breeding season and would therefore potentially affect breeding for a maximum of two years, assuming that construction will take approximately 22 months.

Likely Significant Effects

9.5.3 For the purposes of this assessment, Greenland white-fronted goose effects also require consideration within the context of the Kintyre Goose Roosts SPA via the HRA process. The Magnitude of Effect is therefore considered within the context of the Kintyre Goose Roosts SPA population in addition to the wider countryside population. With regards to the HRA (as detailed above in paragraphs 9.3.11 to 9.3.14), and as previously stated, the proposed development is not directly connected to, or necessary for the management of, the SPA (Step 1) and it is considered likely to have a significant effect, either alone or in combination, on the SPA (Step 2). Step 3 requires an Appropriate Assessment to be undertaken of the implications for the SPA in view of that SPA's conservation objectives. This chapter provides information to inform the Appropriate Assessment.

Predicted Effects: Construction

9.5.4 The main potential effects of construction activities across the proposed development are the displacement and disruption of breeding/wintering and foraging birds as a result of noise and general disturbance over a short-term period (either the duration of a particular construction activity within working hours, or the duration of the whole construction period).

9.5.5 Effects on breeding/wintering birds would be confined to areas surrounding temporary construction compounds, turbines, tracks and other infrastructure. Relevant information has been consulted for the purposes of this assessment, and although much of the scientific evidence of the effects on birds in relation to construction activities have produced inconsistent conclusions, as a broad generalisation, larger bird species such as raptors, or those that feed in flocks in the open tend to be more susceptible to disturbance than small birds living in structurally complex habitats (such as woodland, scrub and hedgerow) (Hill *et al.* 1997).

9.5.6 Direct habitat loss will also occur due to the construction of the proposed development, which will be both short-term (e.g. temporary compounds, laydown areas) and long-term (access tracks and turbines). This may impact on breeding or foraging individuals.

Greenland White-Fronted Goose

9.5.7 For the purposes of this assessment, the effect is considered within the context of the Kintyre Goose Roosts SPA as all the Greenland white-fronted geese recorded are assumed to be components of the SPA population (and associated SSSIs).

9.5.8 The information presented here may also inform an appropriate assessment should SNH advise the competent authority that this is required.

9.5.9 To establish the impact of the proposed development on the integrity of an SPA, it is necessary to consider the relevant conservation objectives which may be affected. The conservation objectives for the Kintyre Goose Roosts SPA are outlined in paragraph 9.3.15.

9.5.10 **Effect – Roosting and Flight Path Displacement:** In light of the proposed development's proximity to the SPA, conservation objectives 1, 2a, 2b and 2e are considered relevant. Conservation objectives 2c and 2d are not relevant and are therefore scoped out of the HRA.

9.5.11 Construction phase activities may displace birds from flying between their roosting and foraging grounds or disturb roosting birds by virtue of increased activity within the proximity of the SPA/local area.

9.5.12 **Nature Conservation Importance and relevant Conservation Status:** as an Annex 1 and BoCC Red listed species, with connectivity to an SPA, Greenland white-fronted goose is classified as High NCI. The Greenland white-fronted goose is a very localised winter visitor to Scotland with the 2016 British spring count reported as 10,286 (of which 5,183 were recorded on Islay, Goose News Issue 16). About 30 locations in Scotland (mostly on the west coast) provide safe roost sites from which birds travel out to forage in nearby wetland or grass pasture (Forrester *et al.* 2007). The majority of the Scottish sites are in Argyll, with the highest numbers on Islay (5,183 birds in Spring 2016, Goose News Issue 16). The distribution is linked to what was ancestrally their peat bog habitat, and although now they feed most commonly on agriculturally improved grasslands, there is usually a link to traditional peat bog or loch roost sites. In autumn, birds may briefly use feeding areas away from their traditional wintering sites, but re-sightings of marked birds show very high between-year wintering site fidelity. The Scottish population increased from around 7,000 birds in the early 1980s (numbers that had been depleted by shooting) to a peak of around 22,000 in 1998/99, after which numbers have declined despite protection (Forrester *et al.* 2007). The initial rise in numbers was due to a ban on hunting from 1981, however breeding productivity in Greenland declined consistently from the early 1980s, and the productivity in recent years has not been enough to replace mortality (Stroud *et al*. 2012). The breeding population has declined by about 30% between the 1990s and 2010 (Stroud *et al*. 2012). This poor breeding success may relate to the spread of Canada geese in Greenland but this is uncertain. Twelve sites in Scotland have been designated as SPAs for this species and it is Red-Listed under international conservation criteria and is a priority for action in the UK. The present conservation status is considered Unfavourable in Scotland due to this recent large decline in numbers and prolonged low breeding success.

9.5.13 The Kintyre Goose Roosts SPA and Ramsar supports a wintering population of international importance with a mean winter peak (1991/92 – 1995/96) of 2,300 representing 8% of the world population and 16% of the GB population and was last assessed in 2014 as **Favourable Maintained**. The condition of the notified natural feature of Kintyre Goose Lochs SSSI was monitored between November 2000 and March 2004. Numbers of Greenland white-fronted geese at the site have been maintained. The average of the international field counts, 2000-01 to 2003-04 was 2,208, an increase of 0.36% on the baseline figure (1990/01 – 1994/95 mean winter peak). Crabtree *et al*. (2010) however, estimated from winter counts that the peak Kintyre population of Greenland

white-fronted goose in the winter of 2009/2010 was 3,360 individuals, and that the population was stable.

9.5.14 **Magnitude of Effect:** Greenland white-fronted geese were recorded across all surveys (mainly VP and goose roost surveys) across 174 recorded flights during the 2012/2013, 2013/2014, 2016/2017 and 2017/2018 non-breeding seasons. Of these, only nine flights passed within 500 m of the proposed development (i.e. within the CRAA) and only four crossed the airspace where the proposed development would be (two overflew the operational Tangy I and Tangy II wind farm). Virtually all flight activity was associated with flights to and from Lussa Loch (1.5 km east to the closest turbine), which is considered the main roosting loch for this sub-population of geese, and along a long and well-established north-south flight path to the east of the proposed development. This flight path is consistent with a large body of historical data and evidence that indicates this is the preferred and established route to and from Lussa Loch. Disturbance to roosting geese at Lussa Loch is not considered likely, given the distance of the loch from the proposed development and the natural visual and noise screening that the local topography, retained forest both within and outwith the application boundary to the east provides.

9.5.15 Tangy Loch (approximately 500 m from the proposed development) is a rarely used roosting loch for these geese and there are only four instances of geese landing, or being observed, on Tangy Loch recorded during baseline surveys (9.4.33). On the two occasions when geese came in to land on Tangy Loch the approach flight to the loch was from the south-east (i.e. south of Tangy Loch and therefore the proposed development). The recent survey findings of infrequent use of Tangy Loch match the evidence gathered over the past 20 years that this is a rarely used satellite roosting site for Greenland white-fronted geese and it is more likely to be used by small numbers of greylag geese (SNH, undated a; Lawrence, 2004).

9.5.16 Given how infrequently Tangy Loch is used as a roost, any disturbance effects on this roost are likely to be minimal as any birds that may use it will likely, in light of any possible disturbance effects upon approach, alter their course and continue on to the nearby and main roost site at Lussa Loch.

9.5.17 The proposed development is within the site of the existing Tangy I and Tangy II Wind Farms, the first of which has been in operation for almost 20 years, and as noted by SNH (undated) there is no evidence to indicate that the construction of these wind farms caused any disturbance or flight activity displacement during construction. Forest felling has been undertaken in the vicinity of Lussa Loch in the recent past without any obvious effects, and therefore it may be reasonably assumed the construction of the proposed development will also have minimal effect on goose flight activity.

9.5.18 During construction, goose flightlines may shift slightly further away from the proposed development to keep further away from any construction disturbance at the proposed development. This would not result in any additional energetic costs since the flight deviation will be insignificant in the context of their normal daily activities. Under the worst-case construction scenario, disturbance will occur over 20 months, which could affect up to three non-breeding seasons (albeit partially).

9.5.19 Within the context of the wider population, the construction effect on the Greenland white-fronted goose population is therefore considered to be **Negligible** spatial and **Short Term** temporal.

9.5.20 Within the context of the Kintyre Goose Roosts SPA, the construction effect on the Greenland white-fronted goose population associated with the SPA is therefore considered to be **Negligible** spatial and **Short Term** temporal.

9.5.21 **Significance of Effect:** based on the considerations above and prior to any mitigation, the significance of effect on the wider countryside Greenland white-fronted goose population is considered to be **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

9.5.22 Whilst a Likely Significant Effect could not be ruled out for Greenland white-fronted goose, the magnitude of effect (arising from construction) is considered to be minimal and therefore there is **no potential for an Adverse Effect on the Integrity of the Kintyre Goose Roosts SPA** under the Habitat Regulations (9.3.11 to 9.3.14).

9.5.23 **Proposed Mitigation:** Although no significant effects are predicted, a number of mitigation measures will be put in place during the winter period to ensure all reasonable measures are taken to avoid disturbance to commuting flights of, or roosting, Greenland white-fronted geese in the area:

- Prior to the commencement of works an agreed timetable for construction, which takes account of the need to protected geese using Tangy Loch or Lussa loch from disturbance during building works, shall be submitted and approved by Argyll and But Council in consultation with SNH. The duly approved timetable shall be adhered to be contractors for the duration of the construction period;
- Any construction works, vehicular traffic, or other activity shall be confined to the period 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays. Turbine deliveries would only take place outside these times with the prior consent of the local authority and police. Those activities that are unlikely to give rise to noise audible at the site boundary may continue outside of the stated hours; and
- Any blasting shall be confined to Monday to Friday, between the hours of 10:00 and 16:00. Blasting on Saturday mornings shall be a matter for negotiation between contractor and the local authority.

9.5.24 The Ecological Clerk of Works (ECoW) will oversee the implementation of the above mitigation measures.

9.5.25 **Residual Construction Effects:** given that no mitigation is required, the residual effects of construction disturbance on wintering Greenland white-fronted goose remain as above (i.e. **Not Significant**), however the proposed mitigation will ensure that construction disturbance is minimised still further below the predicted effect level.

Predicted Effects: Operation – Collision Risk

9.5.26 Birds that utilise the airspace within the turbine area at potential collision heights during the lifetime of the proposed development will be at risk of collision with turbines. The risk of collision with moving wind turbine blades is related to the amount of flight activity over the site, the topography of the site, the species' behaviour, and the ability of birds to detect and manoeuvre around rotating turbine blades.

9.5.27 Band *et al.* (2007) describe a method of quantifying potential bird collisions with onshore turbines, in which: (i) the activity rate per unit area per season is extrapolated; (ii) the likelihood of a collision with a blade for a bird passing through the rotor swept area is calculated; and (iii) an 'avoidance rate' is applied to account for behavioural adaptation of birds to the presence of turbines. This results in a figure for the likely mortality rate at the wind farm which is then assessed within the context of the species' relevant populations to determine the significance of any losses. Collision Risk Modelling (CRM) results are presented per species (including those scoped out) in Table 9-3 to Table 9-8 in **Appendix 9.1** with details of all the collision modelling output located in **Appendix 9.1, Annex E**.

Greenland White-Fronted Goose

9.5.28 The HRA process, as described above in Construction Effects, is applicable here for collision mortality effects on Greenland white-fronted geese. SPA conservation objectives 1 and 2a are considered relevant.

9.5.29 **Effect:** wintering Greenland white-fronted geese flying into and out of Tangy Loch and Lussa Loch may be subject to collision risk with turbines, which could affect the SPA, regional and Scottish

population size. Following collision risk modelling, a highest mean non-breeding season collision risk for Greenland white-fronted goose of 0.0382 was predicted (one bird every 26.2 years; further details can be found in **Appendix 9.1, Annex E**.

9.5.30 Given the presence of the existing Tangy I and Tangy II Wind Farm, there is potential that the collision rate has been underestimated for the proposed development as a consequence of reduced goose flight activity within the current Wind Farm (i.e. that the existing Wind Farm has altered goose flight paths that would, in the absence of the Wind Farm, have flown over the area covered by the existing Wind Farm and therefore been included in the collision modelling for the proposed development). To account for this, a precautionary adjustment to the predicted collision rate has been undertaken by subtracting the area of the operational Tangy I and Tangy II Wind Farms (77ha) from the area of the Tangy IV CRAA (602.4ha) to obtain an estimate of the CRAA for just the new development area (525.4ha). The collision risk for this reduced CRAA was calculated from that for the complete CRAA, by multiplying the original estimate by the area of the total CRAA divided by the area of the reduced CRAA[18]. This generates an adjusted annual collision rate for Greenland white-fronted goose of 0.0438 (one bird every 22.8 years).

9.5.31 **Nature Conservation Importance and relevant Conservation Status:** Greenland white-fronted goose is considered to be of High NCI. The Scottish population is considered to be in an Unfavourable Conservation Status, however the SPA population (and indeed the regional Argyll population) was considered as of April 2014 to be Favourable Maintained (paragraph 9.5.12).

9.5.32 **Magnitude of Effect:** Greenland white-fronted goose adult annual survival rate over the period 1982-2007 was estimated at 0.88 (Trinder 2010). Geese are relatively long-lived, slow breeding species, and as such population growth is most sensitive to change in the adult survival rate. Changes to this rate have a proportionally much greater effect on the risk of population decline than changes to either juvenile survival or reproduction (Trinder, 2010).

9.5.33 The British wintering population has been most recently estimated as 10,286 birds of which 5,183 overwinter on Islay (Goose News Issue 16). Considering the population outwith Islay (5,103), at an annual adult mortality of 0.12 (Trinder 2010) this indicates a minimum loss of 612 birds per year (this assumes adult mortality for all age classes – in reality younger birds will have higher mortality). The additional predicted loss of 0.0438 birds per year due to collision would therefore equate to an additional mortality of 0.007 % which is considered to be of **negligible** magnitude (Table 9.3).

9.5.34 The SPA population is estimated to be 2,300 birds, which at an annual adult mortality of 0.12 (Trinder 2010) indicates a minimum loss of 276 birds per year (assuming adult mortality), the additional predicted loss of 0.0438 birds per year due to collision would therefore equate to an increase in mortality of 0.016% which is considered to be of **negligible** magnitude (Table 9.3).

9.5.35 Wintering geese have been assessed as having a very high turbine collision avoidance rate at onshore wind farms, with an avoidance rate of 99.8% advised by SNH (SNH 2013a and 2013b). This would indicate that if geese were to fly near the proposed development during the operational period, the risk of collision would be very low and unlikely to be of a level that would be noticeable against annual background mortality rates. There are no reported collisions of geese associated with the existing Tangy I and II Wind Farm projects.

9.5.36 Within the context of the wider population, the magnitude of collision effect on the Greenland white-fronted goose population is therefore considered to be **Negligible** spatial and **Long Term** temporal.

9.5.37 Within the context of the Kintyre Goose Roosts SPA and SSSIs, the magnitude of collision effect on the Greenland white-fronted goose population is therefore considered to be **Negligible** spatial and **Long Term** temporal.

[18] i.e. (602.4/525.4) X 0.0382

9.5.38 **Significance of Effect:** based on the considerations above and prior to any mitigation, the significance of effect on the wider countryside Greenland white-fronted goose population is considered to be **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

9.5.39 Whilst a Likely Significant Effect could not be ruled out for Greenland white-fronted goose, the magnitude of effect (arising from operation) is considered to be minimal and therefore there is **no potential for an Adverse Effect on the Integrity of the Kintyre Goose Roosts SPA** under the Habitat Regulations (9.3.11 to 9.3.14).**Proposed Mitigation:** none required, however it is proposed that operational monitoring should be undertaken of Greenland white-fronted goose roosting activity (and flight paths) at Tangy Loch and Lussa Loch (see Section 9.6).

9.5.40 **Residual Operational Effects:** given that no mitigation is required, the residual effects of collisions on wintering Greenland white-fronted goose remain as above (i.e. **Not Significant**).

Predicted Effects: Operation – Displacement

Evidence of displacement of breeding and non-breeding birds in general

9.5.41 The displacement of nesting and foraging birds from the proposed development has the potential to extend beyond the construction phase, as described above, and to occur during the operational phase. It is recognised that disturbance may occur due to maintenance activities throughout the operational phase, although since these are likely to be of shorter duration and smaller extent than construction activities, effects will be lower than those predicted for construction effects (see previous section).

9.5.42 Displacement away from operational turbines has been found to occur in a number of individual wind farm studies, although the effects vary considerably between sites and species. Devereux *et al*. (2008) showed that wind farms had no, or at most a minimal, effect on the local distribution of wintering farmland birds and across a range of breeding bird species but predominantly waders and passerines at upland wind farms, Pearce-Higgins *et al.* (2012) found no displacement effects on any bird species at operating wind farms, other than where such displacement had already occurred during construction, and for some species the effects during construction were reversed during operation with numbers returning to pre-construction numbers. Consistent with the findings of Pearce-Higgins *et al*. (2012), Hale *et al*. (2014) found no evidence of displacement due to wind turbines in breeding grassland songbirds. However, Sansom *et al.* (2016) suggested that breeding golden plovers may be affected by operational turbines up to 400 m away.

9.5.43 A North American study of redheads (which are ducks) found that breeding numbers at ponds within the wind farm were reduced by 77% compared to the situation pre-construction despite a three-fold increase in breeding numbers in the area outwith but near to the wind farm (Lange *et al*. 2018), suggesting that breeding ducks avoided nesting within the wind farm area itself.

9.5.44 An additional consideration is the displacement of birds from larger areas where the turbines act as a barrier to bird movement. The likelihood of this effect occurring tends to increase with wind farm size, where large turbine arrays can force birds to alter their regular flight-paths, resulting in an increase in distance flown and so energy expended. However, a review of the literature suggests that none of the barrier effects identified so far have significant effects on populations (Drewitt and Langston, 2006). This was also the conclusion from modelling of energy costs to those bird species most likely to be sensitive to barrier effects (large and long-lived breeding birds such as seabirds) by Masden *et al.* (2010).

9.5.45 Pearce-Higgins *et al*. (2009) observed certain species experiencing localised population increases with proximity to wind farm infrastructure installations, so while some birds may be displaced locally, others may benefit from the introduction of new structures into the habitat, or some other consequence of construction. This finding was further supported by Pearce-Higgins *et al*. (2012) who reported significant increases in breeding numbers of skylarks and stonechats at wind farms.

Evidence of Displacement of Geese by Wind Farms

9.5.46 Rees (2012) reviewed evidence for behavioural responses of geese to wind farms in literature published up to early 2012. She concluded that there was insufficient evidence at that time to determine whether landscape-scale displacement of foraging geese occurred as a result of wind farms. However, she concluded that geese tend to avoid foraging within 100 m of wind turbines, and that geese tended to alter flight direction when between 5 and 1 km distant, to avoid entering wind farms and so may experience a barrier effect. This was confirmed by Plonczkier and Simms (2012), who used radar to track flights of geese near to an operational offshore wind farm, and concluded that geese showed very high macro-avoidance, over 94% of flocks adjusting their flight direction to avoid entering the wind farm.

9.5.47 Rees (2012) concluded that available evidence at that time was insufficient to assess the scale or extent of displacement of geese. Since then, several detailed studies have improved the evidence base. While Larsen and Madsen (2000) found that pink-footed geese tended to avoid foraging within 100 m of wind turbines, Madsen and Boertmann (2008) showed that these birds demonstrated habituation to the presence of turbines, foraging in 50% smaller avoidance distances than they had initially shown when the wind farms first became operational. Habituation of foraging habitat use by geese and other birds to the presence of operational wind farms has also been shown by Farfan *et al*. (2017).

9.5.48 Zehtindjiev *et al*. (2017) concluded that wind farms in agricultural habitat did not cause any displacement at a landscape scale of red-breasted geese wintering in Bulgaria. Harrison *et al*. (2018) did find local displacement by wind turbines of white-fronted geese wintering in Bulgaria, but considered that the displacement was very small scale, with densities reduced <100 m from turbines. The main determinant of foraging goose density in their study was distance from the roost site rather than presence of wind farms or other human structures such as roads and power lines which had only very local effects (Harrison *et al*. 2018).

Greenland White-Fronted Goose

9.5.49 **Effect – Roosting and Flight Path Displacement:** the conservation objectives relevant to this effect are 1, 2a, 2b and 2e. The turbines and operational activities (e.g. turbine maintenance) may displace birds from flying between their roosting and foraging grounds or disturb roosting birds by virtue of increased activity within the proximity of the SPA/local area. Field surveys and historical data have indicated the main roosting loch for Greenland white-fronted geese and the subpopulation in the vicinity of the proposed development is Lussa Loch, with Tangy Loch being a very infrequently used satellite roost. There is an established roost flight path in a well-defined corridor to the east of the proposed development.

9.5.50 **Nature Conservation Importance and relevant Conservation Status:** Greenland white-fronted goose is of High NCI. The Scottish population is considered to be in an Unfavourable Conservation Status, however the SPA population (and indeed the regional Argyll population) is considered as of April 2014 to be Favourable Maintained (paragraph 9.5.12).

9.5.51 **Magnitude of Effect:** Figure 9.26 details all goose flight activity recorded across all surveys. The flight paths to and from Lussa Loch is to the east of the proposed development over Skeroblin Cruach which corroborates with a substantial body of historical data over the past 20 years, indicating that this is the established flight path of the geese over a number of goose generations (Appendix 9.1 Annex G). Goose flight paths around Tangy Loch (mainly of greylag goose and grey goose), either crossed east/west below the operational Tangy I and Tangy II (and therefore also the proposed development) or headed south on a broad front around Skeroblin Hill (Figure 9.26). Only four Greenland white-fronted goose flights were recorded crossing the proposed development (with two of these crossing the operational Tangy I and Tangy II at height). These four flights account for a small proportion of the total flight activity (2.3 %), therefore displacement effects on commuting geese are unlikely to have an effect as the geese tend to use the well-established flight paths as described and rarely overly the proposed development.

9.5.52 Tangy Loch (approximately 500 m from the proposed development) is a rarely used roosting loch for these geese and there are only four instances of geese landing, or being observed, on Tangy Loch recorded during baseline surveys (9.4.33). On the two occasions when geese came into land on Tangy Loch the approach flight to the loch was from the south-east (i.e. from below Tangy Loch and therefore the proposed development). The recent survey findings of infrequent use of Tangy Loch match the evidence gathered over the past 20 years that this is a rarely used satellite roosting site for Greenland white-fronted geese and it is more likely to be used by small numbers of greylag geese (SNH, undated a; Lawrence, 2004).

9.5.53 The historical data consulted only makes one observation of four Greenland white-fronted geese altering their flight path as result of the existing turbines at Tangy I wind farm. This small flock was within the context of more than an estimated 13,500 goose movements recorded over the 2002/2003 winter surveys. These geese made a measured diversion to the north-east around the wind farm area and continued on their original course, however this would appear to be an infrequent occurrence and any energy costs of any extra flight or flight deviation will be insignificant in the context of their normal daily activities.

9.5.54 In keeping with most other studies of displacement, it appears that geese have a low sensitivity to disturbance at operational wind farms and at most maintain a buffer of a few hundred metres but often much less (Larsen and Madsen 2000, Madsen and Boertmann 2008), although more so with regards daily commutes between roosts and feeding sites (Rees 2012). They will occasionally fly through wind farms (Rees 2012) but they have been found to show high macro-avoidance (tending to fly around rather than through wind farms; Plonczkier and Simms 2012), and to be highly adept at avoiding individual turbines (SNH 2013a, SNH 2013b). Given the distance of the proposed development site from the established flight path and roost sites, and that a wind farm has been operational on the same site since the mid-1990s to which the geese may have habituated to without apparent effect on the population or their behaviour it implies any avoidance of the area close to turbines would be of long-term temporal and negligible spatial magnitude at the population or subpopulation level.

9.5.55 Within the context of the wider population, the operational displacement effect on Greenland white-fronted goose population is therefore considered to be **Negligible** spatial and **Short Term** temporal.

9.5.56 Within the context of the Kintyre Goose Roosts SPA, the operational displacement effect on the Greenland white-fronted goose population associated with the SPA is therefore considered to be **Negligible** spatial and **Short Term** temporal.

9.5.57 **Significance of Effect:** based on the considerations above and prior to any mitigation, the significance of effect on the wider countryside Greenland white-fronted goose population is considered to be **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

9.5.58 Whilst a Likely Significant Effect could not be ruled out for Greenland white-fronted goose, the magnitude of effect (arising from operational displacement) is considered to be minimal and therefore there is **no potential for an Adverse Effect on the Integrity of the Kintyre Goose Roosts SPA** under the Habitat Regulations (9.3.11 to 9.3.14).

9.5.59 **Proposed Mitigation:** none required, however it is proposed that operational monitoring should be undertaken of Greenland white-fronted goose roosting activity (and flight paths) at Tangy Loch and Lussa Loch (see Section 9.6).

9.5.60 **Residual Operational Effects:** given that no mitigation is required, the residual effects of collisions on wintering Greenland white-fronted goose remain as above (i.e. **Not Significant**).

Predicted Effects: Decommissioning

9.5.61 Decommissioning effects, because of the long timeframe until their occurrence (around 25-30 years), are difficult to predict with confidence. For the purpose of this chapter they are considered

to be similar to those of construction effects in nature, but of shorter duration, with the result being a restored habitat within an area where displaced birds will be able to return. Thus, effects assessed during construction are considered to apply to decommissioning.

9.5.62 An equivalent mitigation strategy to that described in paragraph 9.5.23 will ensure any displacement to Greenland white-fronted geese associated with Tangy Loch and Lussa Loch is kept to a minimum.

Predicted Effects: Cumulative & In-Combination

9.5.63 This section presents information about the potential cumulative and in-combination effects of the proposed development combined with other nearby existing or proposed projects or activities that are subject to an EIA process.

9.5.64 SNH (2012) provides guidance on assessing the cumulative effects on birds. This assessment follows the principles set out in that guidance. According to SNH, *"The key principle for all cumulative impact assessments is to focus on the likely significant effects and in particular those which are likely to influence the outcome of the consenting process".*

9.5.65 Cumulative effects may include cumulative disturbance-displacement, collision mortality, habitat loss or barrier effects. Some cumulative effects, such as collision risk may be summed quantitatively, but according to SNH (2012), "*In practice some effects, such as levels of disturbance or the barrier effect, may need considerable additional research work to assess impacts quantitatively. A more qualitative process may need to be applied until this quantitative information is available, e.g. from post-construction monitoring or research*".

9.5.66 For the cumulative assessment, the NHZ level is considered practical and appropriate for breeding species of wider countryside interest. For the in-combination assessment (required for the HRA) and considering the SNH (2016) connectivity guidance, projects within 8 km of the Kintyre Goose Roosts SPA are considered.

9.5.67 The assessment uses a three-tiered approach based on the levels of likelihood and confidence that a particular project will be consented and combine with the proposed development to act on an IOF to create a cumulative effect. The tiered process of assessment, ordered in descending likelihood of cumulative effects takes the following form:

1. The proposed development with existing and in-construction projects;
2. The proposed development with operational, in-construction and approved projects; and
3. The proposed development with operational, in-construction, approved and in-planning projects.

9.5.68 Wind farm projects at scoping stage have been scoped out as they do not have sufficient information on potential impacts to be included, as the baseline survey period is ongoing, or results have not been published. Projects that have been refused or withdrawn have also been scoped out.

9.5.69 Small projects with three or fewer turbines have also been excluded as often these projects are not subject to the same level of detail of ornithological assessment, and so there are no directly comparable data. Because of the small scale of such projects, effects are likely to be negligible on the IOFs assessed here. Other small-scale renewable projects such as micro hydro schemes have also been scoped out for similar reasons.

9.5.70 SNH's Natural Spaces website[19] was accessed to download the Onshore Wind Farm Proposals GIS Shapefile (version 21 June 2018), which presents the location of wind farms across Scotland, to provide the initial scope for this assessment. Further internet searches were required to check and update the status of some projects.

[19] https://gateway.snh.gov.uk/natural-spaces/

9.5.71 Following the Assessment of Likely Significant Effects on the Kintyre Goose Roosts SPA, in-combination effects on the SPA for Greenland white-fronted goose have been considered below. Table 9.11 provides a summary of the wind farm projects within 8 km for the SPA – for a number of cases projects did not undertake collision modelling for Greenland white-fronted goose (likely due to very low or no activity recorded during baseline surveys) or no relevant information could be sourced, indicated by 'N/A' in the table.

Table 9.11: Scoped-In Wind Farm Projects Within 8 km of the SPA

Project	Status	Number of Turbines	Information Available for Greenland White-Fronted Goose Collision Estimates
Auchadaduie WF	Application	3	0
Beinn an Tuirc Phase 1	Installed	46	N/A
Beinn an Tuirc Phase 2	Installed	19	0.005 at 95 % avoidance rate (the actual collision risk estimate at Beinn an Tuirc Phase 2 was nil as no at risk flights passed through the wind farm area; the 0.005 collision risk estimate was based on alternative scenario modelling where all flights recorded were modelled as passing through the wind farm area if they had been displaced or disorientated by low cloud or mist conditions). Converted to 99.8% avoidance rate the annual collision risk is 0.0002.
Beinn and Turic Phase 3	Approved	18	N/A
Blary Hill	Installed	14	N/A
Clachaig glen	Application	14	N/A
Cour	Installed	10	0.018 at 99.8 % avoidance rate.
Deucheran Hill	Installed	9	N/A
Eascairt WF - Kintyre	Application	13	N/A
Gigha Community WF	Installed	4	N/A
Killean	Application	17	0.04 at 99.8% avoidance rate (1 every 15.6 years). Observed flight activity was multiplied by 28% to account for unobserved night time activity.
Low Ugdale	Application	-	N/A

9.5.72 Of the twelve other wind farms considered, three predicted a collision risk for Greenland white-fronted goose: Cour Wind Farm, Beinn an Turic Wind Farm Phase 2 and the proposed Killean Wind Farm. Cour Wind Farm lies 21.5 km to the north east of the proposed development but 5-6 km from the Loch Garasdale and Loch an Fhraoich components of the Kintyre Goose Roosts SPA. Beinn an Turic Wind Farm Phase 2 lies 7 km to the north east of the proposed development (and north of Lussa Loch) and adjacent to Beninn an Turic Phase 1. An actual collision risk of nil was predicted for Beinn an Turic Phase 2, however scenario collision modelling (under low cloud or mist conditions with a 95 % avoidance rate) did predict a low collision risk for Greenland white-fronted goose. Converted to the current goose avoidance rate of 99.8 %, the revised collision risk from the scenario modelling is 0.0002 per year. A collision risk of 0.04 at 99.8% avoidance rate was estimated for Killean Wind Farm. This collision risk value includes a 28% increase to account for hypothetical and unobserved night time activity.

9.5.73 No Greenland white fronted goose flights were observed at nine wind farms. The absence of flights is likely due to the habit of geese to use regular flight paths either on migration or between roosts and feeding locations, with only irregular flights likely to deviate away from these established routes, possibly as a result of poor visibility or strong wind conditions. Many of the wind farms included in the cumulative assessment are located either outside migration routes or away from routes between roosting locations and feeding areas. As a result, geese are not expected to fly over these areas regularly.

9.5.74 The maximum annual Greenland white-fronted collision rate associated with the proposed development was predicted to be 0.0438 (one every 22.8 years). When also including the predicted collision rate from all installed and approved projects (converted to a 99.8 % avoidance rate if required, Table 9.12), an in-combination annual collision rate of 0.102 (one every 9.8 years[20]) is predicted. This equates to a 0.037% increase in the baseline mortality.

Table 9.12: In-Combination Collision Effects for Projects within 8 km of the Kintyre Goose Roosts SPA: Predicted Annual Collision Rates

Species		Greenland white-fronted goose
SPA Population		2,300
Collision Rate	**Installed**	0.0182
	Approved	0
	Application	0.04
	Tangy IV	0.0438
	Total	0.102
Background Adult Mortality Rate		0.12
Adult mortality rate including cumulative collisions		0.120044
Increase in mortality rate due to cumulative collisions (%)		0.037 %
Increase in mortality rate due to Tangy IV (%)		0.016 %

9.5.75 This additional mortality is of a negligible magnitude and any cumulative increase is likely to have a virtually undetectable effect on the risk of population decline (e.g. see population viability analysis in Trinder 2010).

9.5.76 Overall, despite general declines in Greenland white-fronted goose numbers for a number of natural reasons (Stroud *et al*. 2012), the Kintyre Goose Roosts SPA population is still considered to be in **Favourable** conservation status (March 2014) and as such, the in-combination effect on the Greenland white-fronted goose population associated with the SPA is therefore considered to be **Negligible** spatial and **Long Term** temporal.

9.5.77 Therefore, whilst a Likely Significant Effect could not be ruled out for Greenland white-fronted goose, the magnitude of effect (arising from in-combination collisions) is considered to be negligible and therefore there is **no potential for an Adverse Effect on the Integrity of the Kintyre Goose Roosts SPA** under the Habitat Regulations (9.3.11 to 9.3.14).

9.6 Monitoring

9.6.1 During construction, a goose roost survey will be undertaken weekly between September and April to ensure there are no disturbance effects on geese using either Tangy Loch or Lussa Loch to roost and their associated commuting flights. The surveys would be undertaken by an appointed

[20] Note: this includes the precautionary scenario modelling from Beinn an Turic Phase 2 and the 28% of additional hypothetical activity at Killean.

ornithologist (or the ECoW if suitably qualified) in the vicinity of Tangy Loch and in the direction of the established flight path from Lussa Loch, at dawn and dusk. The results would be used to detail any effects on geese and inform any further mitigation measures if they are deemed to be required in light of any disturbance effects.

9.6.2 Goose flight activity monitoring vantage point surveys should be carried out post-construction to collect data on goose flight activity during the operational period. It is recommended these surveys be carried out in years 1, 2, 5, 10 and 15 during the operational period.

9.7 Summary

9.7.1 A summary of the predicted effects (unmitigated) for Greenland white-fronted goose are detailed in Table 9.13. Mitigation has been proposed during construction (and decommissioning) to minimise any potential impact on roosting geese (paragraph 9.5.23) and monitoring is detailed in Section 9.6.

Table 9.13: Summary of Predicted Effects

	Construction/ Decommissioning	Operation – Collision	Operation – Displacement	In-Combination	Residual
Greenland white-fronted goose	Negligible, Not Significant No potential to adversely affect the integrity of the Kintyre Goose Roosts SPA	Negligible, Not Significant No potential to adversely affect the integrity of the Kintyre Goose Roosts SPA	Negligible, Not Significant No potential to adversely affect the integrity of the Kintyre Goose Roosts SPA	Negligible, Not Significant No potential to adversely affect the integrity of the Kintyre Goose Roosts SPA	Negligible, Not Significant No potential to adversely affect the integrity of the Kintyre Goose Roosts SPA

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