



LUGGIES KNOWE WIND ENERGY

Year 1 Avian Report: September 2020 – August 2021

Client: Shetland Aerogenerators Ltd

Project/Proposal No: 3515

Version: 0.2

Date: 2022-10-30





Document Information

Project Name:	LUGGIES KNOWE WIND ENERGY
Document Title:	Year 1 Avian Report: September 2020 – August 2021
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Date:	2022-10-30
Version:	0.2
Project/Proposal Number:	3515
ITPEnergised Office:	60 Elliot Street, Glasgow, UK, G3 8DZ

Revision History

Version	Date	Authored	Reviewed	Approved	Notes
0.1	2021-08-24	A Taylor	R King	R King	First Issue for internal review
0.2	2021-08-25	A Taylor	R King	R King	First Issue for client

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1. Introduction

1.1 Overview

ITPEnergised was appointed by Shetland Aerogenerators Ltd to undertake a suite of ornithological surveys in support of the proposed installation of an additional wind turbine in addition to the already operational turbine located on the Luggies Knowe wind farm site on the Hill of Gremista approximately 1.2 km north of Lerwick (hereafter referred to as the 'Site'). The Site is located at British National Grid (BNG) 446191 1145162 and covers an area of 65.9 hectares (ha) and its location is shown on Figure 1.

The Site was previously submitted to planning and approved as a three-turbine development, although only one turbine was built out and is now operational in the north of the Site.

1.2 Site Description

The Site is open moorland, predominantly consisting of wet heath / acid grassland habitats and surrounded on three sides by industrial land, including open areas of mining and large processing plants and then open sea. Further moorland extends south-west. A number of small lochans and the Loch of Kebister are found south-west of the site boundary. The only structure within the Site is the operational turbine located in the north which is accessed by a hard standing track from the road which runs along the northern Site boundary.

2. Aims

This report presents the ornithological survey work conducted by ITPE between September 2020 and August 2021 to assess the baseline conditions and in support of subsequent planning application for the Proposed Development.

Collectively, the objectives of the surveys are to:

- Map the distribution of breeding birds, including scarce and priority species;
- Record the presence and abundance of birds considered to be of a conservation priority; and
- Quantify the level of flight activity by birds of conservation importance.

3. Legislation and Biodiversity

3.1 Legislation

All relevant legislation and guidance documents have been considered as part of this assessment, as referenced in this report (a summary of pertinent nature conservation legislation is presented below).

Of particular relevance are:

- Council Directive 2009/147/EC on the conservation of wild birds (the Birds Directive) ¹;
- The Ramsar Convention on Wetlands 1976;

¹ Although the UK has now left the European Union, there has been no significant change in the wording of UK nature conservation legislation based on European Directives, and these are therefore considered to remain relevant to the present report.



- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive);
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended);
- The Wildlife and Countryside Act 1981 (as amended);
- The Wildlife and Natural Environment (Scotland) Act 2011 (as amended); and
- The Nature Conservation (Scotland) Act 2004 (as amended), which places a statutory duty on all public bodies to further the conservation of biodiversity through the Scottish Biodiversity Strategy, with Scottish priority species and habitats listed on the Scottish Biodiversity List (SBL), itself based on the former UK Biodiversity Action Plan (UKBAP), and regional biodiversity targets defined through a Local Biodiversity Action Plan (LBAP). The LBAP of relevance to this report is the Highland LBAP.

3.1.1 International Conventions and Directives

3.1.1.1 The Birds Directive (2009/147/EC)

The European Union (EU) Directive on the Conservation of Wild Birds (2009/147/EC) was first adopted in 1979 and is the primary mechanism for delivering the EU's obligations under the Convention on Biological Diversity (CBD), and the Ramsar and Bonn Conventions. Collectively, the Birds and Habitats Directives require Member States to take action in order to protect all bird species and their habitats which includes the designation of Special Protection Areas (SPAs) in respect to species listed on Annex I of the Directive.

3.1.1.2 Ramsar Convention on Wetlands

The Convention on Wetlands of International Importance (the Ramsar Convention) was adopted in Iran in February 1971 and came in to force in the UK in May 1976. The Convention considers the subject area of wetland conservation and comprises three elements of activity:

- The designation of wetlands of international importance as Ramsar sites;
- The promotion of the sustainable use of all wetlands in the territory of each country; and
- International co-operation with other countries to further the sustainable use of wetlands and their resource.

3.1.1.3 The Habitats Regulations

In Scotland, the Habitats Directive is translated into specific legal obligations by the Conservation (Natural Habitats, &c.) Regulations 1994. This piece of legislation is usually known as the Habitats Regulations.

In relation to ornithological interests, the Habitats Regulations cover the requirements for:

- Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), which are sites that are internationally important for threatened habitats and species; making a network of sites designated as together known as Natura2000 network.

The Habitats Regulations have been most recently amended in 2012.

3.1.1.4 The Convention on Biological Diversity (CBD)

The CBD was adopted at the Earth Summit in Rio de Janeiro, Brazil in June 1992, and came into force in December 1993. It was the first global treaty to provide a legal framework for biodiversity conservation. The treaty has three primary goals:

- The conservation of biological diversity;
- The sustainable use of its components; and
- The fair and equitable sharing of the benefits arising from the use of genetic resources.



Signatories are required to create and enforce national strategies and action plans to conserve, protect and enhance biological diversity.

The UK Government ratified the convention and published the UKBAP in 1994 and to compliment the UKBAP, separate biodiversity strategies for each of the devolved governments have been subsequently developed, including the Scottish Biodiversity Strategy, launched in 2004.

3.1.2 National Legislation

3.1.2.1 The Wildlife and Countryside Act

The Wildlife and Countryside Act 1981 (as amended) (WCA) is the principal mechanism for wildlife protection in the UK. Schedule 1 of the Act lists bird species that are afforded special protection. The principal designation established under the Act is the citation of Sites of Special Scientific Interest (SSSI).

The Act also makes it an offence (with exception to species listed in Schedule 2) to intentionally:

- Kill, injure, or take any wild bird;
- Take, damage or destroy the nest of any wild bird while that nest is in use or being built; or
- Take or destroy an egg of any wild bird.

3.2 Biodiversity

3.2.1 Biodiversity Duty Report

Under the Nature Conservation (Scotland) Act 2004, all public bodies are required to further the conservation of biodiversity when carrying out their public responsibilities and duties. Following an amendment to the Wildlife and Natural Environment (Scotland) Act 2011, public bodies are required to publish a publicly available report on the actions they have taken to meet this biodiversity duty.

3.2.2 Scottish Biodiversity List

Scottish Ministers created the SBL in 2005 in order to satisfy the requirements under Section 2(4) of the Nature Conservation (Scotland) Act 2004 and to assist public bodies in carrying out conservation of biodiversity, and to provide the general public with information regarding conservation within Scotland. The list contains habitats, plants and species which are deemed to be of principal importance to the Scottish population and meet the social and scientific criteria. This report focuses on the scientific value of the SBL entries.

Species details, including a list of scientific criteria and reasoning for inclusion to the list, can be located within the Scottish Biodiversity List: Technical Report (Scottish Government, 2013).

3.2.3 The Shetland Local Biodiversity Action Plan

Living Shetland outlined a Shetland Local Biodiversity Action Plan, it was last updated in 2004, and identifies locally important habitats and species and highlights and promotes actions to conserve these. Living Shetland was developed with a wide range of partner organisations helping to coordinate its development and implementation (Shetland Islands Council, 2015).

Living Shetland is the Shetland Local Biodiversity Action Plan (LBAP) and outlines 11 priority species and habitat action plans and those relating to ornithology are:-

- Arable birds;
- Breeding waders;
- Eider;
- Merlin;
- Red-necked Phalarope;



- Red-throated diver; and
- Skylark.

3.3 Birds of Conservation Concern

The Birds of Conservation Concern (BoCC) project is a collaboration between the Statutory Nature Conservation Bodies (SNCBs), Royal Society for the Protection of Birds (RSPB), British trust for Ornithology (BTO), Wildfowl and Wetlands Trust (WWT), Game and Wildlife Conservation Trust (GWCT) and several other organisations. It uses an approach based on quantitative assessments against standardised criteria, in order to place individual bird species on 'Red', 'Amber' or 'Green' lists to indicate different levels of conservation concern. Red in the context of BoCC is not the same as IUCN's Red List, though IUCN status is one of the criteria used in BoCC assessment. Collectively, the changes in the numbers and proportions of species on Red, Amber or Green lists provide a gauge of the broad direction of status of UK birds and point to the degree of threat they face, as well as the efficacy of conservation measures taken (Eaton *et al.*, 2015).

Birds on the Red and Amber lists are subject to at least one of the factors listed below:

- Red - red list species are those that are globally threatened, have had an historical population decline in the UK from 1800 -1995, a rapid (> or = 50%) decline in UK breeding population over the past 25 years, or a rapid (> or = 50%) contraction of UK breeding range over the past 25 years;
- Amber - amber listed species have had a historical population decline from 1800-1995 but are recovering; population size has more than doubled over the past 25 years, a moderate (25-49%) decline in UK breeding population over the past 25 years, a moderate (25-49%) contraction of UK breeding range over the past 25 years, a moderate (25-49%) decline in UK non-breeding population over the past 25 years, or species with unfavourable conservation status in Europe also known as Species of European Conservation Concern (SPEC); and
- Green - green listed species have no identified threat to their population status.

4. Consultation

4.1 Statutory

Consultation with NatureScot (NS) was initiated on 1st October 2020 to which NS responded with a courtesy email on 6th October with a detailed follow up message on 15th October confirming they were happy in general with the scope of the ornithology surveys proposed, the location of the vantage points (VPs) and corresponding viewsheds.

The email also outlined the potential for breeding activity of red-throated diver in the area around the Site and their potential for connectivity with the East Coast Mainland Special Protection Area (SPA). The response also outlined there was no requirement for a dedicated coastal seabird survey.

5. Methods

5.1 Overview

This section describes the methods used for the ornithological surveys, which comprised a combination of desk study and field survey.

5.2 Desk Study

An ornithological desk study was undertaken to compile existing baseline data for the Site and local area.



In terms of nature conservation designations of relevance to birds, the desk study aimed to identify international designations such as SPAs and Ramsar wetlands within 20km of the Site boundary for all SPAs. National statutory designations, such as SSSIs and National Nature Reserves (NNRs) were identified within 10km of the Site boundary.

Only ornithological features are considered relevant to the present study. Any Local Nature Conservation Sites (LNCSs) or non-statutory designations, such as Local Biodiversity Sites, were identified within a 2km distance of the Site boundary. Existing records that are freely available for commercial use of protected or otherwise notable species (e.g. SBL/LBAP priority species) were identified with a 2km distance of the Site boundary. Records from the last 10 years were considered relevant to the study.

Data for priority / notable species and designated sites were obtained from the following databases:

- National Biodiversity Network (NBN) Atlas;
- NatureScot, formerly Scottish Natural Heritage (SNH), SiteLink website;
- Scotland's Environment Interactive Map; and
- MAGIC: Nature on the Map.

The Shetland Biological Record Centre will be contacted at the end of 12 months of survey to provide further historical records for ornithology species within 2km of the site boundary.

5.3 Field Surveys

5.3.1 Determination and Selection of Vantage Points

Pre-scoping consultation with NS, combined with the results of the desk study, identified that VP surveys would be required to account for the potential presence of 'scarce' diurnal raptors, waterfowl and wading bird species within and adjacent to the Site.

Two VPs were established using GIS software combined with Ordnance Survey digital data. The VP locations were placed to cover the area of the Site which is displayed within Figure 1. The VP location and the corresponding viewsheds were verified during a site visit on 26th September 2020. VP locations and bearings are provided in Table 1.

Table 1 - VP Locations and Orientation

VP	Grid Reference	Bearing
1	HU 46040 44649	15°
2	HU 46285 45158	195°

5.3.2 Diurnal Vantage Point Surveys

Surveys commenced in September 2020, during which information on bird flight activity was collected throughout timed watches following recommended guidance and methods as outlined by NS, (SNH, 2017). To date, a total of 11 months of data has been gathered in order to support a future Ecological Impact Assessment (EclA) forming part of the planning application for the Proposed Development. Surveyors undertook the surveys in such a way as to minimise the potential for disturbance impacts on bird behaviour associated with their presence near the Site, including arriving at the survey point a minimum of 15 minutes prior to the commencement of each VP watch.

All surveys were stratified, where possible, across three daylight periods (termed 'dawn', 'day' and 'dusk') to allow for diurnal variation in activity rates. All surveys comprised watches lasting no more than three hours in duration and a minimum of 30 minutes break was observed by the surveyor between subsequent watches.



All surveys were undertaken by a single observer in a wide range of weather conditions, but mainly in conditions of good ground visibility (> 2km) and timings were adjusted to account for changes in sunrise and sunset times within each survey season.

During each VP watch, two methods of recording were used comprising focal sampling of target species and activity summaries of secondary species. Observations were recorded using seven different height bands in order to allow for multiple potential turbine specification, the height bands will be merged together once a finalised specification has been approved. The height bands used were:

- HB1: < 10 m;
- HB2: $10 \geq < 20$ m;
- HB3: $20 \geq < 30$ m;
- HB4: $30 \geq < 40$ m;
- HB5: $40 \geq < 50$ m;
- HB6: $50 \geq < 150$ m; and
- HB7: ≥ 150 m.

Flightline data were noted in the field onto recording sheets and later transferred to a Microsoft Excel spreadsheet for analysis. Each flightline recorded during each VP watch was annotated on to a survey map and cross-referenced to its corresponding data entry on the recording sheet.

At the time of writing, the expected collision risk height with turbine blades is between 13.9 m and 149.9 m (i.e. rotor diameter of 136m) and so the VP data were merged into three height bands for analysis:

- HB1: < 14 m;
- HB2: $14 \geq < 150$ m (potential collision height); and
- HB3: ≥ 150 m.

The total number of survey hours between September 2020 and August 2021 at each VP location comprised:

- VP1 – 36 hours non-breeding season;
- VP1 – 36 hours breeding season;
- VP2 – 36 hours non-breeding season; and
- VP2 – 36 hours breeding season.

Full details of the survey dates and timings are shown in Appendix A: Table A1.

5.3.3 Breeding Bird Walkover Surveys

A modified Brown and Shepherd (1993) survey method, which is designed for moorland/upland habitats, was followed for the breeding bird survey. NatureScot guidance (SNH, 2017) recommends that this survey follows a four-visit approach, carried out between April to July, with a minimum of two weeks between survey visits. A walked transect was followed, visiting all the areas of suitable habitat within a 500m buffer around the site boundary aiming to survey for birds within 100m of all points inside the Site boundary. Within visits, duplicate records of waders separated by less than a threshold distance of 500 m were considered to correspond to birds of the same pair, while those separated by more than the threshold distance were considered to be from different pairs. Exceptions to this occurred when recorded birds seen within the threshold distance of each other as definitely representing different pairs.

Following the four visits, all survey data are considered together, along with the noted behaviour observed, and territories of breeding birds are defined as either; confirmed, probable, possible or non-breeding.

Survey visits took place during the 2021 breeding season on:

- Survey visit 1 – 20th April;



- Survey visit 2 – 8th May;
- Survey visit 3 – 13th June; and
- Survey visit 4 – 14th July.

5.3.4 Breeding Raptor Survey

Surveys for breeding raptors were completed following methods as described in Hardey *et al.* (2013). A four-visit walkover survey approach was used, with survey visits being spaced between April and early August 2020 and covering the Site and a 2km site buffer study area (where access permissions allowed). The survey area is continuously scanned for target species during the walkover. This includes stops at “mini” vantage points where the view is scanned for a period (usually 15-20 minutes) across suitable habitat for target species. Surveys for breeding moorland raptors generally require four visits between April and August.

The first survey visit is primarily to detect displaying birds and/or territory occupancy by the various target species. A second visit is then used to identify active nests. The third visit is then carried out to check for the presence of young birds, and the final fourth visit is used to record fledged young (Hardey *et al.*, 2013).

Survey visits took place during the 2021 breeding season on:

- Survey visit 1 – 21st April;
- Survey visit 2 – 7th May;
- Survey visit 3 – 12th June; and
- Survey visit 4 – 16th July.

5.3.5 Focal Diver Surveys

The potential for breeding red-throated diver (*Gavia stellata*) on lochans in the Site and wider area as well as the possibility that flight paths of both red and black-throated divers could pass over the airspace over Site was mentioned during the initial consultation with NS. The presence of breeding red-throated diver within the Site and a 1km study area was noted during the breeding bird walkover and a specific diver survey for all suitable freshwater habitat between 500m and 1km of the Site boundary. The surveys were incorporated into the breeding walkover surveys on the dates outlined above.

In addition to the breeding lochan walkover survey, following the discovery of breeding activity for red-throated diver, focal diver VP surveys were undertaken to cover breeding lochans between May and August 2021. These surveys aim to record at least 20 flightlines from each of the of diver breeding lochans identified during the breeding bird walkover surveys.

The surveys were undertaken to identify typical flight pathways used by divers to commute to and from their nesting lochan to feeding sites on the seas or other larger waterbodies. Survey methods followed those outlined in Gilbert *et al* (2011). The focal lochans surveys were complimented by diurnal VP surveys in two locations which covered the three known breeding lochans within the Site and wider survey buffer and recorded flightlines specifically for divers.

The total number of survey hours between May 2021 and August 2021 at each diver VP location comprised:

- D1 – 36 hours; and
- D2 – 36 hours.

5.3.6 Survey Limitations

Full access was available onto the Site and the majority of the immediate surrounding area throughout the survey period, where access in the survey buffers was restricted these areas were scanned from suitable vantage points using binoculars. As such, no significant limitation to the surveys were noted.



6. Baseline

6.1 Desk Study

6.1.1 Site Designations

As summarised in Table 2, and displayed on Figure 2, three international and five national statutory nature conservation designations occur within 20km and 10km of the Site, respectively.

Table 2: Statutory Nature Conservation Designations (bird qualifying features only) within the Desk Study Search Criteria

Name	Designation	Distance and Direction from the Site	Reason for Designation
East Mainland Coast	SPA	100 m NE at closest point.	Designated for wintering great northern diver (<i>Gavia immer</i>), and Slavonian grebe (<i>Podiceps auritus</i>). The site is also selected as an important foraging area for breeding red-throated diver.
Noss	SPA	6.5 km SE	Breeding seabird assemblage as well as breeding fulmar (<i>Fulmarus glacialis</i>), gannet (<i>Morus bassanus</i>), great skua (<i>Stercorarius skua</i>), guillemot (<i>Uria aalga</i>), kittiwake (<i>Rissa tridactyla</i>) and puffin (<i>Fratercula arctica</i>).
	SSSI		Breeding seabird assemblage as well as breeding gannet, great skua, kittiwake and Arctic skua (<i>Stercorarius parasiticus</i>).
	NNR		Seabird Assemblage.
Ward of Culswick	SSSI	19 km W	Breeding Arctic skua and whimbrel (<i>Numenius phaeopus</i>).
Mousa	SPA	19 km SSE	Mousa qualifies under Article 4.1 by regularly supporting internationally important breeding colonies of storm petrel (<i>Hydrobates pelagicus</i>) (4,750 pairs, 6% of GB & 2% of total world breeding populations) and Arctic tern (<i>Sterna paradisaea</i>) (up to 1,000 pairs, 1% of GB).
	RSPB / SSSI		Breeding Arctic tern, Black guillemot (<i>Cephus grylle</i>) and storm petrel.

6.1.1.1 Non-statutory Designations

No locally designated sites, designated for ornithological reasons, were recorded within 2km of the site boundary, and five IBA were recorded within 20km of the Site and are detailed in Table 3 below. A full ornithological desk study will be completed at the completion of 12 months survey.

Table 3: Non Statutory Nature Conservation Designations (bird qualifying features only) within the Desk Study Search Criteria



Name	Designation	Distance and Direction from the Site	Reason for Designation
Moorland Areas	IBA	3.9 km NW	Moorland breeding bird assemblage.
South Bressay	IBA	4.8 km SE	Breeding skuas.
Noss	IBA	6.5 km SE	Breeding seabird assemblage as well as breeding gannet, great skua and guillemot.
Sandwick and Clift Hills	IBA	14.9 km S	Breeding skuas.
West Burrafirth	IBA	17.5 km NW	Breeding red-throated diver.

6.1.1.2 External Data

A data request from the Shetland Biological Records Centre was undertaken with all records of bird of conservation concern requested within 5km of the Site. A total of 71 migratory, wintering and breeding bird species records were obtained within 5km of the Site that had been recorded within the previous 10 years. A total of four schedule 1 species merlin, red-throated diver, whimbrel and whooper swan were recorded and are displayed in Figure 11.

6.2 Survey Results

The following section outlines the results of a full year of ornithological survey. VP survey visit details (i.e. dates, times and weather data) are presented in [Error! Reference source not found.](#), Table A1, with VP target species flight data summarised in Annex A Table A2 and individual species flight data in Annex A table A3-A19.

6.2.1 Scarce Raptors

Three Schedule 1 species of raptor were recorded during the ornithological surveys; merlin (*Falco columbarius*), hen harrier (*Circus cyaneus*) and marsh harrier (*Circus aeruginosus*).

6.2.1.1 Merlin

Two flights of an individual female-type merlin were recorded on March 13th and April 27th, both flights recorded from VP1 during VP surveys (Figure 3). The total flight time was 76 seconds all recorded below 40m in height.

A male merlin was recorded 1km south-west of the Site during the July breeding raptor walkover surveys but no evidence of breeding activity was recorded during the breeding season surveys.

6.2.1.2 Hen harrier

A single record of a vagrant hen harrier was the only record for this species throughout all the surveys conducted. The registration consisted of a single female-type bird and was recorded from VP2 on September 27th (Figure 3) during VP surveys.



6.2.1.3 Marsh harrier

A single record of a vagrant male marsh harrier was registered in the southern section of the 2km survey buffer during the May breeding raptor surveys and was the only record for this species throughout all the surveys conducted.

6.2.2 Waders

6.2.2.1 Curlew

A total of twelve curlew (*Numenius arquata*) flights comprising a combined 57 individuals were recorded during the VP surveys (Figure 5). Six flights were recorded in November, one in September, April and May and two in June and the maximum count a group consisting of 18 birds recorded on September 11th. The total flight time recorded was 531 seconds with 376 seconds recorded at PCH (14-150m).

The breeding bird survey identified three curlew territories (one probable and two possible) all three recorded over 200m from the Site boundary but within the 500m survey buffer (see Figure 10).

6.2.2.2 Knot

A group of eight knot were recorded from VP1 on May 14th during VP surveys (Figure 5).

6.2.2.3 Oystercatcher

Two flights of two oystercatcher (*Haematopus ostralegus*) were recorded during the VP surveys (Figure 5), with one flight on June 15th and one on July 13th, the total flight time recorded was 156 seconds all recorded below 20m.

The breeding bird survey identified three oystercatcher territories (two probable and one possible) all three recorded in the 500m survey buffer, two north of the site and one south-east (see Figure 10).

6.2.2.4 Snipe

Two flights of individual snipe (*Gallinago gallinago*) flight were recorded during the VP surveys (Figure 5), both flights on April 28th, the total flight time recorded was 208 seconds all recorded below 40m.

The breeding bird survey identified seven probable snipe territories, two within the Site and five in the 500m survey buffer (see Figure 10).

6.2.2.5 Redshank

Redshank (*Tringa tetanus*) were not recorded from VP surveys but a probable redshank territory was recorded 250m north-east of the Site boundary during the breeding bird survey (see Figure 10).

6.2.3 Wildfowl and Diver

6.2.3.1 Greylag Goose

Eighteen flights totalling 134 greylag goose were recorded from VP surveys with four flights in October, twelve flights in April and two in May (Figure 6). The flight time recorded was 1,870 seconds of which 1,371 seconds was recorded at PCH (14-150m).

The breeding bird survey identified two greylag goose territories both recorded in the 500m survey buffer, one north of the Site and one south (see Figure 10).

6.2.3.2 Red-throated Diver

Red-throated diver were first recorded during VP surveys on 29th April from VP1, with two records totalling six birds, with to date a total of 46 flights recorded totalling 79 individuals (Figure 5). A further 36 flights totalling 44 birds were recorded from focal diver watches between 8th May and 16th July (Figure 6).

The total flight time recorded from VP surveys was 5,623 seconds of which the majority 5,293 seconds was recorded at PCH (14-150m). A further 45 flights recorded during focal diver watches and followed similar



routes. Three pairs of red-throated diver were confirmed as breeding during the breeding bird walkover surveys, all three pairs were noted as having young by the July surveys.

Further information in non-redacted version.

6.2.3.3 Black-throated Diver

An adult black-throated diver was recorded on Loch of Kebister on 17th August 2021 during a focal diver watch.

6.2.3.4 Long tailed duck

A single flight of two long-tailed duck was recorded from VP surveys (Figure 3). The flight time totalled 94 seconds, all of which was recorded between a height of 51-150m.

6.2.4 Skuas, Terns and Gulls

6.2.4.1 Great skua

Thirty flights totalling 45 great skua were recorded from VP surveys, all flights occurring between April 29th and August 19th (Figure 7). The flight time recorded was 2,543 seconds, with ,661 seconds recorded at PCH (14-150m).

The breeding bird survey identified two probable great skua territories one in the north-west of the Site and one 200m west in the 500m survey buffer (see Figure 10).

6.2.4.2 Arctic tern

Two flights of two Arctic tern were recorded during the VP surveys (Figure 7), with one flight on May 14th and one on July 13th, the total flight time recorded was 115 seconds all recorded below 30m.

6.2.4.3 Common gull

Ten flights totalling 21 common gull (*Larus canus*) were recorded from VP surveys with all flights between March and June (Figure 9). The flight time recorded was 313 seconds.

6.2.4.4 Glaucous gull

Two flights totalling of individual glaucous gull (*Larus hyperboreus*) were recorded from VP surveys with one flight in February, and one in March (Figure 9). The flight time recorded was 104 seconds.

6.2.4.5 Great black-backed gull

A total 116 flights of a combined 315 great black-backed gull (*Larus marinus*) were recorded from VP surveys with flights spread throughout the survey period, with a peak count of 42 on March 13th (Figure 8). The flight time recorded was 6,077 seconds of which 3,763 seconds recorded at PCH (14-150m).

The breeding bird survey identified three great black-backed gull territories all recorded in the 500m survey buffer, two north of the Site and one east (see Figure 10).

6.2.4.6 Herring gull

A total 105 flights of a combined 271 herring gull (*Larus argentatus*) were recorded from VP surveys with flights spread throughout the survey period generally involving one or two birds, a peak count of 24 birds was recorded on November 14th (Figure 9). The flight time recorded was 5,507 seconds of which 3,374 seconds recorded at PCH (14-150m).

The breeding bird survey identified a herring gull territory in the eastern section of the 500m survey buffer (see Figure 10).



6.2.5 Other Species

6.2.5.1 Raven

Raven (*Corvus corax*) were commonly recorded during VP surveys, with occasional big groups noted associated with the rubbish tip east of the Site. Numbers peaked at 140 perched individuals on 18th August, 43 on 14th June and 38 on 29th April.

6.2.5.2 Other Species

The breeding bird surveys identified a BoCC Red list species: skylark (*Alauda arvensis*), two BoCC Amber list species: meadow pipit (*Anthus pratensis*), red grouse (*Lagopus lagopus*), as well as wheatear (*Oenanthe oenanthe*) and hooded crow (*Corvus cornix*) breeding within the Site and 500m survey buffer.

6.3 Previous survey work

Ornithology surveys were completed for the original Luggies Knowe site in 2008 and 2009 which was approximately 35.3 hectares and covered the majority of the northern half of the current Site boundary. Surveys were similar to those undertaken in 2020-21 including a breeding bird survey, breeding raptor survey, vp survey and diver lochans surveys. Additional migratory and gull specific watches were completed although it should be noted gulls were included as target species in 2020-21 surveys, as per the NS consultation.

The earlier breeding bird survey, which covered the entirety of the current Site, produced similar results to the current surveys with a red-throated diver recorded and small numbers of skylark, twite, curlew, great skua, snipe, red grouse and meadow pipit.

A single VP was used, slightly north of the current VP1 was surveyed for a total of 36 hours with further gull specific watches done in 2011. Migratory watches were also completed from this location in 2008 and 2009.

VP surveys identified that gulls and corvids were the most commonly recorded species, and also included red-throated diver (5 flights), golden plover, Arctic and common tern plus regular but low levels of great skua activity between March and September. Gull activity was high throughout the year.

Additional focal diver lochans watches produced 26 flights in 2008 and three in 2009.

Winter and migratory watches recorded infrequent flocks of wildfowl with one flock of pink-footed geese (*Anser brachyrynchus*) and one of whooper swan (*Cygnus cygnus*), one of greylag geese and a flock of lapwing. Winter numbers of gulls were very high, although these were associated with the former landfill located east of the Site that was used for disposing of fish industry waste products. No evidence of merlin was recorded throughout all surveys.

Further survey work was conducted on a proposed scheme on the landfill site east of Hill of Gremista, directly east to the current Site in 2007. The VP surveys were as to be expected on a landfill site, dominated by gulls and corvids, with herring gull and great black-backed gull the most frequently recorded species. Occasional records were noted for pink-footed goose, curlew, great skua and Arctic tern. The breeding bird surveys recorded a pair of great skua, whimbrel and snipe as well as common species. A pair of red-throated diver were noted on Loch of Kebister but no breeding activity was recorded.

6.4 Data comparison

Winter VP surveys started in September 2020 and were dominated by gull flights, with the majority of flights recorded consisting of great black-backed gull (61 flights) and herring gull (77 flights) with occasional records of common and glaucous gull. The only other target species records were curlew (7 flights), greylag goose (4 flights) and one flight each of merlin, hen harrier and long-tailed duck.

The winter surveys outline similar results to previous surveys completed at the Site with very little flight activity recorded on Site with the exception of the two common gull species which are associated with the recycling centre and industrial land east of the Site.



Gull activity reduced slightly during breeding season VP surveys with great black-backed gull (48 flights) and herring gull (23 flights) with other seabirds present such as great skua (21 flights), Arctic tern (2 flights) and small numbers of flights of wader species curlew, knot, oystercatcher and snipe. A total of 28 flights of red-throated diver were recorded from VP surveys.

The breeding bird surveys identified 3 red-throated diver breeding territories, one within the Site and two located south-west of the Site. A further 36 red-throated diver flights have been collected to date during focal breeding diver surveys.

The breeding bird surveys identified small number of great skua, oystercatcher, curlew, redshank and snipe. No records of merlin were recorded during breeding walkover surveys.

The species recorded during breeding bird walkover survey has remained similar to those outlined in the original Luggies Knowe surveys, the main difference being an increase in the number of breeding pairs of diver from one to three (the location of the third territory would have been outside the original Luggies Knowe 1km survey buffer) with a pair now nesting north of Loch of Kebister.

Once surveys have been completed at the Site a full collision risk modelling will be completed for red-throated diver.

It is considered likely that NS will require a second breeding season of focal diver watches in order to account for year-on-year changes in breeding success and behaviour and in order to help inform HRA considerations in relation to the Proposed Development and potential connectivity to SPA qualifying features.

Although, given the historical nature of the Site and its previous planning approval for a further two turbines, the situation is not considered to be typical and so it is advised that NS are consulted with in order to determine their opinion on the need for further surveys prior to the submission of a planning application.



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Figures

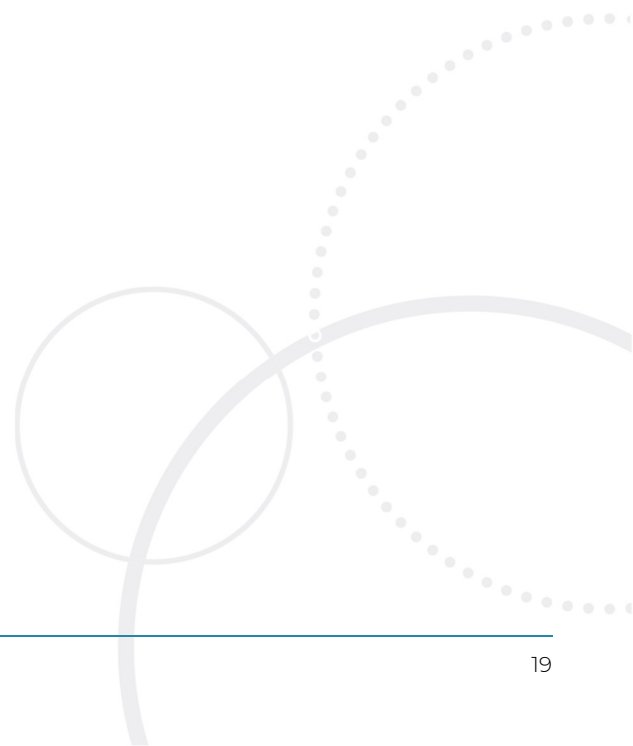
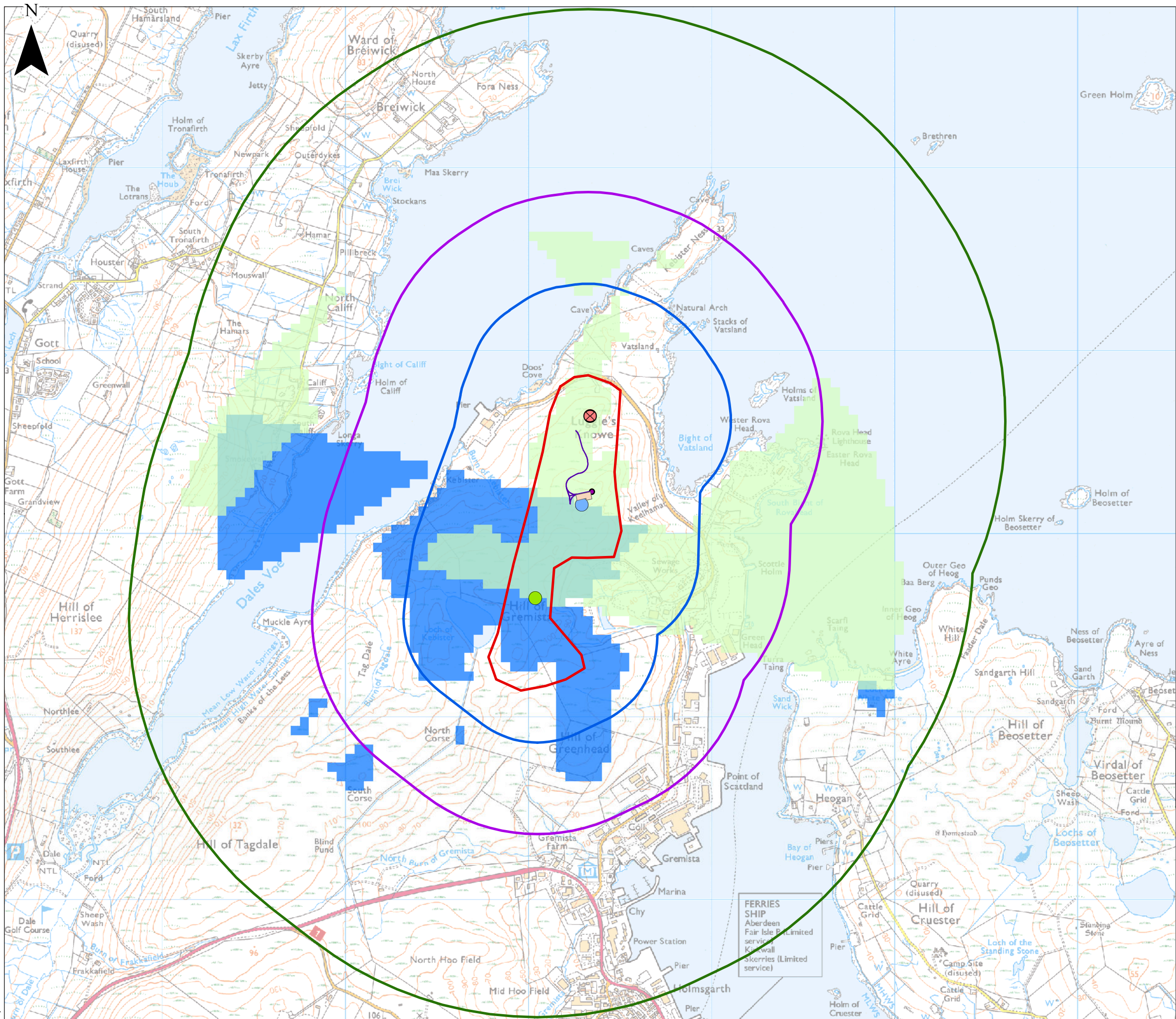


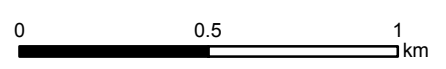


Figure 1 – Vantage Point Locations and Viewsheds



KEY

- Site boundary
- BBS study area (500m)
- Diver study area (1km)
- Raptor study area (2km)
- VP1
- VP2
- Viewshed VP1
- Viewshed VP2



Scale 1:20,000 @ A3



Luggie Knowe Wind Energy Project
Appendix 7.1

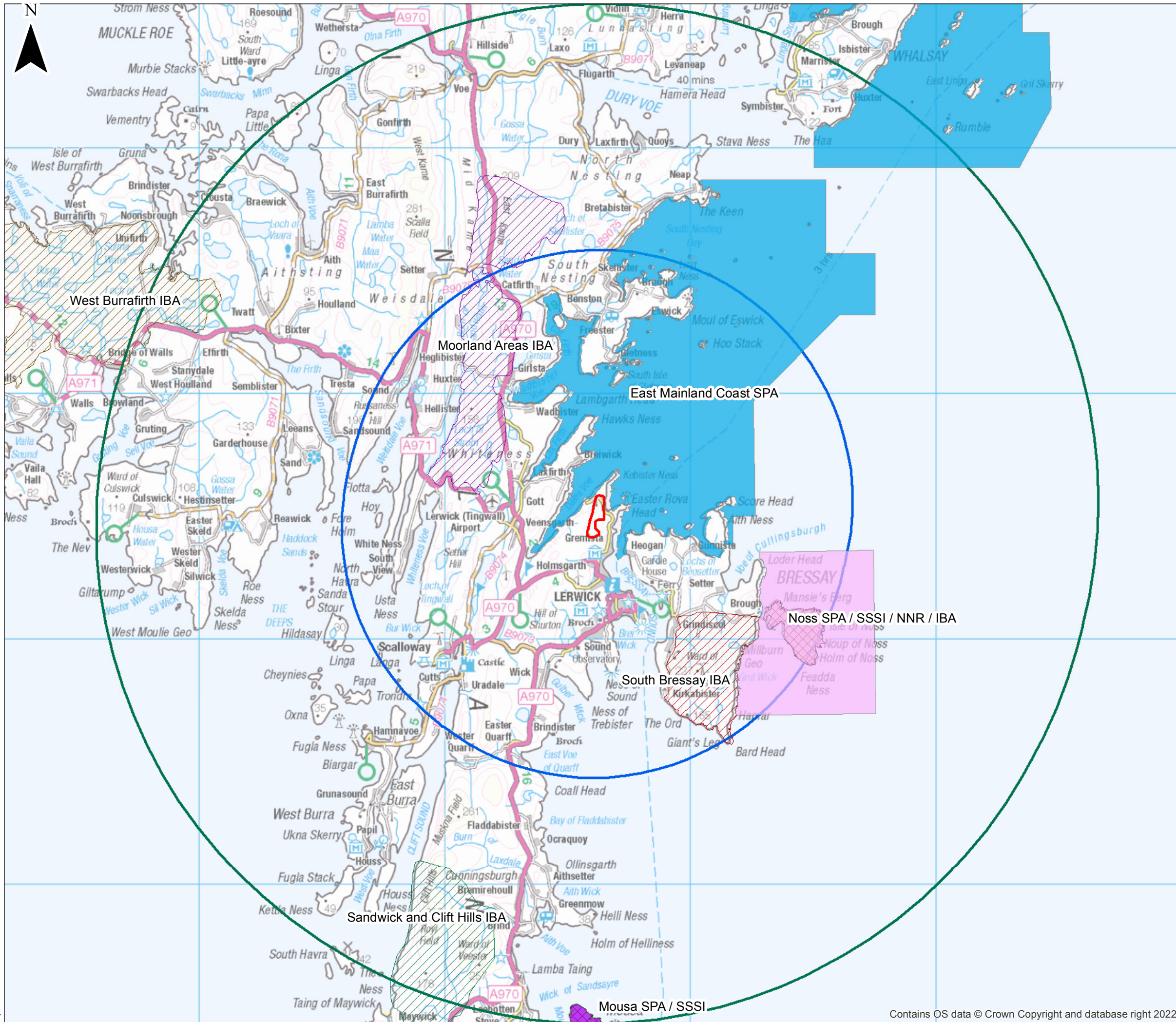
Figure 1
Vantage Point (VP) locations and Viewsheds and Survey Areas

Date: 29/10/2022	Drawn by: AT	Checked by: RK	Version: v1
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Project Number: 3515



Figure 2 – Ornithological Designations



KEY

Special Protection Area (SPA)

- East Mainland Coast, Shetland
- Mousa
- Noss

Site of Special Scientific Interest (SSSI)

- Mousa
- Noss

National Nature Reserve (NNR)

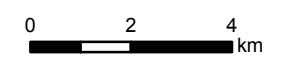
- Noss

RSPB Reserve

- Mousa

RSPB Important Bird Areas (IBA)

- Moorland Areas, Central Shetland
- Sandwich and Clift Hills
- South Bressay
- West Burrafirth
- Proposed Site Boundary
- Study Area (10 km)
- Study Area (20 km)



Scale 1:150,000 @ A3

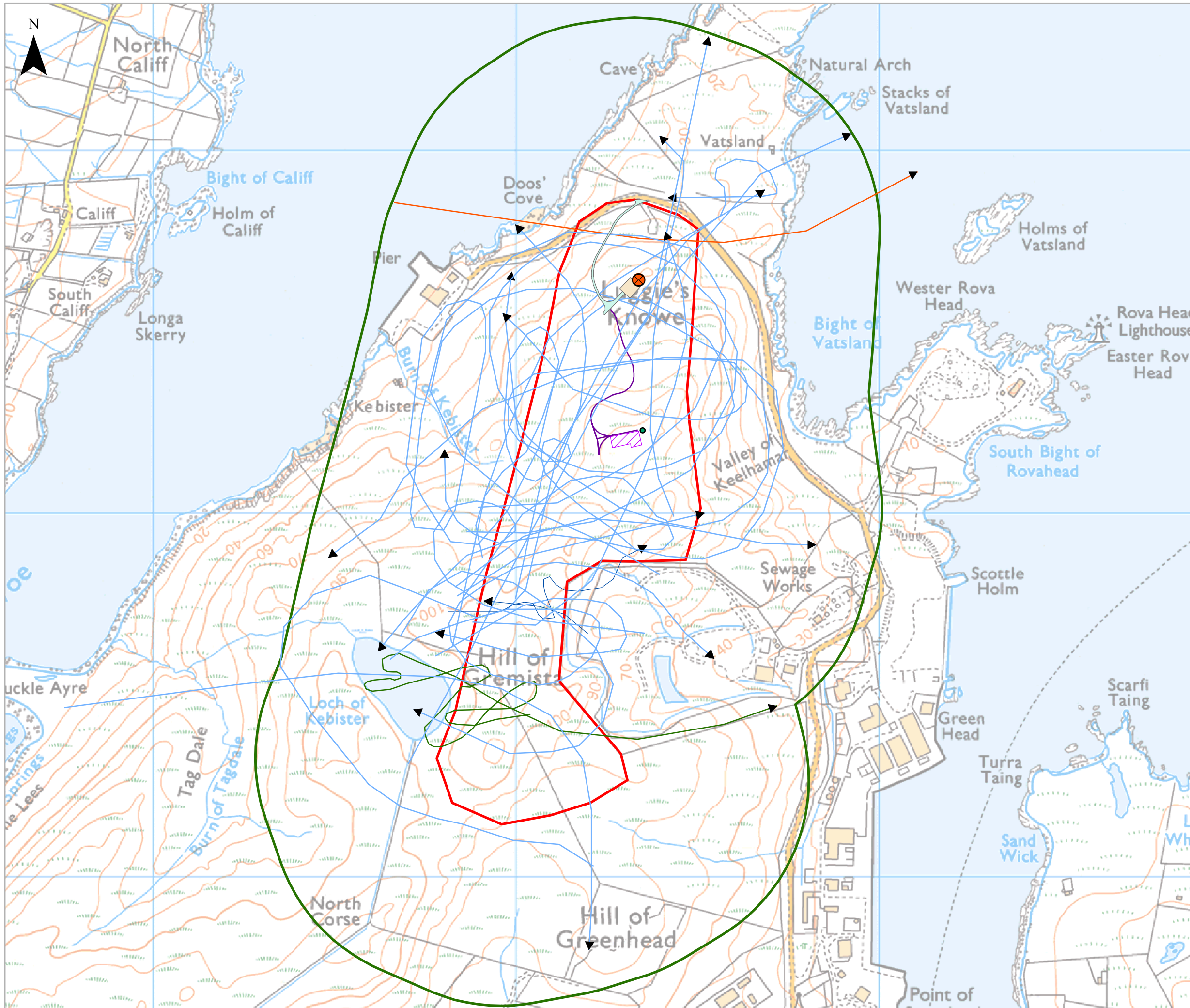


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Appendix 7.1

Figure 2
Ornithological Designations



Figure 3 – Schedule 1 Raptor and Wildfowl Flightlines



- KEY**
- Site Boundary
 - 500m buffer
- Luggie's Knowe Flightlines**
- Species**
- Greylag goose
 - Hen harrier
 - Long-tailed duck
 - Merlin
 - X Operational Turbine

Coordinate System: British National Grid
 Projection: Transverse Mercator

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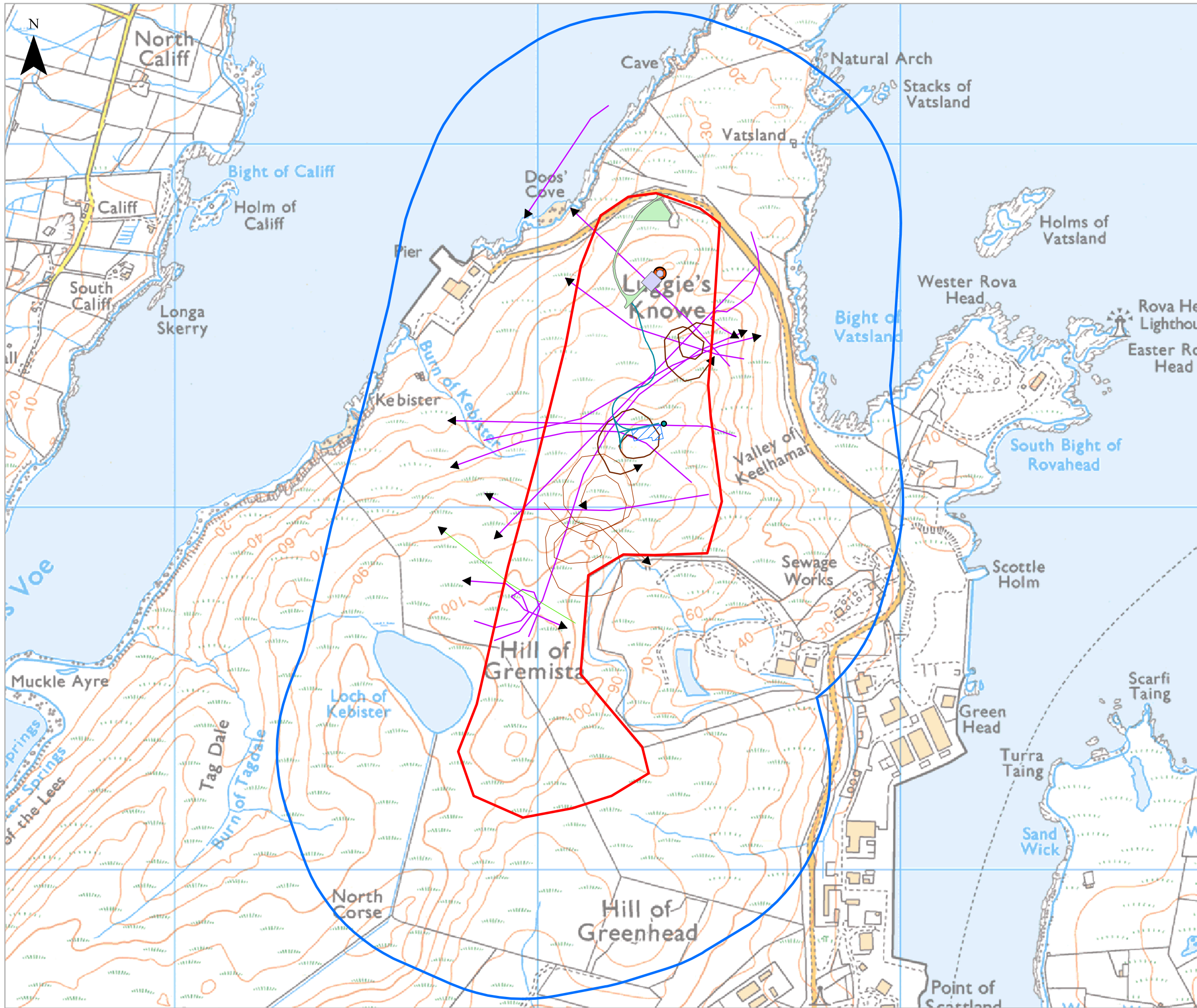
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 Technical Appendix 7.1

Figure 3
Raptor and Wildfowl Flightlines

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Figure 4 – Wader Flightlines





KEY

- Site Boundary
- 500m study area
- x Operational Turbine

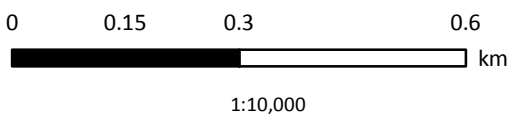
Luggie's Knowe Flightlines

Species

- Curlew
- Knot
- Oystercatcher
- Snipe

Coordinate System: British National Grid
 Projection: Transverse Mercator

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Figure 4
Wader Flightlines

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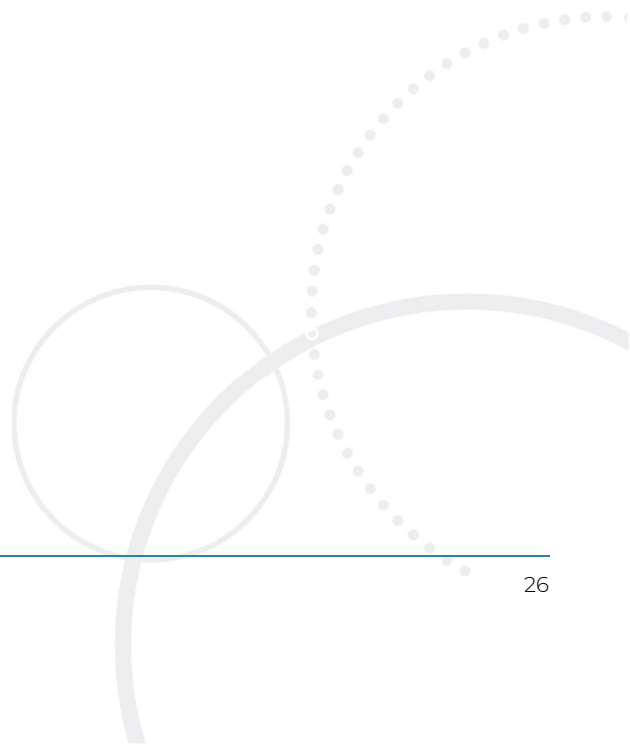
Figure 5 – Red-Throated Diver VP Flightlines

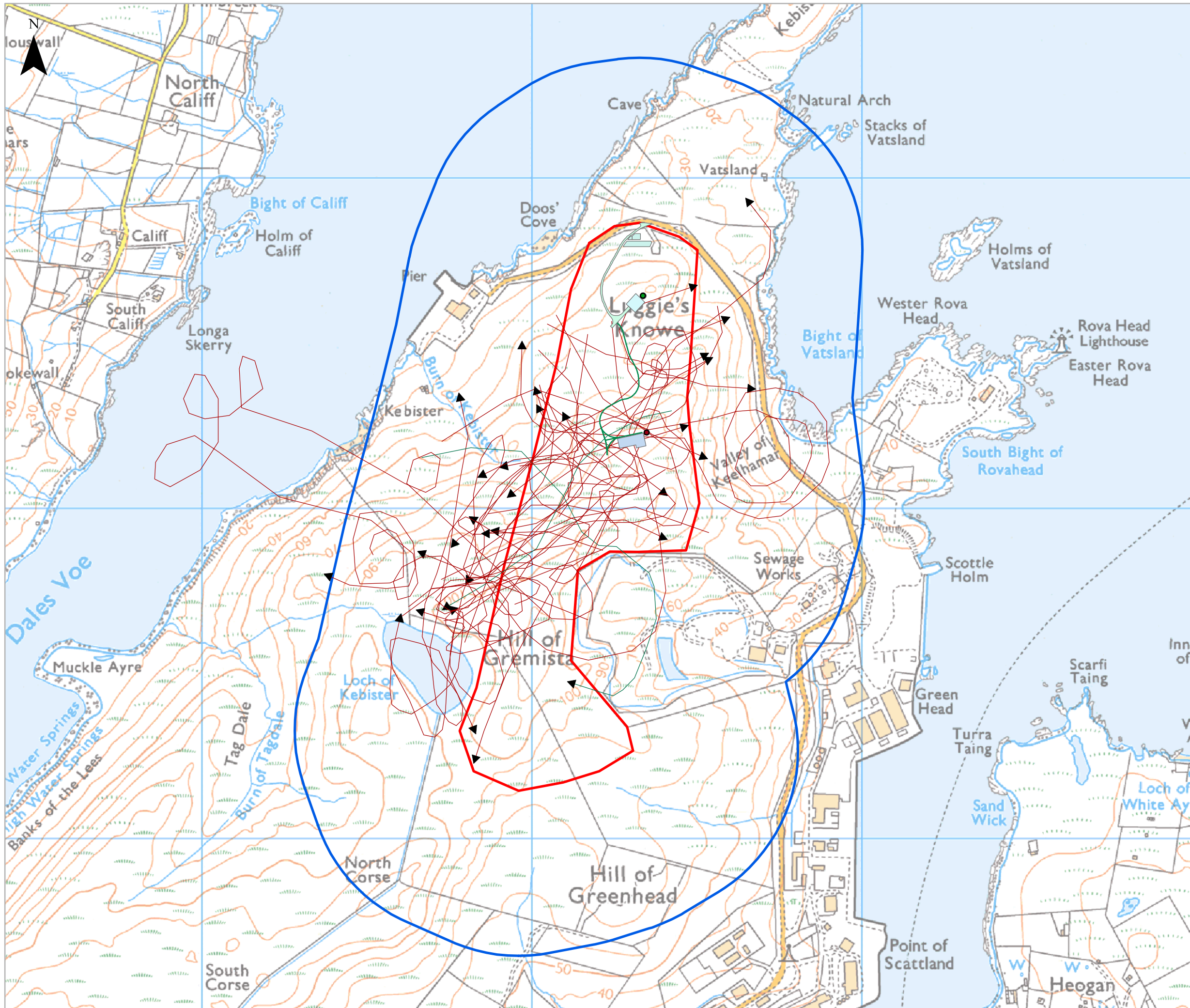
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Figure 6 – Red-Throated Diver Nests and Breeding Lochan Flightlines

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Figure 7 – Seabird Flightlines





KEY

- Site boundary
- Study Area (500m)

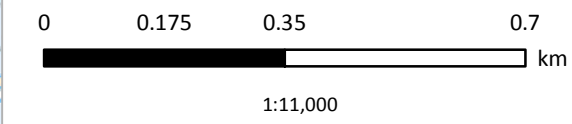
Luggie's Knowe Flightlines

Species

- Arctic tern
- Great skua

Coordinate System: British National Grid
 Projection: Transverse Mercator

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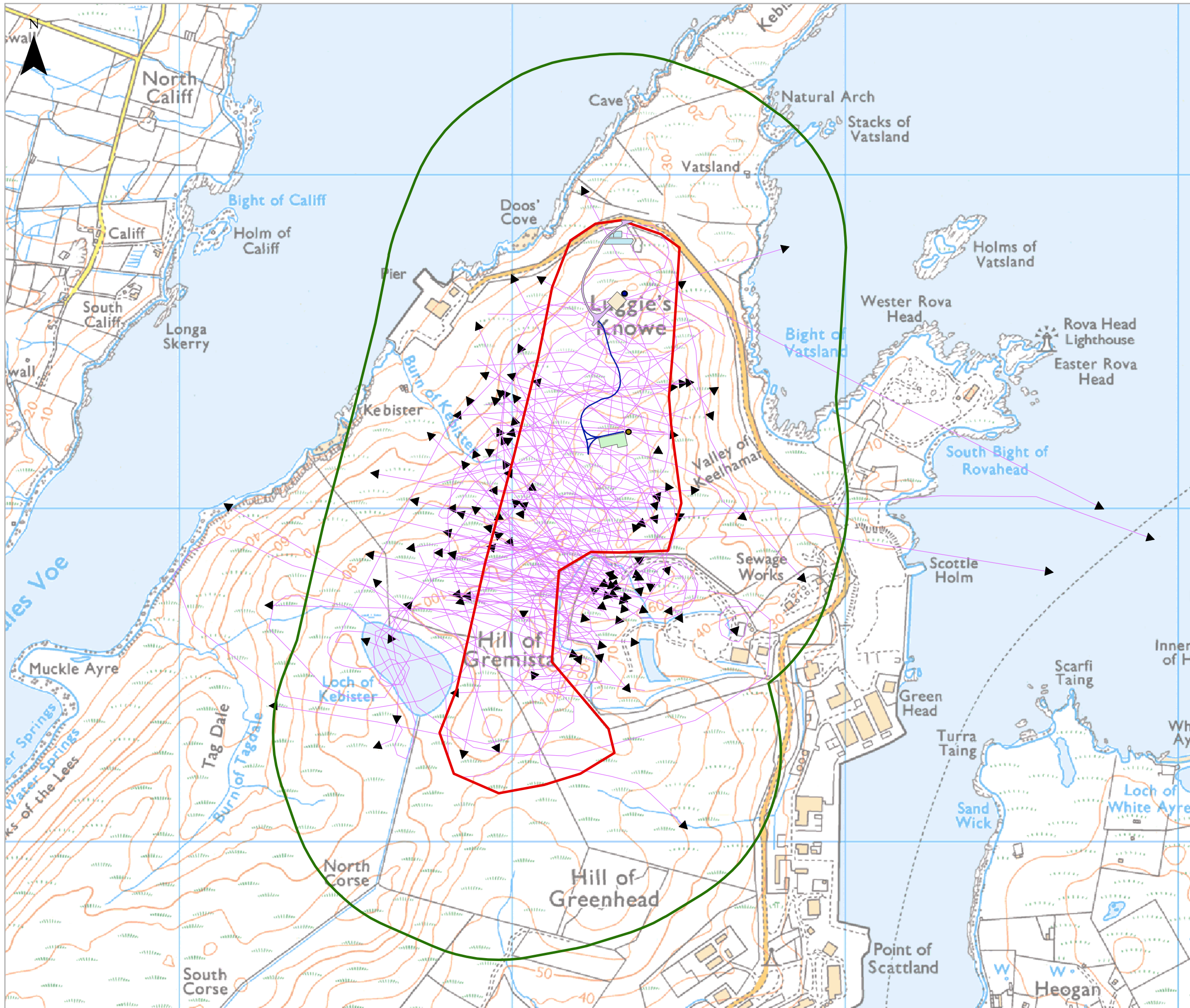


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Figure 7
Seabird flightlines

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Figure 8 – Great Black-backed Gull Flightlines

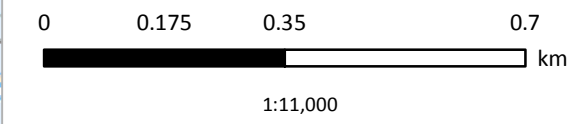


KEY

- Site Boundary
- Study Area (500m)
- Species**
- ▶ Great black-backed gull

Coordinate System: British National Grid
 Projection: Transverse Mercator

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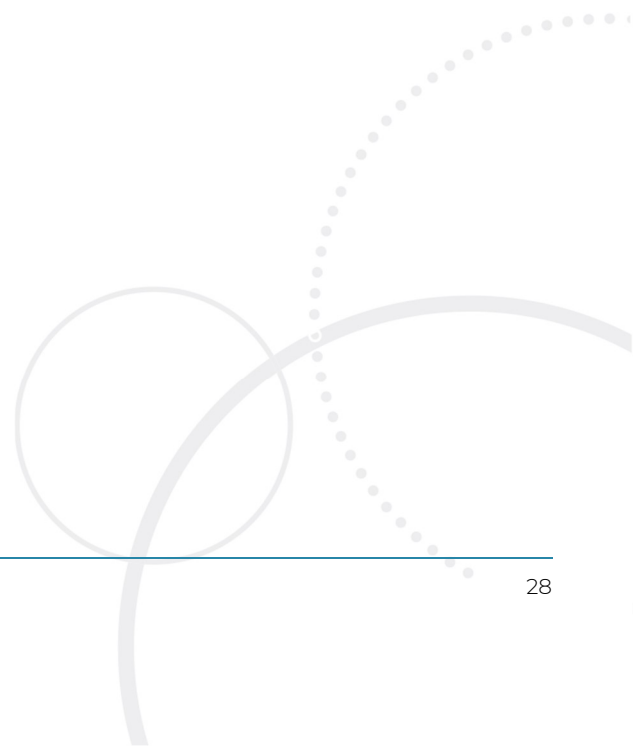


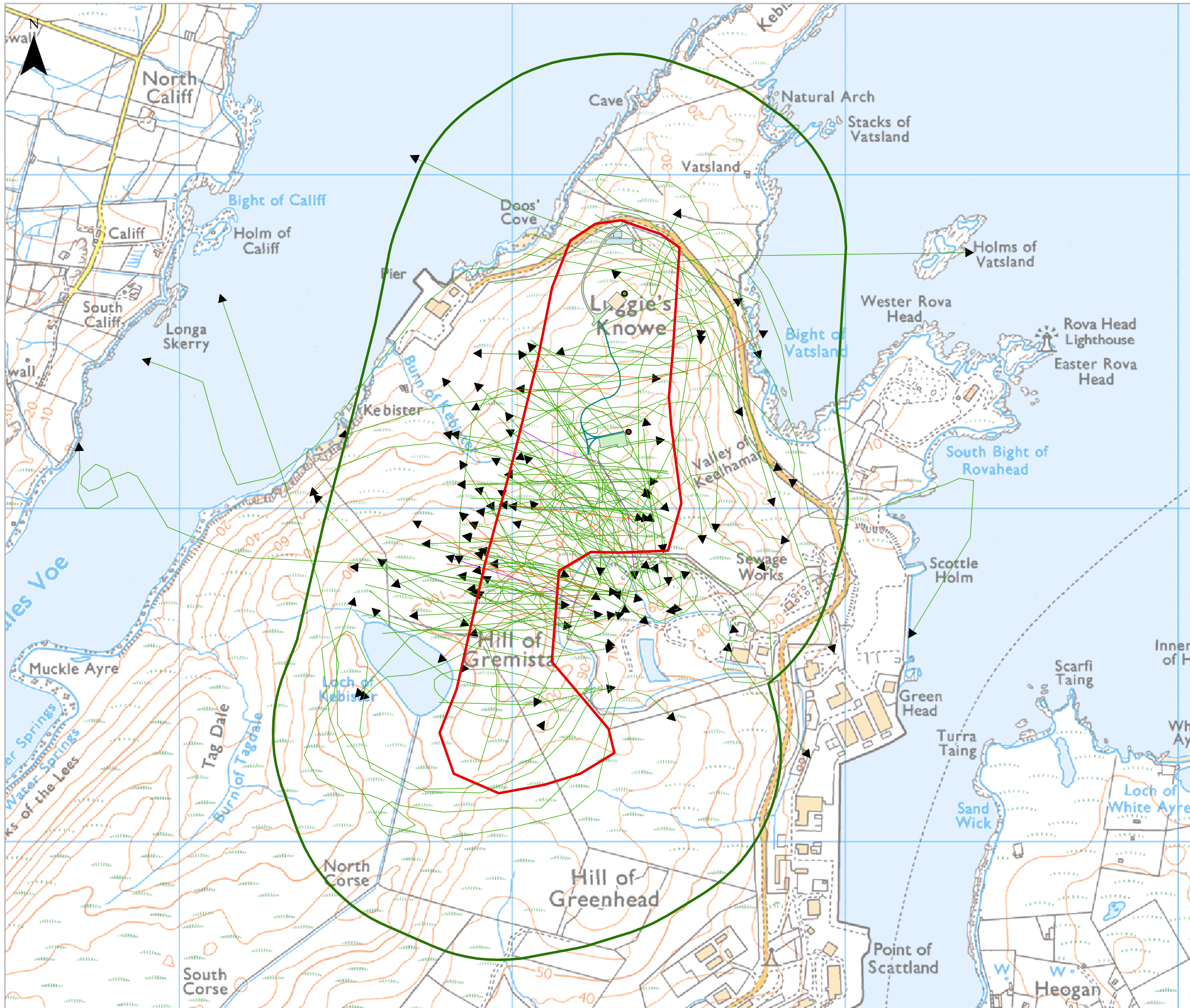
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Figure 8
Great black-backed gull flightlines

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Figure 9 – Common, Glaucous and Herring Gull Flightlines





KEY

- Site Boundary
- Study Area (500m)

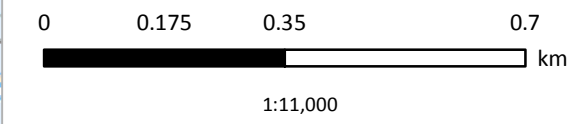
Luggie's Knowe Flightlines

Species

- Common gull
- Glaucous gull
- Herring gull

Coordinate System: British National Grid
 Projection: Transverse Mercator

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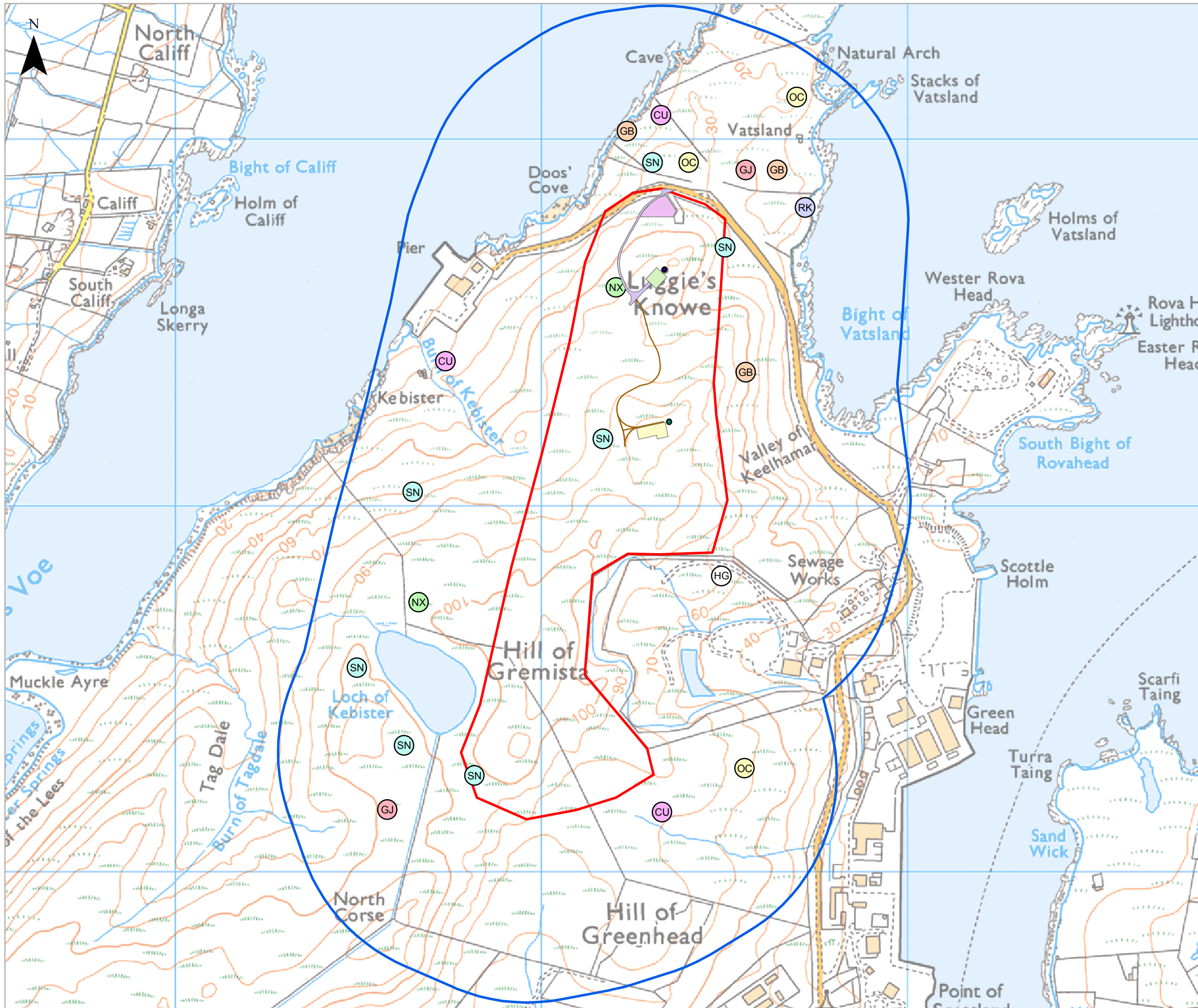


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Figure 9
Herring Common and Glaucous gull flightlines

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Figure 10 – Breeding Bird Territories



KEY

- Site boundary
- Study area (500m)

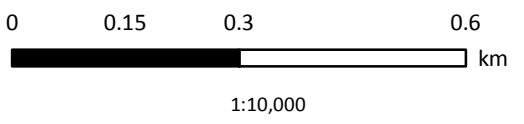
Territories

Species

- Curlew (CU)
- Great black-backed gull (GB)
- Greylag goose (GJ)
- Herring gull HG
- Great skua (NX)
- Oystercatcher (OC)
- Redshank (RK)
- Snipe (SN)

Coordinate System: British National Grid
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Figure 10
Breeding Bird Territory

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Figure 11 – Desk Study Results

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Appendix A: Survey Data Summary

Table A1 - Vantage point survey timings and weather

Date	Vantage Point	Start time	Stop Time	Time (Hrs)	Wind Direction	Wind speed	Cloud cover	Rain	Snow	Frost
26-Sep-20	1	15:00	18:00	3	NNE	4	4	0	0	0
27-Sep-20	2	12:20	15:20	3	NNE	3	8	1	0	0
10-Oct-20	2	15:11	18:11	3	NNW	3	7	0	0	0
11-Oct-20	2	11:39	14:39	3	NNW	4	5	0	0	0
12-Oct-20	1	07:41	10:41	3	SE	3	8	1	0	0
12-Oct-20	1	11:11	14:11	3	ESE	4	8	1	0	0
11-Oct-20	1	15:09	18:09	3	WNW	4	6	1	0	0
12-Nov-20	2	07:48	10:13	2.5	S	5	8	3	0	0
12-Nov-20	2	12:42	15:42	3	SSW	4	8	3	0	0
13-Nov-20	2	11:15	11:48	0.5	SE	3	8	3	0	0
13-Nov-20	2	12:18	15:18	3	SSW	5	7	0	0	0
14-Nov-20	1	09:07	12:07	3	SE	4	6	3	0	0
14-Nov-20	1	12:37	15:37	3	S	5	5	0	0	0
03-Feb-21	1	11:10	14:10	3	SE	4	4	0	1	2
03-Feb-21	1	14:40	16:20	2	E	4	4	0	1	1
05-Feb-21	1	15:08	16:28	1	SE	5	8	0	1	1
04-Feb-21	2	09:45	12:45	3	SSE	4	6	0	1	1
04-Feb-21	2	13:26	16:26	3	ESE	4	6	0	1	1
05-Feb-21	2	08:08	11:08	3	SE	5	7	0	1	1
05-Feb-21	2	11:38	14:38	3	SE	5	7	0	1	1
10-Mar-21	1	09:30	12:30	3	S	4	4	0	0	0
10-Mar-21	1	13:00	16:00	3	S	4	5	0	0	0
11-Mar-21	2	10:30	13:30	3	W	5	7	1	0	0
11-Mar-21	2	14:00	17:00	3	W	5	7	1	0	0
13-Mar-21	1	06:25	09:25	3	WSW	5	7	4	1	0
13-Mar-21	1	09:55	12:55	3	SW	4	4	3	1	0
27-Apr-21	1	09:45	12:45	3	NNE	5	6	0	0	0
29-Apr-21	1	05:05	08:05	3	NE	5	7	4	0	1
28-Apr-21	2	05:05	08:05	3	NE	5	7	4	0	0
28-Apr-21	2	08:38	11:38	3	NW	3	7	1	0	0
14-May-21	1	15:00	18:00	3	NNE	4	8	0	0	0
14-May-21	1	18:35	21:35	3	NNW	4	8	2	0	0
15-May-21	2	15:05	18:05	3	E	3	8	2	0	0
15-May-21	2	18:38	21:38	3	E	2	8	2	0	0
14-Jun-21	1	09:15	12:15	3	WSW	4	5	0	0	0
14-Jun-21	1	12:45	15:45	3	SW	4	6	0	0	0
15-Jun-21	2	09:30	12:30	3	SSE	5	8	0	0	0
15-Jun-21	2	13:00	16:00	3	SSE	4	8	0	0	0
12-Jul-21	1	13:45	15:45	3	SSE	3	8	0	0	0
12-Jul-21	1	17:15	20:15	3	S	4	8	2	0	0

Date	Vantage Point	Start time	Stop Time	Time (Hrs)	Wind Direction	Wind speed	Cloud cover	Rain	Snow	Frost
13-Jul-21	2	13:40	16:40	3	ENE	1	8	0	0	0
13-Jul-21	2	17:10	20:10	3	NE	2	8	0	0	0
16-Aug-21	1	14:28	17:28	3	WNW	5	5	0	0	0
17-Aug-21	1	05:27	08:27	3	S	2	8	0	0	0
17-Aug-21	1	08:57	11:57	3	SSE	1	8	0	0	0
18-Aug-21	1	17:53	20:53	3	N	4	6	0	0	0
18-Aug-21	2	05:29	08:29	3	WNW	3	8	1	0	0
18-Aug-21	2	08:59	11:59	3	NNW	2	8	1	0	0
19-Aug-21	2	14:20	17:20	3	WNW	4	7	0	0	0
19-Aug-21	2	17:50	20:50	3	W	4	8	0	0	0

Meteorological Key:

Wind speed	Cloud cover	Rain	Snow	Frost
calm = 0 light air = 1 Light breeze = 2 Gentle Breeze = 3 Mod. Breeze = 4 fresh breeze = 5 strong breeze = 6 mod. gale = 7 fresh gale = 8 strong gale = 9	In eighths e.g 0/8 = no cloud 8/8 = full cloud cover	None = 0 Occasional=1 Drizzle / mist = 2 Light shower = 3 Heavy shower = 4 Heavy rain = 5	None = 0 On Site = 1 Snowing = 2	None = 0 Ground = 1 All day = 2

Table A2 - Summary of Target Species Flight Time

Species	Flights	Total No birds	Sum of Duration (Seconds)	HB1 - 0-10	HB2 - 11-20	HB3 - 21-30	HB4 - 31-40	HB5 - 41-50	HB6 - 51-150	HB7 - 150+
Arctic tern	2	4	115		23	52	40			
Common gull	10	21	313		205	108				
Curlew	12	57	531		43	280	86	47	30	45
Glaucous gull	2	2	104		46	30	28			
Great black-backed gull	116	315	6,077	353	1,054	2,268	1,233	585	288	296
Great skua	30	45	2,543		468	1,036	676	202	60	101
Greylag goose	18	134	1,870	281	45	432	521	246	77	268
Hen harrier	1	1	211	75						136
Herring gull	105	271	5,507	309	1,079	1,862	848	543	451	415
Knot	1	8	46				46			
Long-tailed duck	1	2	94							94
Merlin	2	2	76		27	10	29	10		
Oystercatcher	2	4	156		95	61				
Red-throated diver	46	79	5,623		155	413	1,216	1,745	1,715	369
Snipe	2	2	208		15	30	75	88		

Table A3 – Arctic Tern

Date	VP	No	Sex	Time	Duration	HB1 - 0-10	HB2 - 11-20	HB3 - 21-30	HB4 - 31-40	HB5 - 41-50	HB6 - 51-150	HB7 - 150+
14-May-21	1	3	U	17:08	63	23	40					
13-Jul-21	2	1	U	19:15	52		12	40				

Table A4 – Common gull

Date	VP	No	Sex	Time	Duration	HB1 - 0-10	HB2 - 11-20	HB3 - 21-30	HB4 - 31-40	HB5 - 41-50	HB6 - 51-150	HB7 - 150+
10-Mar-21	1	2	U	13:46	48	48						
13-Mar-21	1	2	U	08:48	23	23						
13-Mar-21	1	7	U	09:24	46	15	31					
13-Mar-21	1	2	U	11:06	27		27					
13-Mar-21	1	1	U	12:45	11	11						

Date	VP	No	Sex	Time	Duration	HB1 - 0-10	HB2 - 11-20	HB3 - 21-30	HB4 - 31-40	HB5 - 41-50	HB6 51-150	HB7 - 150+
28-Apr-21	2	1	U	08:47	42	42						
28-Apr-21	2	1	U	10:10	43	40	3					
15-May-21	2	1	U	16:39	19	19						
14-Jun-21	1	1	U	11:21	27		27					
15-Jun-21	2	3	U	10:12	27	7	20					

Table A5 – Curlew

Date	VP	No	Sex	Time	Duration	HB1 - 0-10	HB2 - 11-20	HB3 - 21-30	HB4 - 31-40	HB5 - 41-50	HB6 51-150	HB7 - 150+
11-Sep-20	1	18	U	16:46	39			39				
12-Nov-20	2	8	U	13:14	53	20	30	3				
12-Nov-20	2	7	U	15:02	45		45					
12-Nov-20	2	2	U	10:04	31			31				
13-Nov-20	2	1	U	13:12	39		30	9				
13-Nov-20	2	1	U	11:22	44		40	4				
14-Nov-20	1	12	U	11:12	75					30	45	
28-Apr-21	2	2	U	10:31	27		27					
15-May-21	2	1	U	18:53	37		37					
14-Jun-21	1	1	U	15:28	47				47			
15-Jun-21	2	1	U	13:36	47		47					
16-Aug-21	1	3	U	15:33	47	23	24					

Table A6 – Glaucous gull

Date	VP	No	Sex	Time	Duration	HB1 - 0-10	HB2 - 11-20	HB3 - 21-30	HB4 - 31-40	HB5 - 41-50	HB6 51-150	HB7 - 150+
04-Feb-21	2	1	U	13:38	58		30	28				
13-Mar-21	1	1	U	06:36	46	46						

Table A7 – Great black-backed gull

Date	VP	No	Sex	Time	Duration	HB1 - 0-10	HB2 - 11-20	HB3 - 21-30	HB4 - 31-40	HB5 - 41-50	HB6 51-150	HB7 - 150+
26-Sep-20	1	2	U	15:43	22			5		5	12	
26-Sep-20	1	3	U	16:39	39				9	15	15	
26-Sep-20	1	3	U	17:13	46	8	30	8				
27-Sep-20	2	3	U	12:57	42					21	21	
27-Sep-20	2	1	U	13:00	55				20	15	20	
27-Sep-20	2	8	U	13:06	101					15	86	
10-Oct-20	2	1	U	15:52	47				24	23		
12-Nov-20	2	2	U	15:31	67		52	15				
12-Nov-20	2	1	U	08:20	42		30	12				
12-Nov-20	2	1	U	08:37	27	7	20					
12-Nov-20	2	1	U	10:13	39			9	30			
13-Nov-20	2	2	U	12:53	12	6	6					
13-Nov-20	2	3	U	13:06	51				51			
13-Nov-20	2	2	U	13:29	64			4	60			
13-Nov-20	2	1	U	15:02	26		26					
13-Nov-20	2	1	U	15:12	35		35					
13-Nov-20	2	1	U	15:14	24			24				
14-Nov-20	1	4	U	12:54	69		20	30	19			
14-Nov-20	1	2	U	09:42	61		31	30				
14-Nov-20	1	3	U	10:02	57			15	42			
14-Nov-20	1	7	U	10:47	82				30	52		
14-Nov-20	1	1	U	11:22	22		22					
14-Nov-20	1	3	U	11:51	20			15	5			
14-Nov-20	1	10	U	11:59	68			34	34			
03-Feb-21	1	1	U	13:34	39		20	19				
04-Feb-21	2	1	U	10:26	45		23	22				
04-Feb-21	2	2	U	11:11	51		21	30				
04-Feb-21	2	3	U	11:15	74							74
04-Feb-21	2	1	U	12:33	59					7	7	45
04-Feb-21	2	1	U	12:41	71					11	45	15
05-Feb-21	1	2	U	16:10	87							87

Date	VP	No	Sex	Time	Durati on	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
05-Feb-21	2	3	U	09:56	139	15	15		15	64	30	
05-Feb-21	2	7	U	12:08	300	150	150					
05-Feb-21	2	1	U	13:32	132						30	102
05-Feb-21	2	1	U	14:04	48					30	9	9
05-Feb-21	2	2	U	14:31	102			15	15	30	21	21
10-Mar-21	1	1	U	10:13	64		64					
10-Mar-21	1	2	U	11:50	43		28	15				
10-Mar-21	1	1	U	12:12	56	6	50					
10-Mar-21	1	1	U	14:32	96		66	30				
11-Mar-21	2	12	U	12:18	32	32						
11-Mar-21	2	1	U	13:01	27	27						
11-Mar-21	2	1	U	13:24	14	14						
11-Mar-21	2	3	U	15:47	28	28						
11-Mar-21	2	1	U	16:11	34	34						
11-Mar-21	2	2	U	16:23	19	19						
11-Mar-21	2	14	U	16:37	74			37	37			
11-Mar-21	2	1	U	16:46	26	26						
13-Mar-21	1	1	U	06:48	18		9	9				
13-Mar-21	1	1	U	08:55	41		26	15				
13-Mar-21	1	42	U	08:58	79	49	30					
13-Mar-21	1	2	U	10:53	64	44	20					
13-Mar-21	1	1	U	11:21	32	17	15					
13-Mar-21	1	2	U	11:31	52		32	20				
13-Mar-21	1	1	U	11:34	27	15	12					
13-Mar-21	1	2	U	11:37	24	9	15					
13-Mar-21	1	2	U	12:02	27	20	7					
13-Mar-21	1	19	U	12:18	87	43	44					
13-Mar-21	1	1	U	12:43	23	23						
13-Mar-21	1	1	U	12:49	25	25						
13-Mar-21	1	3	U	12:52	48	6	30	6	6			
27-Apr-21	1	3	U	10:12	31	10	21					
28-Apr-21	2	1	U	06:52	41		41					

Date	VP	No	Sex	Time	Durati on	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
28-Apr-21	2	2	U	07:36	37	22	15					
28-Apr-21	2	1	U	09:54	38		19	19				
28-Apr-21	2	1	U	10:02	32	2	30					
28-Apr-21	2	2	U	10:53	28		8	20				
28-Apr-21	2	1	U	11:07	74		30	29	15			
28-Apr-21	2	2	U	11:32	87		29	29	29			
29-Apr-21	1	2	U	05:08	64		4	60				
29-Apr-21	1	2	U	05:10	49	9	40					
29-Apr-21	1	3	U	07:04	39		19	20				
29-Apr-21	1	1	U	07:12	51		45	6				
29-Apr-21	1	1	U	07:52	32		17	15				
14-May-21	1	1	U	15:29	44		44					
14-May-21	1	1	U	17:54	39	9	30					
15-May-21	2	1	U	16:13	32	32						
14-Jun-21	1	1	U	10:11	27		7	20				
14-Jun-21	1	1	U	10:39	19			19				
14-Jun-21	1	2	U	11:02	39		30	9				
14-Jun-21	1	26	U	11:42	232	60	60	60	52			
14-Jun-21	1	2	U	12:51	53			15	38			
14-Jun-21	1	3	U	12:57	65		32	33				
14-Jun-21	1	1	U	13:14	31	6	25					
14-Jun-21	1	1	U	13:38	59		9	25	25			
14-Jun-21	1	1	U	15:04	39		20	19				
14-Jun-21	1	1	U	15:17	18		18					
14-Jun-21	1	2	U	15:33	38		19	19				
14-Jun-21	1	4	U	15:41	24	20	4					
15-Jun-21	2	1	U	10:33	21		21					
15-Jun-21	2	2	U	13:12	34		4	30				
15-Jun-21	2	1	U	14:18	22		22					
15-Jun-21	2	3	U	14:43	19	10	9					
15-Jun-21	2	2	U	14:49	218	15	60	120	23			
15-Jun-21	2	1	U	14:55	46		31	15				

Date	VP	No	Sex	Time	Duration	HB1 - 0-10	HB2 - 11-20	HB3 - 21-30	HB4 - 31-40	HB5 - 41-50	HB6 51-150	HB7 - 150+
15-Jun-21	2	1	U	15:07	34	4	30					
15-Jun-21	2	2	U	15:24	78	30	33	15				
15-Jun-21	2	1	U	15:27	23		23					
15-Jun-21	2	1	U	15:29	20		20					
15-Jun-21	2	1	U	15:48	26		26					
12-Jul-21	1	1	U	14:36	39		30	9				
12-Jul-21	1	1	U	15:02	78	30	48					
12-Jul-21	1	1	U	15:08	72		50	22				
12-Jul-21	1	2	U	17:44	43			43				
12-Jul-21	1	1	U	19:04	107	57	50					
13-Jul-21	2	1	U	18:37	167		83	84				
13-Jul-21	2	1	U	19:14	34		34					
13-Jul-21	2	2	U	14:48	33		33					
13-Jul-21	2	1	U	16:17	23	23						
16-Aug-21	1	1	U	15:48	34	17	17					
18-Aug-21	1	1	U	18:08	39	39						
18-Aug-21	1	2	U	20:23	41		41					
18-Aug-21	1	1	U	20:42	51			45	6			
18-Aug-21	2	1	U	10:57	42	27	15					
18-Aug-21	2	2	U	11:49	19	9	10					
18-Aug-21	2	1	U	11:51	27		13	14				

Table A8 – Great skua

Date	VP	No	Sex	Time	Duration	HB1 - 0-10	HB2 - 11-20	HB3 - 21-30	HB4 - 31-40	HB5 - 41-50	HB6 51-150	HB7 - 150+
27-Apr-21	1	4	U	12:36	74		15	44	15			
27-Apr-21	1	3	U	12:40	330	45	105	165	15			
28-Apr-21	2	3	U	08:55	57		50	7				
28-Apr-21	2	1	U	09:14	49	9	40					
28-Apr-21	2	2	U	10:43	68	15	26	27				
29-Apr-21	1	2	U	07:34	41		21	20				
29-Apr-21	1	1	U	07:57	86	15	45	26				

Date	VP	No	Sex	Time	Durati on	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
29-Apr-21	1	2	U	08:03	141		30	60	51			
14-May-21	1	1	U	15:46	81		70	11				
14-May-21	1	2	U	16:08	62	22	40					
15-May-21	2	2	U	15:18	47	13	20	14				
15-May-21	2	1	U	16:02	73	13	60					
15-May-21	2	1	U	17:49	47	40	7					
15-May-21	2	2	U	20:36	88	44	44					
15-Jun-21	2	1	U	13:51	78	30	33	15				
15-Jun-21	2	1	U	15:27	26		26					
12-Jul-21	1	1	U	15:27	114	57	57					
12-Jul-21	1	2	U	15:43	56	28	28					
12-Jul-21	1	1	U	18:07	52		26	26				
12-Jul-21	1	1	U	20:04	79	15	60	4				
13-Jul-21	2	1	U	19:52	76	38	38					
16-Aug-21	1	1	U	14:56	52		52					
16-Aug-21	1	1	U	15:57	74		15	59				
17-Aug-21	1	1	U	06:31	73		30	43				
17-Aug-21	1	1	U	09:53	37		18	19				
17-Aug-21	1	1	U	10:14	61	21	20	20				
18-Aug-21	1	1	U	19:12	41			41				
18-Aug-21	1	1	U	19:14	18	18						
18-Aug-21	2	1	U	11:52	61			15	46			
19-Aug-21	2	2	U	17:56	401	45	60	60	75	60	101	

Table A9 – Greylag goose

Date	VP	No	Sex	Time	Durati on	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
10-Oct-20	2	64	U	17:52	181						11	170
12-Oct-20	1	5	U	11:59	52					20	32	
12-Oct-20	1	21	U	07:42	131						120	11
12-Oct-20	1	5	U	08:30	205						105	100
27-Apr-21	1	2	U	09:48	56		56					

Date	VP	No	Sex	Time	Durati on	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
27-Apr-21	1	2	U	10:25	73	13	30	30				
27-Apr-21	1	2	U	11:22	92			60	32			
27-Apr-21	1	2	U	11:49	63		48	15				
28-Apr-21	2	2	U	05:19	133		30	50	53			
28-Apr-21	2	3	U	06:12	52			26	26			
28-Apr-21	2	8	U	07:12	192		96	96				
28-Apr-21	2	2	U	07:18	155	15	70	70				
28-Apr-21	2	3	U	09:32	81		27	27	27			
28-Apr-21	2	2	U	10:14	56		13	13	30			
29-Apr-21	1	4	U	05:32	123		30	60	33			
29-Apr-21	1	2	U	06:43	72		15	57				
14-May-21	1	3	U	16:59	102				45	57		
14-May-21	1	2	U	19:42	51	17	17	17				

Table A10 – Hen harrier

Date	VP	No	Sex	Time	Durati on	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
27-Sep-20	2	1	U	14:09	211						136	75

Table A11 – Herring gull

Date	VP	No	Sex	Time	Durati on	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
11-Sep-20	1	2	U	15:40	55				55			
11-Sep-20	1	2	U	16:58	27				7	20		
26-Sep-20	1	1	U	16:51	51				21	15	15	
27-Sep-20	2	1	U	14:59	43		13	15	15			
11-Oct-20	2	1	U	11:46	72	15	30	15	12			
11-Oct-20	2	2	U	14:26	42				21	21		
13-Nov-20	2	1	U	13:58	57			12	45			
13-Nov-20	2	2	U	14:36	33				33			
14-Nov-20	1	2	U	13:21	32			32				
14-Nov-20	1	3	U	15:35	18		8	10				

Date	VP	No	Sex	Time	Duration	HB1 - 0-10	HB2 - 11-20	HB3 - 21-30	HB4 - 31-40	HB5 - 41-50	HB6 51-150	HB7 - 150+
14-Nov-20	1	1	U	10:58	63		3	30	30			
14-Nov-20	1	7	U	11:46	84		15	30	39			
14-Nov-20	1	22	U	12:04	109					50	59	
14-Nov-20	1	2	U	12:06	18		10	8				
03-Feb-21	1	1	U	12:59	74		15	44	15			
04-Feb-21	2	1	U	09:58	63		33	30				
04-Feb-21	2	1	U	10:47	49			40	9			
04-Feb-21	2	1	U	11:14	36				21	15		
04-Feb-21	2	2	U	14:06	64					45	19	
04-Feb-21	2	2	U	14:29	81			15	30	20	8	8
04-Feb-21	2	1	U	14:56	67					22	22	23
04-Feb-21	2	1	U	15:17	64			15	30	19		
04-Feb-21	2	2	U	15:52	72						36	36
04-Feb-21	2	6	U	15:56	104				30	30	44	
04-Feb-21	2	1	U	16:14	51						15	36
05-Feb-21	1	2	U	15:26	39						39	
05-Feb-21	1	1	U	15:32	61				8	45	8	
05-Feb-21	1	2	U	15:54	75							75
05-Feb-21	1	2	U	16:07	42					15	27	
05-Feb-21	2	1	U	10:14	41						41	
05-Feb-21	2	1	U	10:19	84						15	69
05-Feb-21	2	2	U	10:45	204	15	45	15	30	45	30	24
05-Feb-21	2	4	U	10:54	83					30	15	38
05-Feb-21	2	8	U	12:08	300	150	150					
05-Feb-21	2	1	U	12:24	21		7	7	7			
05-Feb-21	2	1	U	14:17	36			18	18			
10-Mar-21	1	2	U	09:48	76	70	6					
10-Mar-21	1	2	U	10:52	51	21	30					
10-Mar-21	1	3	U	10:56	59	14	45					
10-Mar-21	1	2	U	11:22	82		52	30				
10-Mar-21	1	5	U	13:08	52		22	30				
10-Mar-21	1	1	U	13:21	36		36					

Date	VP	No	Sex	Time	Durati on	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
10-Mar-21	1	4	U	14:02	72		36	36				
10-Mar-21	1	7	U	14:43	45		45					
10-Mar-21	1	1	U	14:57	43		28	15				
10-Mar-21	1	1	U	15:38	11	11						
10-Mar-21	1	3	U	15:51	27	10	17					
11-Mar-21	2	1	U	11:12	41	21	20					
11-Mar-21	2	3	U	12:19	18	9	9					
11-Mar-21	2	8	U	13:18	34		19	15				
11-Mar-21	2	2	U	13:21	56	15	41					
11-Mar-21	2	2	U	14:14	24	24						
11-Mar-21	2	3	U	14:51	43			43				
11-Mar-21	2	1	U	16:29	31	16	15					
11-Mar-21	2	7	U	16:52	49		25	24				
13-Mar-21	1	1	U	06:43	32		32					
13-Mar-21	1	1	U	07:05	57		27	30				
13-Mar-21	1	1	U	07:07	26	20	6					
13-Mar-21	1	1	U	07:21	29	29						
13-Mar-21	1	4	U	08:22	52	30	22					
13-Mar-21	1	4	U	08:31	64	32	32					
13-Mar-21	1	1	U	08:39	57	42	15					
13-Mar-21	1	1	U	08:51	34	19	15					
13-Mar-21	1	9	U	09:03	45	15	30					
13-Mar-21	1	1	U	09:11	37	15	22					
13-Mar-21	1	2	U	09:23	41	41						
13-Mar-21	1	6	U	10:34	76	30	30	16				
13-Mar-21	1	2	U	10:43	51		51					
13-Mar-21	1	1	U	10:55	42	15	27					
13-Mar-21	1	4	U	11:09	49	34	15					
13-Mar-21	1	1	U	11:35	19	19						
13-Mar-21	1	14	U	11:45	78	39	39					
13-Mar-21	1	2	U	11:48	41		41					
13-Mar-21	1	2	U	11:55	16	16						

Date	VP	No	Sex	Time	Durati on	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
13-Mar-21	1	4	U	11:59	35	18	17					
13-Mar-21	1	3	U	12:39	31	31						
13-Mar-21	1	1	U	12:51	29	29						
28-Apr-21	2	1	U	07:07	38	8	20	10				
28-Apr-21	2	1	U	07:31	38		38					
28-Apr-21	2	1	U	07:34	29	9	20					
28-Apr-21	2	1	U	09:53	23		20	3				
28-Apr-21	2	1	U	10:07	38	10	15	13				
28-Apr-21	2	4	U	11:02	81		40	41				
28-Apr-21	2	2	U	11:23	62		22	40				
29-Apr-21	1	1	U	05:10	41		41					
14-Jun-21	1	3	U	09:43	41		15	26				
14-Jun-21	1	14	U	11:42	232	60	60	60	52			
14-Jun-21	1	1	U	13:52	21		1	20				
15-Jun-21	2	2	U	09:48	18		15	3				
15-Jun-21	2	2	U	11:49	23		20	3				
15-Jun-21	2	1	U	12:15	14		14					
15-Jun-21	2	2	U	14:29	31	11	20					
15-Jun-21	2	2	U	15:54	38		8	30				
12-Jul-21	1	2	U	14:51	53		53					
12-Jul-21	1	1	U	17:26	39		30	9				
13-Jul-21	2	1	U	19:17	44		44					
13-Jul-21	2	1	U	14:46	39		39					
13-Jul-21	2	1	U	14:47	44	14	30					
13-Jul-21	2	1	U	14:50	55	25	30					
13-Jul-21	2	1	U	14:52	41		41					
18-Aug-21	2	1	U	11:47	26	13	13					
19-Aug-21	2	1	U	15:08	14	14						
19-Aug-21	2	1	U	15:21	22	20	2					
19-Aug-21	2	2	U	15:29	112	30	15	15	15	15	22	
19-Aug-21	2	2	U	20:43	44					44		

Table A12 – Knot

Date	VP	No	Sex	Time	Duration	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
14-May-21	1	8	U	17:28	46			46				

Table A13 – Long-tailed duck

Date	VP	No	Sex	Time	Duration	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
12-Oct-20	1	2	U	08:37	94						94	

Table A14 – Merlin

Date	VP	No	Sex	Time	Duration	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
13-Mar-21	1	1	U	08:14	27	27						
27-Apr-21	1	1	U	10:34	49		10	29	10			

Table A15 – Oystercatcher

Date	VP	No	Sex	Time	Duration	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
15-Jun-21	2	2	U	12:13	89	45	44					
13-Jul-21	2	2	U	13:53	67	50	17					

Table A16 – Red-throated diver – VP only

Date	VP	No	Sex	Time	Duration	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
28-Apr-21	2	2	U	05:41	175			45	45	45	40	
28-Apr-21	2	2	U	07:23	62	15	15	20	12			
28-Apr-21	2	1	U	08:06	32	8	8	8	8			
28-Apr-21	2	2	U	09:59	122			62	45	15		
28-Apr-21	2	1	U	11:35	32	12	20					
29-Apr-21	1	2	U	05:26	212				120	77	15	
29-Apr-21	1	4	U	05:56	147		15	30	30	72		

Date	VP	No	Sex	Time	Duration	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
14-May-21	1	2	U	15:14	100		25	25	25	25		
14-May-21	1	2	U	16:41	87			22	45	20		
14-May-21	1	2	U	18:36	94			30	30	34		
14-May-21	1	2	U	20:29	45			39	6			
15-May-21	2	2	U	16:39	71	15	15	15	26			
15-May-21	2	2	U	17:02	112			45	45	22		
15-May-21	2	1	U	20:51	94				15	79		
15-May-21	2	2	U	21:26	65				30	35		
14-Jun-21	1	1	U	12:06	187	30	15	30	30	82		
15-Jun-21	2	1	U	15:32	79				30	49		
12-Jul-21	1	1	U	13:49	234	15	60	75	60	24		
12-Jul-21	1	1	U	18:29	112			15	30	50	17	
12-Jul-21	1	1	U	18:41	97		30	30	30	7		
13-Jul-21	2	3	U	17:26	94			15	45	15	19	
13-Jul-21	2	1	U	19:56	94			15	30	30	19	
13-Jul-21	2	1	U	13:55	142		30	15	15	82		
13-Jul-21	2	1	U	13:56	184		30	45	30	79		
13-Jul-21	2	1	U	14:02	88		15	15	15	30	13	
13-Jul-21	2	1	U	14:02	210			30	45	45	90	
13-Jul-21	2	1	U	15:41	89		15	15	30	15	14	
13-Jul-21	2	2	U	15:46	178	15	15	45	90	13		
17-Aug-21	1	3	U	06:42	197	15	15	45	60	62		
17-Aug-21	1	3	U	07:33	292			30	90	172		
17-Aug-21	1	1	U	07:33	60		30	30				
17-Aug-21	1	1	U	07:45	132			15	57	60		
17-Aug-21	1	2	U	08:02	176		15	78	83			
17-Aug-21	1	3	U	08:12	144			77	67			
17-Aug-21	1	5	U	11:13	218			15	90	113		
17-Aug-21	1	2	U	11:18	142			30	60	52		
18-Aug-21	1	2	U	18:57	89					15	74	
18-Aug-21	2	1	U	07:28	149			30	30	89		
18-Aug-21	2	1	U	08:27	64			15	49			

Date	VP	No	Sex	Time	Duration	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
18-Aug-21	2	1	U	09:35	59				29	30		
18-Aug-21	2	1	U	09:41	139			15	45	39	30	
18-Aug-21	2	2	U	11:20	78	15	30	30	3			
18-Aug-21	2	2	U	11:42	109			30	30	30	19	
18-Aug-21	2	1	U	11:46	75			30	15	15	15	
19-Aug-21	2	2	U	18:22	183	15	15	30	60	63		
19-Aug-21	2	1	U	20:26	79			30	15	30	4	

Table A17 – Red-throated diver – lochan surveys

Date	VP	No	Sex	Time	Duration	HB1 - 0- 10	HB2 - 11- 20	HB3 - 21- 30	HB4 - 31- 40	HB5 - 41- 50	HB6 51- 150	HB7 - 150+
08-May-21	D1	1	U	15:53	81			81				
08-May-21	D1	2	U	16:14	67	15	15	37				
13-May-21	D1	2	U	15:56	430	30	75	60	60	175	30	
13-May-21	D1	1	U	16:30	49	17	17	15				
13-May-21	D1	1	U	16:50	44	17	17	10				
14-May-21	D2	2	U	12:07	89	15	37	37				
14-May-21	D2	2	U	14:09	123	15	15	45	30	18		
12-Jun-21	D2	1	U	20:35	62	15	15	15	17			
12-Jun-21	D1	1	U	14:12	109	15	15	15	15	30	19	
08-Jul-21	D1	1	U	19:47	84		15	15	15	30	9	
08-Jul-21	D1	1	U	20:23	68	12	12	12	12	20		
08-Jul-21	D1	1	U	21:44	52	10	11	10	11	10		
09-Jul-21	D1	1	U	20:31	92	15	15	15	15	32		
09-Jul-21	D1	1	U	21:50	88	15	15	15	15	28		
09-Jul-21	D1	1	U	22:12	101	15	15	15	15	41		
10-Jul-21	D2	1	U	19:33	73	15	15	15	15	13		
10-Jul-21	D2	1	U	19:52	114			15	75	24		
10-Jul-21	D2	1	U	20:21	146	30	60	56				
10-Jul-21	D2	1	U	21:59	86		15	30	30	11		
10-Jul-21	D2	1	U	22:11	69	15	15	15	24			
11-Jul-21	D2	1	U	15:47	137	15	15	15	60	32		

Date	VP	No	Sex	Time	Duration	HB1 - 0-10	HB2 - 11-20	HB3 - 21-30	HB4 - 31-40	HB5 - 41-50	HB6 51-150	HB7 - 150+
11-Jul-21	D2	1	U	16:22	91	15	15	15	23	23		
11-Jul-21	D2	1	U	16:36	78			15	31	32		
11-Jul-21	D2	1	U	18:14	89	15	15	15	22	22		
11-Jul-21	D2	1	U	18:41	104	15	15	15	59			
14-Jul-21	D2	1	U	12:58	116			15	30	36	35	
14-Jul-21	D2	1	U	13:16	137			45	45	24	23	
14-Jul-21	D2	1	U	14:01	92	15	15	30	27	5		
14-Jul-21	D2	1	U	15:18	94	15	15	15	15	17	17	
15-Jul-21	D2	1	U	16:19	111	15	15	15	15	26	25	
15-Jul-21	D2	2	U	16:53	187	15	15	15	75	45	22	
15-Jul-21	D2	1	U	17:42	95	15	15	15	45	5		
15-Jul-21	D2	2	U	18:06	134		15	15	30	60	14	
16-Jul-21	D2	2	U	17:37	139	15	15	15	30	15	49	
16-Jul-21	D2	1	U	18:29	98	15	15	15	15	19	19	
16-Jul-21	D2	2	U	19:46	108	15	15	15	15	30	18	
11-Aug-21	D1	1	U	10:12	146	15	15	45	71			
11-Aug-21	D1	1	U	10:21	61	15	15	15	16			
12-Aug-21	D1	1	U		112	15	45	30	15	7		
12-Aug-21	D1	1	U		94	5	30	45	14			
12-Aug-21	D1	2	U		311			75	105	131		
12-Aug-21	D1	1	U		232		15	75	90	52		
16-Aug-21	D1	1	U	12:27	98		15	43	40			
16-Aug-21	D1	1	U	12:36	277			105	172			
17-Aug-21	D1	1	U	14:47	178			30	75	73		

Table A18 – Snipe

Date	VP	No	Sex	Time	Duration	HB1 - 0-10	HB2 - 11-20	HB3 - 21-30	HB4 - 31-40	HB5 - 41-50	HB6 51-150	HB7 - 150+
28-Apr-21	2	1	U	06:30	64			30	34			
28-Apr-21	2	1	U	09:47	144	15	30	45	54			



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