

Technical Appendix 15.6
Aviation Impact Assessment
Hollandmey Renewable Energy
Development

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www.cyrrus.co.uk

info@cyrrus.co.uk



Executive Summary

Cyrrus Limited has been engaged to provide guidance on aviation issues associated with the proposed Hollandmey Renewable Energy Development (the proposed Development), 8 km southwest of John o' Groats in northwest Scotland. The proposed Development is anticipated to comprise up to 10 turbines with a blade tip height of up to 149.9 m Above Ground Level (AGL).

Of the aviation stakeholders consulted, the Ministry of Defence (MOD), Edinburgh Airport, Glasgow Airport, Glasgow Prestwick Airport, Highlands and Islands Airports Limited (HIAL) and NATS Safeguarding have all responded with no objection to the proposal.

The nearest Primary Surveillance Radar (PSR) facilities to the proposed Development are the NATS (En Route) plc (NERL) radar at Allanshill, the MOD radar at Royal Air Force Lossiemouth, and the HIAL radar at Inverness Airport. Radar Line of Sight (RLoS) does not exist with any of the radar sites and the radars are therefore unlikely to detect the proposed Development wind turbines.

The proposed Development lies within 10 NM of Wick Airport and within the lateral boundary of the Instrument Flight Procedures (IFPs). These were assessed and there is no impact.

The airspace surrounding the proposed Development is classified as uncontrolled airspace with no identifiable impact to General Aviation or Military flying.

The UK Lower Air Traffic Services (ATS) Route structure is not impacted.

Full details of the modelling and analysis are contained within the body of this report.

Abbreviations

AGL	Above Ground Level
AIP	Aeronautical Information Publication
ANSP	Air Navigation Service Provider
ATMS	Air Traffic Management Strategy
ATC	Air Traffic Control
ATS	Air Traffic Service
CAP	Civil Aviation Publication
DTM	Digital Terrain Model
EIA	Environmental Impact Assessment
ENR	En-Route
FL	Flight Level
GA	General Aviation
HAL	Highlands and Islands Airports Limited
HMR	Helicopter Main Route
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
LARS	Lower Airspace Radar Service
MOD	Ministry of Defence
MSD	Minimum Separation Distance
NERL	NATS (En Route) plc
PSR	Primary Surveillance Radar
RED	Renewable Energy Development
RLoS	Radar Line of Sight
RWY	Runway
SPR	ScottishPower Renewables
SSR	Secondary Surveillance Radar
TMZ	Transponder Mandatory Zone
TTA	Tactical Training Area
VFR	Visual Flight Rules

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1. Introduction

1.1. Background

1.1.1. ScottishPower Renewables (SPR) is proposing to develop Hollandmey Renewable Energy Development (RED) (the proposed Development), 8km southwest of John o' Groats in north west Scotland. The proposed Development is anticipated to comprise up to 10 turbines with a blade tip height of up to 149.9 m Above Ground Level (AGL).

1.1.1. Cyrrus Limited has been engaged to provide guidance on aviation issues to support the Environmental Impact Assessment (EIA) process for the project.

1.2. Effects of Wind Turbines on Aviation

1.2.1. Wind turbines are an issue for aviation Primary Surveillance Radars (PSRs) as the characteristics of a moving wind turbine blade are similar to that of an aircraft. The PSR is unable to differentiate between wanted aircraft targets and unwanted clutter targets introduced by the presence of turbines.

1.2.2. The significance of any radar impact depends on airspace usage in the vicinity of the Site and the nature of the Air Traffic Service (ATS) provided in that airspace.

1.3. Scoping Responses

1.3.1. Following publication of the Scoping Documents¹ and requests for pre-application advice, responses have been received from the following aviation stakeholders:

- Edinburgh Airport – August 2020;
- Glasgow Airport – August 2020;
- Glasgow Prestwick Airport – August 2020;
- Highlands and Islands Airports Limited (HIAL) – August 2020;
- NATS Safeguarding – August 2020; and
- Ministry of Defence (MOD) – September 2020.

1.3.2. The consulted aviation stakeholders have no concerns with the proposed Development. However, in HIAL's response dated 26 August 2020, they stated that surveillance is not currently considered in their safeguarding criteria as they are in the process of determining a final surveillance solution for their Air Traffic Management Strategy (ATMS) combined surveillance and remote tower project at Dundee, Kirkwall, Sumburgh and Wick Airports.

1.4. Aviation Modelling Tasks

- Determine the radar visibility of the proposed Development; and
- Review the nature of the airspace in the vicinity of the proposed Development to determine any potential impact on aviation.

¹ Hollandmey Renewable Energy Development EIA Scoping Topic Information Sheets, July 2020

2. Data

2.1. Hollandmey Renewable Energy Development

2.1.1. A turbine layout for the proposed Development, dated 15 June 2021, was issued in the following file:

- 20210615_HMY_turbines Position.xlsx.

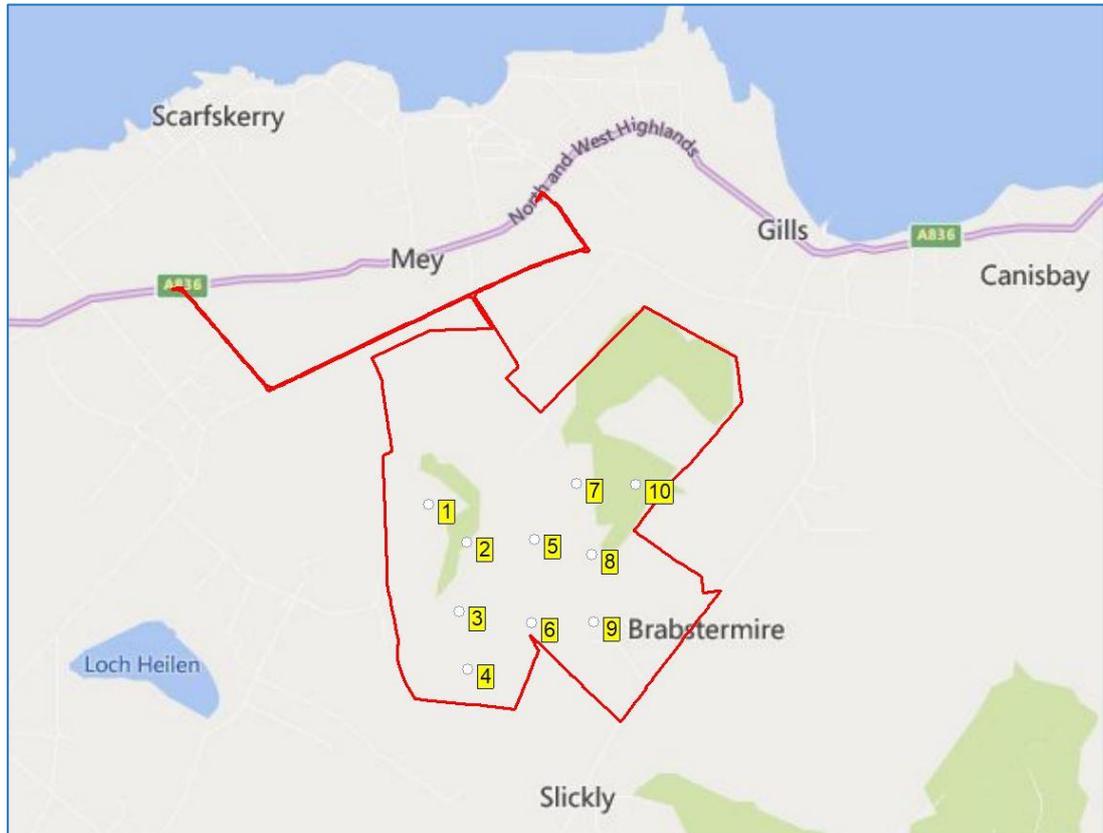
2.1.2. The Ordnance Survey National Grid coordinates for this proposed turbine layout, as used in the assessment, are listed in **Table 1**.

Turbine	Easting	Northing
T1	328397	970004
T2	328796	969598
T3	328700	968860
T4	328781	968240
T5	329515	969620
T6	329467	968729
T7	329963	970204
T8	330120	969444
T9	330129	968731
T10	330588	970185

Table 1: Hollandmey turbine coordinates

2.1.3. The 10 turbines are planned to have a blade (rotor) diameter of 132 m and a maximum blade tip height of 150 m AGL.

2.1.4. The proposed turbine layout used for the modelling is shown in **Figure 1**.



Microsoft® Bing™ screen shot reprinted with permission from Microsoft Corporation
Figure 1: Hollandmey Renewable Energy Development turbine layout

2.2. Radar Data

2.2.1. Radar parameters used in the assessment have been taken from data held on file by Cyrrus.

2.3. Analysis Tools

- ATDI ICS telecom EV v15.5.3 x64 radio network analysis tool;
- Global Mapper v21.1.1 Geographic Information System data processing utility; and
- ZWCAD+ 2015 SP2 Pro v2015.05.26(27086) Computer Aided Design software.

2.4. Terrain Data

- 25m Digital Terrain Model (DTM)

2.4.1. A 3D view of the turbines and the terrain model is shown in **Figure 2**.



Microsoft® Bing™ screen shot reprinted with permission from Microsoft Corporation

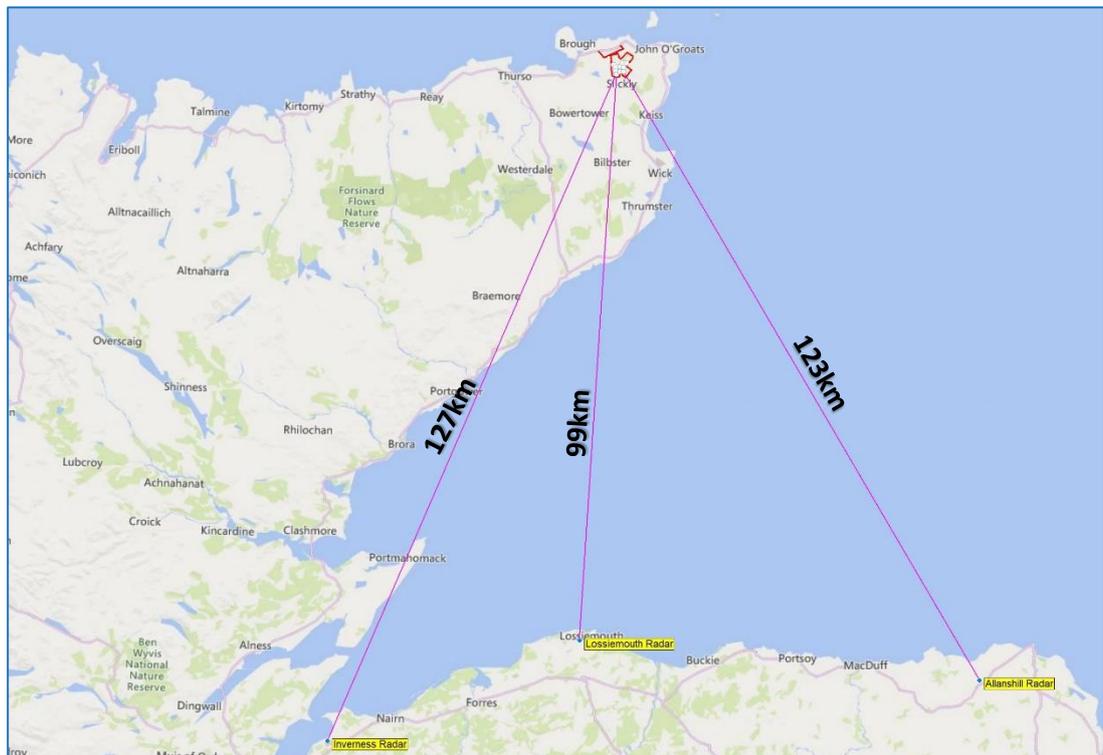
Figure 2: 3D view of turbines and terrain from south east

3. Radar Modelling

3.1. Radar Locations

3.1.1. The nearest PSR facilities to the proposed Development are the NATS (En Route) plc (NERL) radar at Allanshill, the MOD radar at Royal Air Force Lossiemouth, and the HIAL radar at Inverness Airport.

3.1.2. The locations of the three PSRs are shown in **Figure 3**.



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Figure 3: Locations of Hollandmey RED and nearest PSRs

3.1.3. The closest turbine within the proposed Development is approximately 127 km northeast of Inverness Radar, 99 km north of Lossiemouth Radar, and 123 km north west of Allanshill Radar.

3.2. Radar Line of Sight

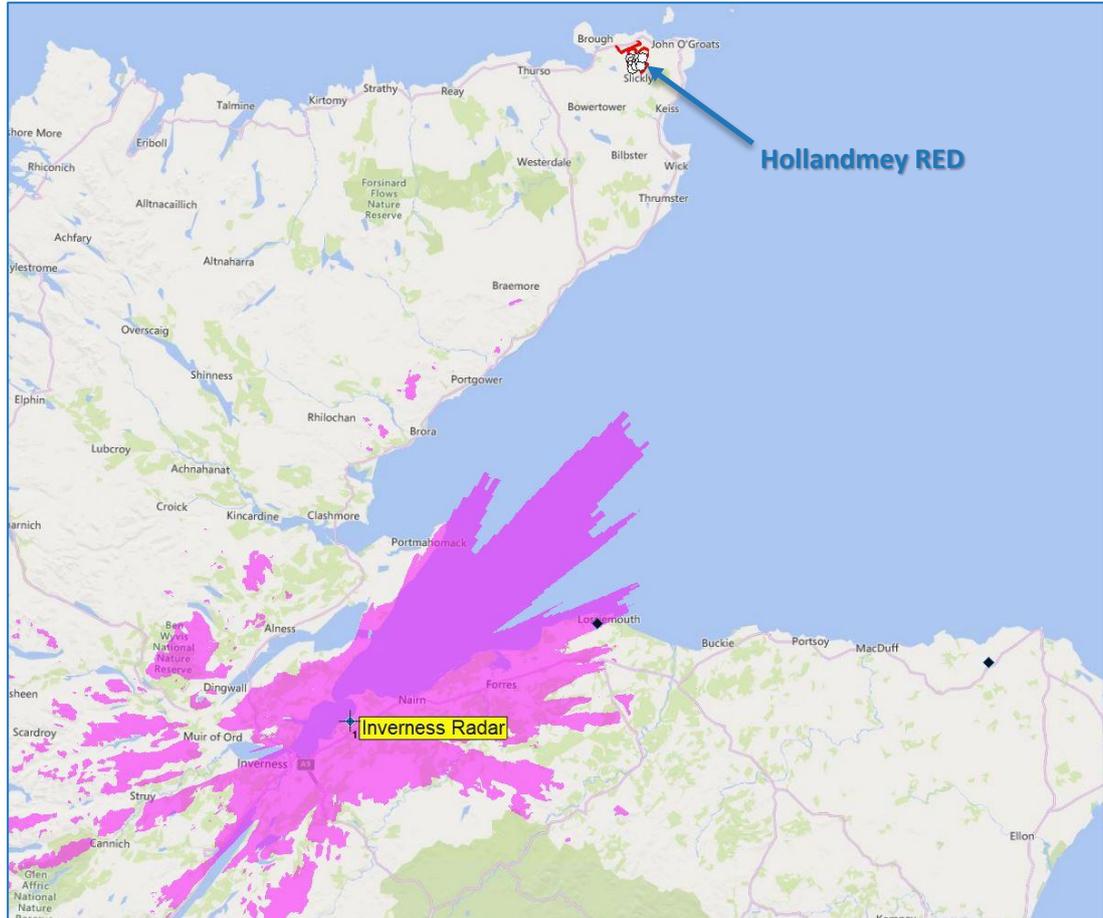
3.2.1. Radar Line of Sight (RLoS) is determined from a radar propagation model (ATDI ICS telecom EV) using 3D DTM data with 25 m horizontal resolution. Radar data is entered into the model and RLoS to the turbines from the radar is calculated.

3.2.2. Note that by using a DTM no account is taken of possible further shielding of the turbines due to the presence of structures or vegetation that may lie between the radars and the turbines. Thus, the RLoS assessments are worst-case results.

3.2.3. For PSR, the principal sources of adverse windfarm effects are the turbine blades, so RLoS is calculated for the maximum tip height of the turbines, i.e. 150 m AGL.

3.3. RLoS – Inverness PSR

3.3.1. The magenta shading in **Figure 4** illustrates the RLoS coverage from Inverness PSR to turbines with a blade tip height of 150 m AGL.



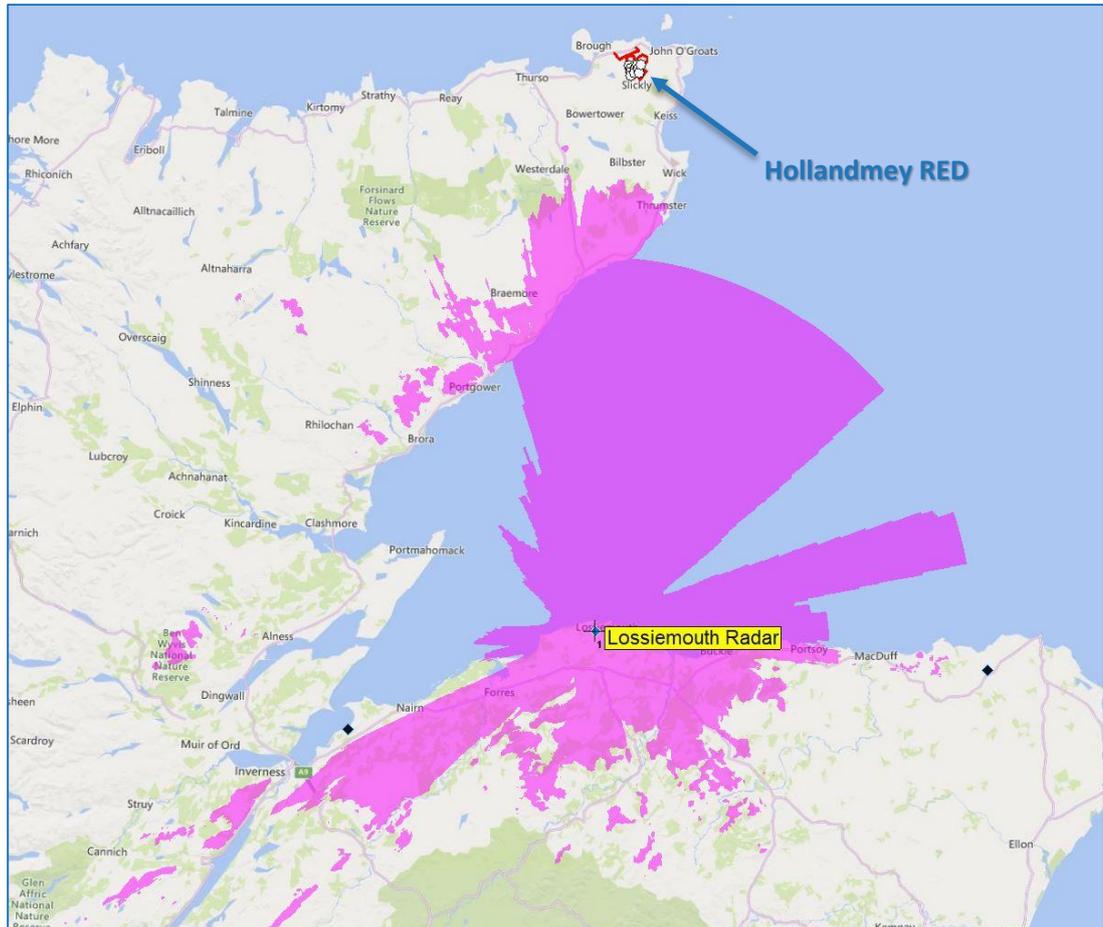
Microsoft® Bing™ screen shot reprinted with permission from Microsoft Corporation

Figure 4: Inverness PSR RLoS to 150m AGL

3.3.2. RLoS does not exist between Inverness PSR and any of the turbines and it can be assumed that Inverness PSR is unlikely to detect the Hollandmey RED turbines.

3.4. RLoS – Lossiemouth PSR

3.4.1. The magenta shading in **Figure 5** illustrates the RLoS coverage from Lossiemouth PSR to turbines with a blade tip height of 150 m AGL.



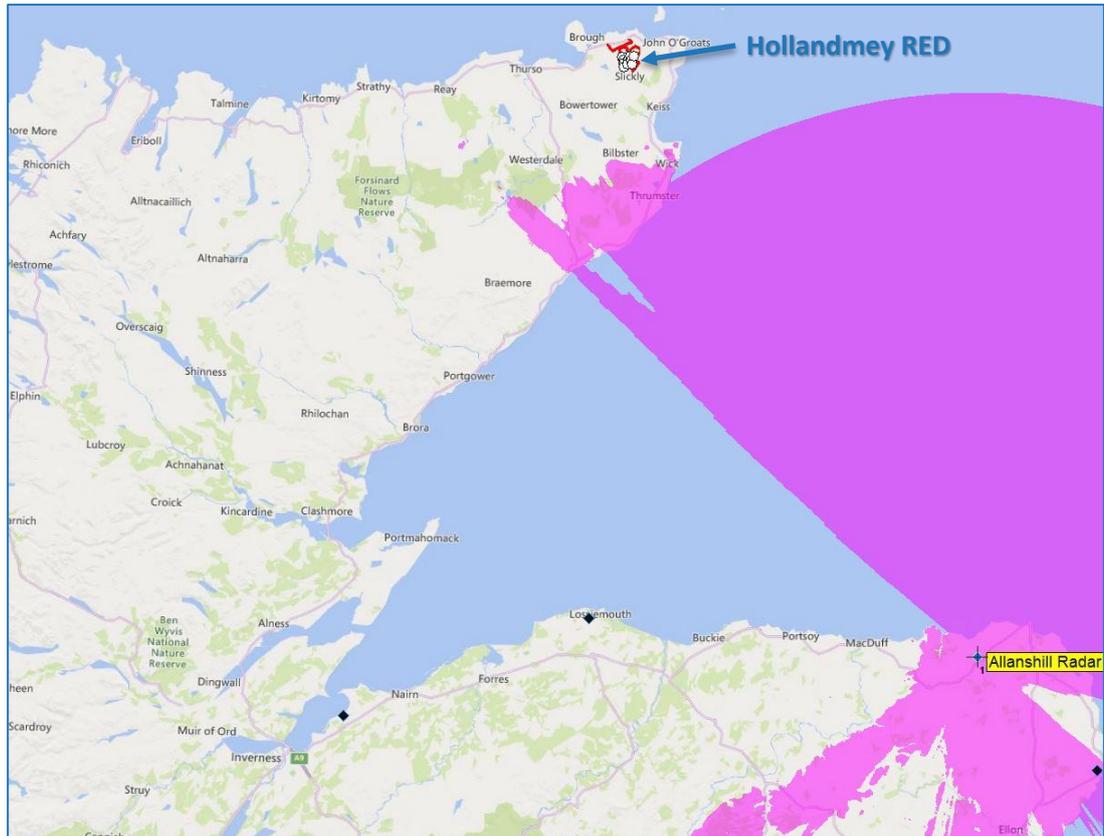
Microsoft® Bing™ screen shot reprinted with permission from Microsoft Corporation

Figure 5: Lossiemouth PSR RLoS to 150m AGL

3.4.2. RLoS does not exist between Lossiemouth PSR and any of the turbines and it can be assumed that Lossiemouth PSR is unlikely to detect the Hollandmey RED turbines.

3.5. RLoS – Allanshill PSR

3.5.1. The magenta shading in **Figure 6** illustrates the RLoS coverage from Allanshill PSR to turbines with a blade tip height of 150 m AGL.



Microsoft® Bing™ screen shot reprinted with permission from Microsoft Corporation

Figure 6: Allanshill PSR RLoS to 150m AGL

3.5.2. RLoS does not exist between Allanshill PSR and any of the turbines and it can be assumed that Allanshill PSR is unlikely to detect the Hollandmey RED turbines.

3.6. Wick Airport

3.6.1. To support their ATMS project, HIAL is exploring alternative surveillance solutions at Wick John O' Groats Airport, including ADS-B (Automatic Dependent Surveillance Broadcast). However, the possibility of a new PSR being installed at Wick Airport has not been discounted. Wick Airport lies approximately 16km south of the proposed Development and it is highly likely that the proposed turbines would be detected by a PSR at Wick Airport.

3.6.2. HIAL has suspended surveillance safeguarding criteria until the final surveillance solution is determined, and therefore has lifted any objections based on PSR interference.

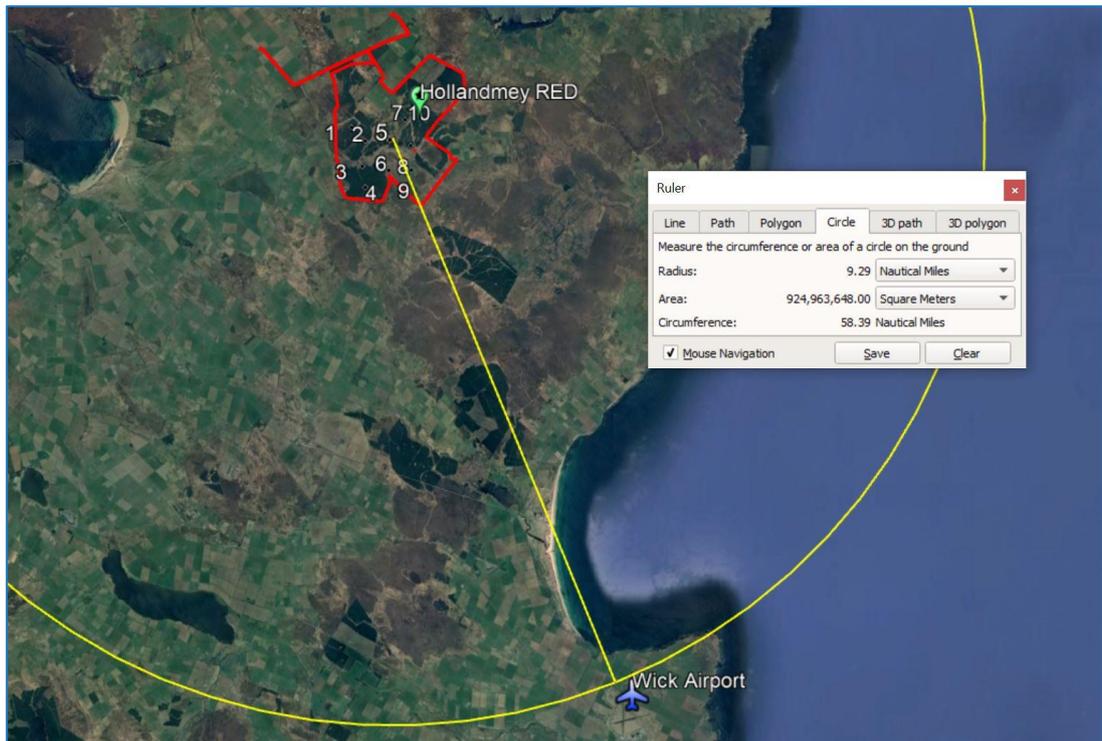
4. Airspace Analysis

4.1. Overview

- 4.1.1. This section of the report will examine the potential impact to aviation, this includes civil and military operations.
- 4.1.2. The airspace surrounding the proposed Development is contained in the UK Aeronautical Information Publication (AIP). The type (airspace classification), usage and dimensions are contained within various sections of the En-Route (ENR) section of the AIP.
- 4.1.3. The airspace in the immediate area around the proposed Development consists of two types of airspace. The immediate airspace portion surrounding the proposed Development is classified as Class G and extends from ground level to Flight Level (FL)75 (approximately 7,500 ft above mean sea level).
- 4.1.4. The Class G airspace is commonly referred to as ‘uncontrolled airspace’ and is predominantly used by General Aviation (GA) and military aircraft. There is no defined ATS within this area as it falls outside the support provided by Lower Airspace Radar Service (LARS) units.
- 4.1.5. The second, higher portion of airspace is marginally on the edge of the proposed Development and is classified as Class E. This extends from FL75 up to FL195. This airspace contains Lower ATS routes.
- 4.1.6. The Class E airspace (specifically ATS Route N560) is under the control of Scottish Control (NERL), located at Prestwick Centre and is declared as a Transponder Mandatory Zone (TMZ).
- 4.1.7. Class E Airspace is commonly referred to as ‘controlled airspace’ and aircraft within it are under a Radar Control Service. A clearance from the controlling authority is required to enter the controlled airspace if an aircraft is under Instrument Flight Rules (IFR) and the control instructions are mandatory. For aircraft flying Visual Flight Rules (VFR), no clearance is required, however pilots are encouraged to contact Air Traffic Control (ATC) and comply with instructions.
- 4.1.8. The TMZ element assists in the creation of a ‘semi-known traffic’ environment meaning that ATC is aware of all traffic operating within the designated airspace due to the appearance of a squawk (i.e. a transponder return). Unfortunately, unless a VFR pilot has chosen to call ATC, the intentions of some aircraft maybe unknown.

4.2. Provision of Air Traffic Services

- 4.2.1. **Figure 7** indicates the approximate location of the proposed Development in relation to a nearby airport. The nearest airport is Wick Airport, less than 10 NM to the south of the proposed Development.
- 4.2.2. **Figure 8** depicts the Airspace and Lower ATS Route structure. It also shows the Helicopter Main Routes (HMRs).



Source: Google Earth Data SIO, NOAA, U.S. Navy, NGA, GEBCO Image © 2021 CNES/Airbus

Figure 7: Proposed Development in relation to Wick Airport



Source: UK AIP ENR 6-27

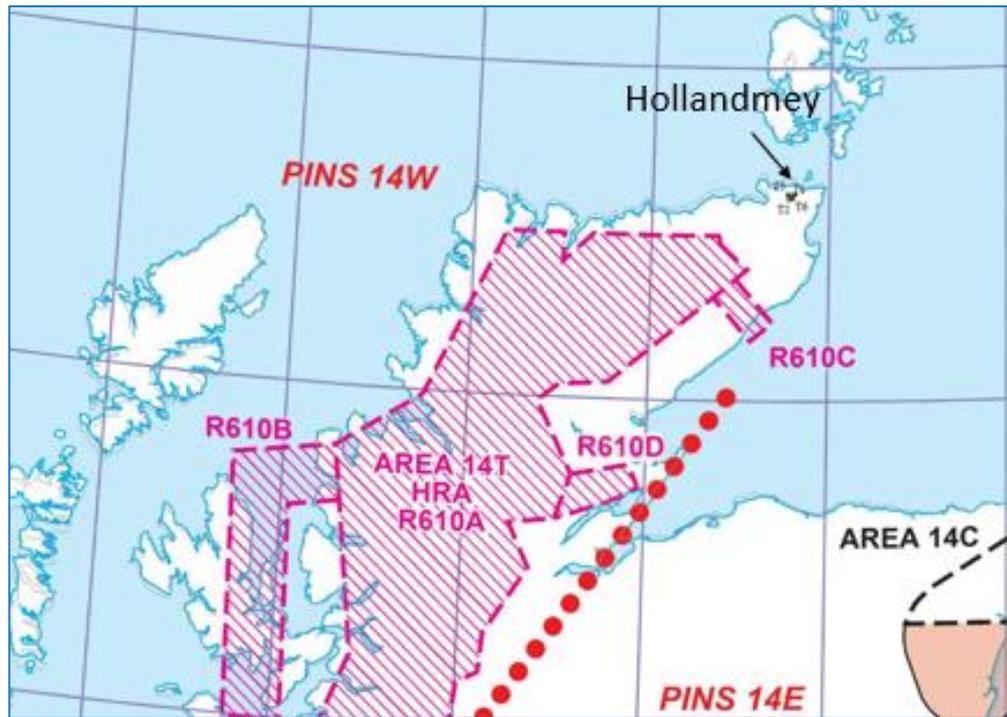
Figure 8: Proposed Development in relation to N560 and the HMRs

- 4.2.3. The proposed Development will not impact upon the Lower ATS Route structure. N560 is a TMZ and accordingly, the controllers rely on Secondary Surveillance Radar (SSR) for the provision of the ATS as all aircraft are required to carry and use a serviceable transponder.
- 4.2.4. The proposed Development is situated adjacent to a HMR X-RAY (as depicted in **Figure 8**) with the closest turbine approximately 1.9 NM from the HMR. The operational Lochend windfarm is closer to the HMR at approximately 1.8 NM.

- 4.2.5. HMRs have no lateral dimensions (only route centrelines are charted). Wind turbine developments can impact significantly on operations associated with HMRs: the effect depends on the degree of proliferation. CAP764 advises that a small number of individual turbines should cause minimal effect, whilst a large number of turbines beneath an HMR could result in significant difficulties by forcing the aircraft to fly higher in order to maintain a safe vertical separation from wind turbines.
- 4.2.6. The proposed Development is marginally inside the 2 NM from HMR route centreline guidance issued by the UK CAA with a majority of turbines sited beyond the 2 NM boundary. This coupled with the location of the operational Lochend site evidence that the proposed Development will not impact HMR X-RAY.
- 4.2.7. Low level surveillance coverage is of particular importance in the provision of full ATS to offshore helicopter operators, and ANSPs need to consider any proposed development that may impact on the supporting PSR feed. In this instance there is no low level PSR coverage and therefore the wind turbines will have no impact.

4.3. Other Airspace Considerations

- 4.3.1. The proposed Development is close to Wick Airport and an Instrument Flight Procedure (IFP) Safeguarding Assessment was identified as a requirement. The IFP report is contained in Annex A and the results indicate no impact on the Wick Airport IFPs.
- 4.3.2. There are no other aerodromes depicted on the VFR chart in the vicinity of the proposed Development.
- 4.3.3. **Figure 9** indicates the proposed Development in relation to the PINS Areas and UK Day Low Flying System. It lies outside of the Highland Restricted Area but is contained within Low Flying Area 14 (Area 1BE at night). It is not situated within the Tactical Training Area (TTA) and therefore Military aircraft do not conduct tactical low flying training down to 100ft Minimum Separation Distance (MSD) in this region.



Source: UK AIP ENR 6-20

Figure 9: Proposed Development in relation to UK PINS Areas and Day Low Flying System

A. Annex A – IFP Safeguarding Assessment.

A.1. Introduction

- A.1.1. Cyrrus conducted an Instrument Flight Procedure (IFP) Safeguarding Assessment on the impact of a proposed Development containing ten turbines near Wick Airport. The development is located within 10 NM of the Airport as shown in **Figure 10**.
- A.1.2. The purpose of the Assessment is to determine if any of the wind turbines infringe the protection surfaces of the IFPs serving the Airport. Each IFP type has a different set of criteria that needs to be considered with any penetration potentially impacting the minimum altitude an aircraft may descend to when conducting an approach, or the minimum gradient they must meet on approach, or exceed on departure.
- A.1.3. These IFPs are particularly important during adverse weather conditions when flight visibility is reduced as they provide the pilot with assurances that there are no obstacles on the defined flight path. Whilst on the descent, the aircraft reaches a Decision Point at which the pilot must have the required visual references², if these references are not visually acquired the pilot must initiate a missed approach; this portion of flight is also protected and is assessed.

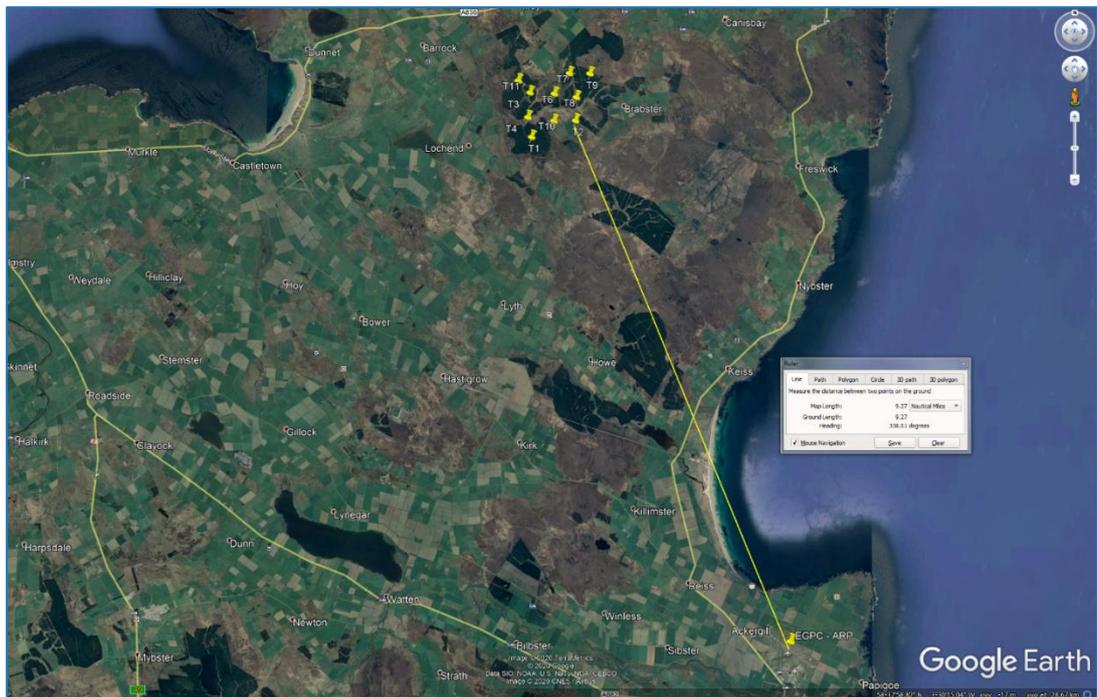


Figure 10: Approximate distance from ARP

² Required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path.

A.2. List of IFPs Assessed

A.2.1. As per the UK Aeronautical Information Publication (AIP) at the date of this report.

- INSTRUMENT APPROACH CHART RNAV (GNSS) RWY 13 (CAT A,B,C);
- INSTRUMENT APPROACH CHART VOR/DME RWY 13;
- INSTRUMENT APPROACH CHART NDB(L)/DME RWY 13;
- INSTRUMENT APPROACH CHART DIRECT ARRIVALS TO VOR/NDB(L) RWY 13;
- INSTRUMENT APPROACH CHART RNAV (GNSS) RWY 31 (CAT A,B,C);
- INSTRUMENT APPROACH CHART VOR/DME RWY 31;
- INSTRUMENT APPROACH CHART DIRECT ARRIVALS TO VOR/DME RWY 31;
- INSTRUMENT APPROACH CHART NDB(L)/DME RWY 31; and
- INSTRUMENT APPROACH CHART DIRECT ARRIVALS to NDB(L)/DME RWY 31.

A.3. Data

A.3.1. The proposed Development data was received in OSGB36 Easting, Northings seen in **Table 2** and converted to WGS84 Latitude, Longitude using the Ordnance Survey GridInQuest II tool. The resulting coordinates are indicated in **Table 3**.

Turbine No	Easting	Northing	Altitude (m)
T1	328397	970004	47
T2	328796	969598	50
T3	328700	968860	47
T4	328781	968240	61
T5	329515	969620	49
T6	329467	968729	55
T7	329963	970204	67
T8	330120	969444	60
T9	330129	968731	64
T10	330588	970185	73
Met Mast	329660	968454	56

Table 2: Proposed Development Data

Turbine No	Ground Level (m)	Hub height (m)	Rotor Diameter (m)	Elev. (m)	Latitude	Longitude
T1	47	84	132	197	58 36 43.3158N	003 14 03.1052W
T2	50	84	132	200	58 36 30.4288N	003 13 37.9272W
T3	47	84	132	197	58 36 06.5168N	003 13 43.0368W

Turbine No	Ground Level (m)	Hub height (m)	Rotor Diameter (m)	Elev. (m)	Latitude	Longitude
T4	61	84	132	211	58 35 46.5237N	003 13 37.3182W
T5	49	84	132	199	58 36 31.5631N	003 12 53.4142W
T6	55	84	132	205	58 36 02.7339N	003 12 55.3879W
T7	67	84	132	217	58 36 50.7020N	003 12 26.3139W
T8	60	84	132	210	58 36 26.2267N	003 12 15.7420W
T9	64	84	132	214	58 36 03.1845N	003 12 14.3922W
T10	73	84	132	223	58 36 50.4500N	003 11 47.5719W
Met Mast	64	N/A	N/A	134	58 35 53.9576N	003 12 43.1278W

Table 3: Converted Turbine Coordinates

A.4. Assessment

- A.4.1. An IFP Safeguarding Assessment was completed against the procedures for Runway (RWY) 13 and 31 at Wick Airport.
- A.4.2. Due to the technical nature of the information, this report is a distillation of the IFP modelling and subsequent assessment of the obstacles, the full data set is available if required³. The purpose of this Report is to identify what procedures were assessed and whether there is an impact. In the event of an impact, potential mitigation is provided⁴.
- A.4.3. Table 4 provides the summary of all the IFPs assessed.

Assessed Procedures	RWY	Impact	Comments
Visual Circling	Both	No	Outside of obstacle protection areas
RNAV(GNSS)	13	No	Nil
VOR/DME		No	Nil
NDB(L)/DME		No	Nil
Direct Arrivals to VOR/NDB(L)		No	Nil
RNAV(GNSS)		No	Nil
VOR/DME	31	No	Nil
NDB(L)/DME		No	Nil
NDB(L)/DME		No	Nil
NDB(L)/DME		No	Nil
Direct Arrivals to VOR/DME		No	Nil

³ Please note that the full data set normally runs in excess of 20 pages per procedure and can only be decoded by those familiar with the output generation from the IFP Software and trained IFP Designers.

⁴ Mitigation for the IFPs is for the Airport to decide upon as these may have a direct impact on their operations.

Assessed Procedures	RWY	Impact	Comments
Direct Arrivals to NDB(L)/DME		No	Outside of obstacle protection areas

Table 4: Summary of Assessed Procedures

A.5. Conclusion

- A.5.1. The wind turbines associated with the proposed Development do not impact any of the IFPs published for Wick Airport.



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