Radar Line of Sight Assessment

Kilgallioch Windfarm Extension

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Executive Summary

Cyrrus Limited has been engaged to provide guidance on aviation issues associated with the proposed Kilgallioch Windfarm Extension development.

The proposed Extension comprises 11 additional turbines with maximum tip heights of 180m. Radar Line of Sight (RLoS) modelling of the indicative layout against the two Primary Surveillance Radar (PSR) facilities (Terma and S511 radars) at Glasgow Prestwick Airport (GPA) shows the following:

- RLoS does not exist between the GPA Terma PSR and the proposed Kilgallioch Windfarm Extension;
- RLoS does not exist between the GPA S511 PSR and the proposed Kilgallioch Windfarm Extension;
- It is therefore highly unlikely that either PSR will detect the proposed turbines.

Any subsequent changes to the turbine layout coordinates within the site boundary will have no impact on the findings of this assessment.

Full details of the assessment are contained within the body of this report.

Abbreviations

AGL	Above Ground Level
ATS	Air Traffic Service
DTM	Digital Terrain Model
GPA	Glasgow Prestwick Airport
PSR	Primary Surveillance Radar
RLoS	Radar Line of Sight

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1. Introduction

1.1. Background

1.1.1. ScottishPower Renewables UK Limited is proposing to construct an extension to the existing Kilgallioch Windfarm. The nearest point of the application boundary is located approximately 9.5km north-west of the village of Kirkcowan in Dumfries and Galloway. The proposed development will comprise up to 11 turbines with a tip height of up to 180m Above Ground Level (AGL).

1.1.2. Cyrrus Limited has been engaged by ITPEnergised to provide guidance on aviation issues to support the Environmental Impact Assessment 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 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 windfarm 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 Report[1], scoping responses were received from the following aviation stakeholders:

- Glasgow Prestwick Airport (GPA);
- Glasgow Airport;
- Edinburgh Airport;
- Highlands and Islands Airports Limited;
- Ministry of Defence; and
- NATS.

1.3.2. Of these respondents, only GPA raised concerns regarding the possibility of the proposed turbines being in line of sight of their radar facilities.

1.4. Radar Line of Sight Assessment

1.4.1. There are two PSR facilities at GPA: A Marconi S511 radar is used for planning purposes while a Terma Scanter 4002 radar is used for approach control.

1.4.2. A Radar Line of Sight (RLoS) assessment will determine the visibility of the proposed turbines to each of the GPA radars.

[1] Kilgallioch Windfarm Extension Scoping Report, April 2019

2. Data

2.1. The following data has been used for the RLoS modelling undertaken in this report:

2.2. Kilgallioch Windfarm Extension

2.2.1. The Ordnance Survey National Grid coordinates for the proposed turbines used in the assessment are taken from file 'KILE_190805_V8 Turbine Layout.csv' supplied on 27th August 2019 and are listed in Table 1.

Turbine	Easting	Northing
1	224926	569849
2	222904	570588
3	223603	570349
4	222907	569869
5	224015	570833
6	224832	570361
7	224572	570851
8	223403	570880
9	224228	569777
10	223551	569794
11	224519	569291

Table 1: Kilgallioch Windfarm Extension turbine coordinates

2.2.2. The turbines are planned to have a maximum tip height of 180m AGL.

2.3. GPA Radar Data

2.3.1. Radar parameters used in the assessment have been taken from data held on file by Cyrrus and provided by GPA.

2.4. Analysis Tools

- ATDI ICS telecom EV v15.4.3 x64 radio network analysis tool;
- ZWCAD+ 2015 SP1 Pro v2014.11.27(26199).

2.5. Terrain Data

- ATDI UK 25m Digital Terrain Model (DTM), 2015, ETRS89 projection.

3. Kilgallioch Windfarm Extension Layout

3.1. The indicative 11 turbine layout used for the modelling is shown in Figure 1.

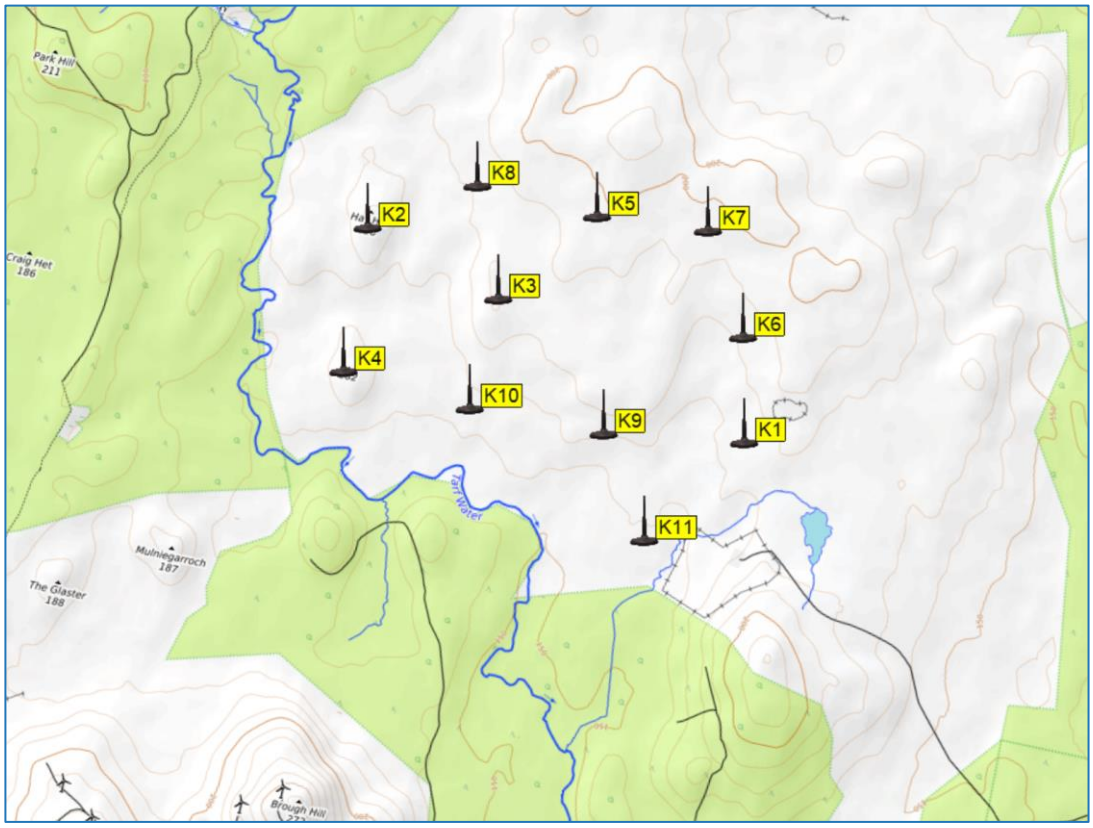

Figure 1: Indicative turbine layout

4. Radar Line of Sight Modelling

4.1. GPA Radars

4.1.1. The locations of the two GPA PSRs are shown in Figure 2.

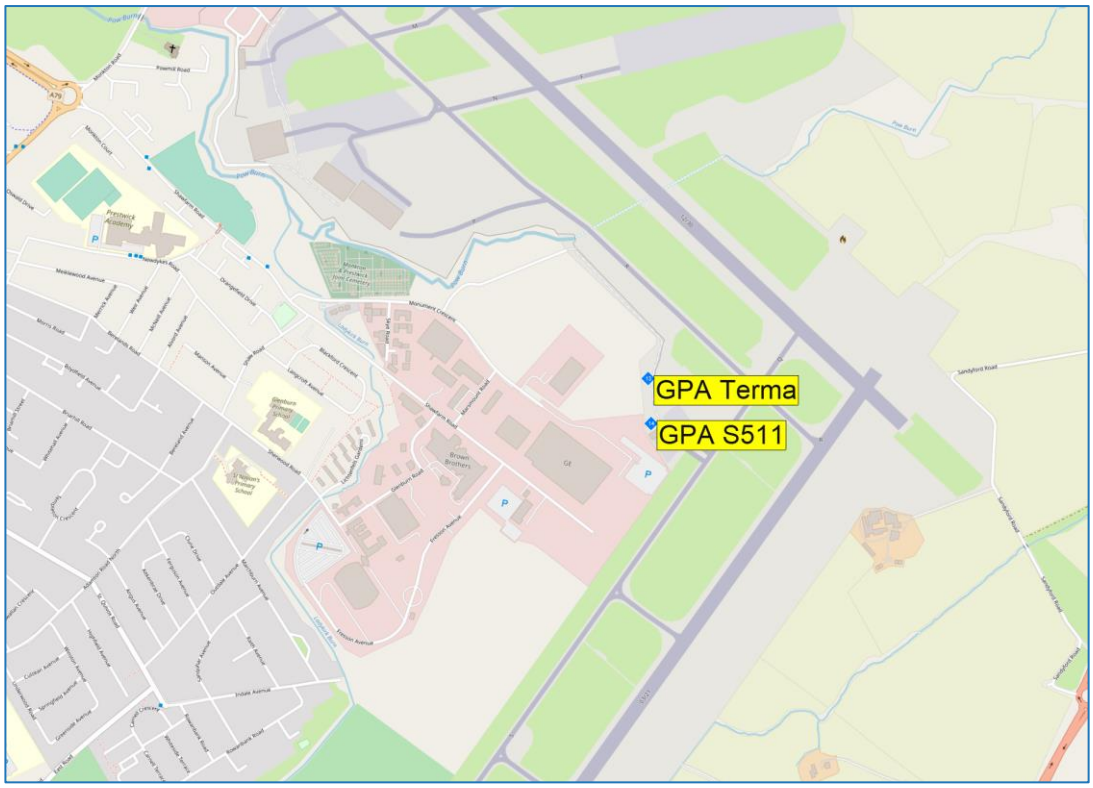

Figure 2: Locations of GPA Terma PSR and S511 PSR

4.1.2. At its closest point the proposed development area is 57km south-west of the GPA PSRs, as shown in Figure 3.

Figure 3: Locations of GPA PSRs and Kilgallioch Windfarm Extension

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

4.1.4. 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.

4.1.5. 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. 180m AGL.

4.1.6. A 3D view of the turbines and the terrain model is shown in Figure 4.

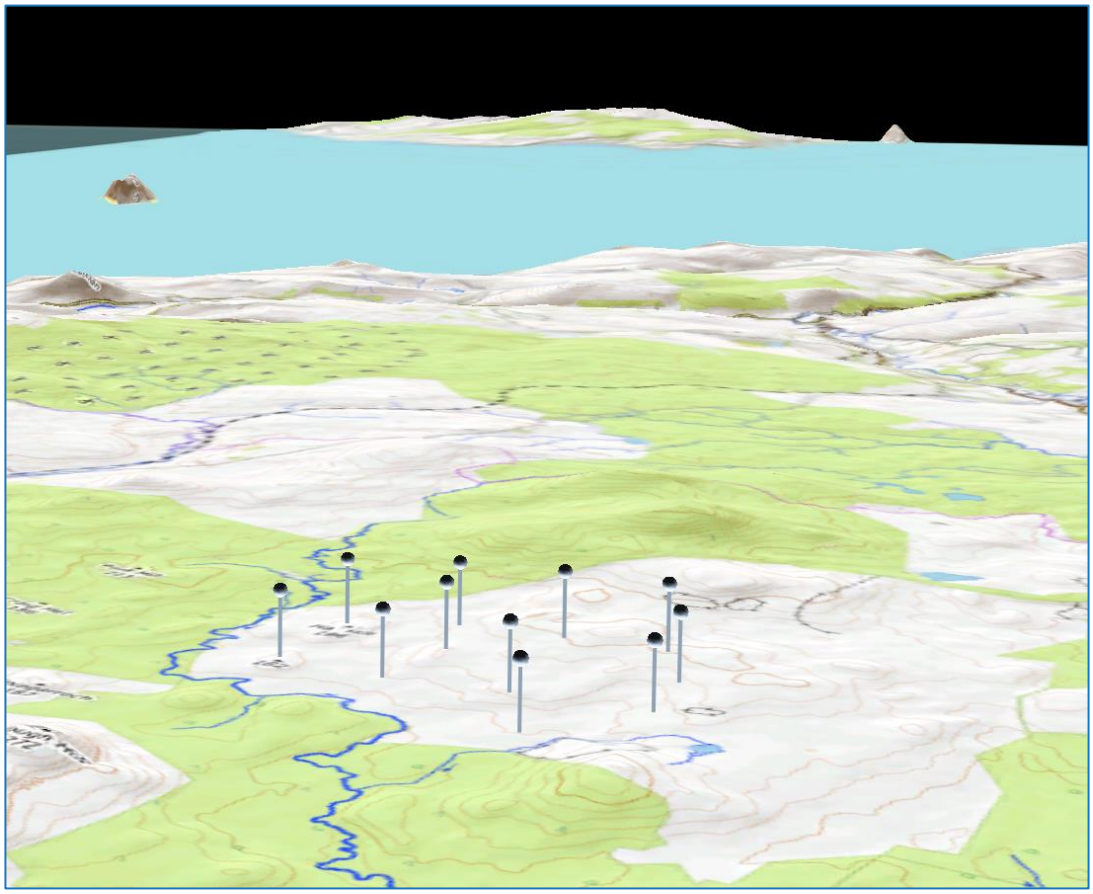

Figure 4: 3D view from the south of turbines and terrain

4.1.7. The magenta shading in Figure 5 illustrates the RLoS coverage from the GPA Terma PSR to turbines with a blade tip height of 180m AGL.

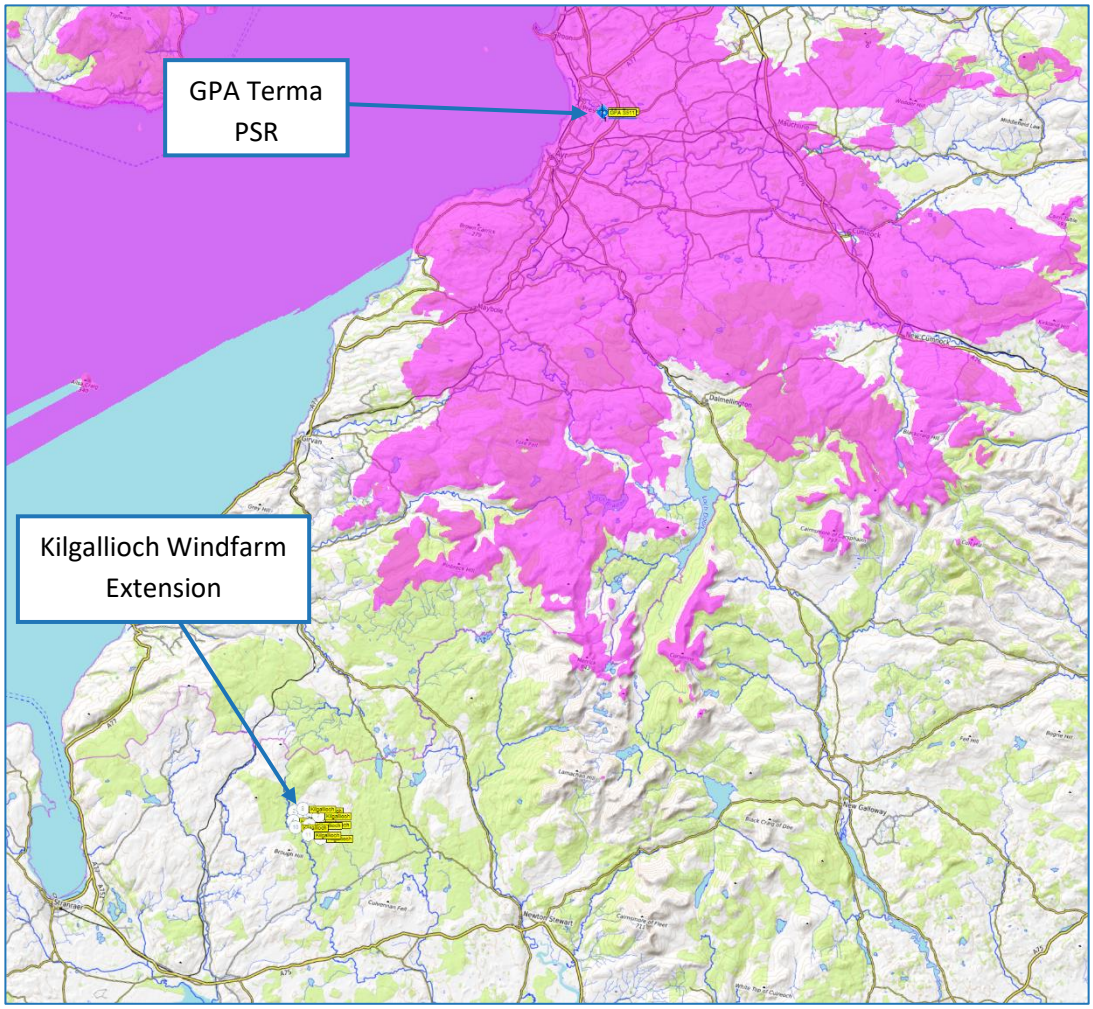

Figure 5: GPA Terma PSR RLoS to 180m AGL

4.1.8. RLoS does not exist between the GPA Terma PSR and any of the turbines in the indicative layout.

4.1.9. The magenta shading in Figure 6 illustrates the RLoS coverage from the GPA S511 PSR to turbines with a blade tip height of 180km AGL.

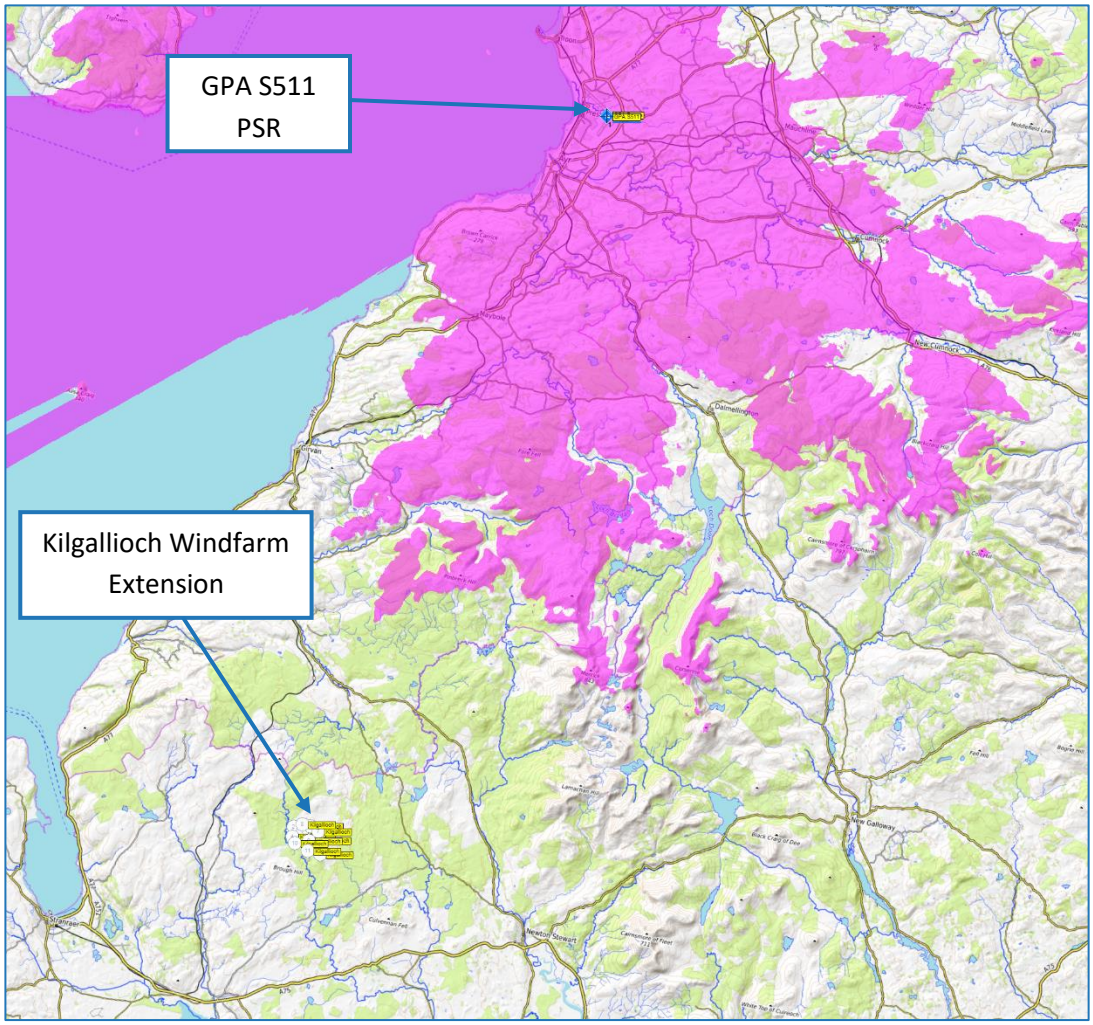

Figure 6: GPA S511 PSR RLoS to 180m AGL

4.1.10. RLoS does not exist between the GPA S511 PSR and any of the turbines in the indicative layout.

4.2. Conclusion

4.2.1. Where no RLoS exists, it can generally be assumed that the radar will not detect the turbines. Neither of the GPA PSRs have RLoS to the proposed turbines and it is highly unlikely that the turbines will be detected.

4.2.2. Any subsequent changes to the turbine layout coordinates within the site boundary will have no impact on the findings of this assessment.