

Appendix 17A

Aviation Review Statement

AiBridges Total Communications Solutions	Procedure: 001	Rev: 3.0
Ballinlee Wind Farm- Aviation Review Statement	Approved: KH	Date: 05/09/25

Report

Ballinlee Wind Farm Aviation Review Statement

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Author: PT\DMG

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Executive Summary

Malachy Walsh and Partners have commissioned Ai Bridges Ltd to review the possible impacts of the proposed wind farm on aviation systems in the vicinity of the proposed development. As part of the review, the following subjects were considered:

- Annex 14 Obstacle Limitation Surfaces (OLS)
- Annex 15 Aerodrome Surfaces
- Minimum Sector Altitudes (MSA)
- Instrument Flight Procedures
- Permitted Wind Farms in vicinity of Proposed Wind Farm
- Communications, Navigation and Radar Surveillance Systems Safeguarding
- Flight Inspection and Calibration
- Aeronautical Obstacle Warning Light Scheme

Annex 14 - Obstacles Limitation Surfaces (OLS)

A review shows that the proposed wind farm would be located outside the Outer Horizontal Surface of the Shannon Runway Obstacles Limitation Surfaces, as defined in ICAO (International Civil Aviation Organization) Annex 14.

As the proposed wind farm is situated outside the Outer Horizontal Surface and there is no penetration of the take-off or approach surfaces, it is unlikely that there will be any impacts to the OLS surfaces for Shannon Airport.

Annex 15 - Aerodrome Surfaces

Following a review of "Terrain and obstacle requirements Area 1" as defined in ICAO Annex 15, wind turbines need to be registered if they are more than 100 meters above terrain. From the centre point (ARP – Airport Reference Point) of Shannon Airport to the boundary of the Area 1 of the Annex 15 Aerodrome Surface is 45km. This area encloses the TMA area i.e. Total Maneuvering Area and this is used for circling and maneuvering by aircraft. Should the proposed windfarm be permitted, the turbines would be within 45km of Shannon Airport's ARP and would be greater than 100m in height. Therefore the turbines would be required to be included in the IAA Electronic Air Navigation Obstacle Dataset.

Minimum Sector Altitudes (MSA)

The Minimum Sector Altitudes (MSA) is the lowest altitude which may be used that will provide a minimum obstacle clearance of 1000ft above all obstacles within a sector of 25 nautical miles (46km) from the VOR/DME at Shannon Airport. The maximum turbine tip-height at the proposed

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wind farm site could be up-to 847ft above mean sea level (AMSL). There is over 1000ft from the maximum height of the wind farm to the MSA altitude and therefore there would appear to be no impact on the published MSA altitudes for Shannon Airport.

Instrument Flight Procedures

There are nine published Instrument and Visual Flight Procedures for arrivals to and departures from Shannon Airport. Due to the distance of the proposed wind farm from the airports, and as there are existing obstacles adjacent to the proposed development, there should be no impacts to these flight procedures.

Communications, Navigation and Surveillance System Safeguarding

As the proposed wind farm is approximately 32km from the Localizer and transmitting antenna at Shannon Airport, it is very unlikely that the proposed wind turbines will have any impact on these ATS communications and radio navigational aids.

For Radar Surveillance Systems, EUROCONTROL Guidelines require a 16km safe distance from the surveillance radar system (SSR), for a "Zone 4 - No Assessment" condition. It has been highlighted in the analysis that turbines located at the proposed farm would be located at a distance of over 27 km from the radar stations at Woodcock Hill and Shannon Airport and in Assessment Zone 4 of the EUROCONTROL Guidelines. As the turbines are located in Assessment Zone 4, a detailed impact assessment on Radar Surveillance Systems will not be required by the IAA.

Flight Inspection and Calibration

Flight checks are conducted annually to ensure that flight procedures and associated navigational aids are safe and accurate. These flight checks are carried out by an IAA approved Flight Inspection Service Provider. The checks are carried out during annual inspections consisting of radial and orbital test flights around Shannon Airport for calibration of instrument landing systems.

Flight Inspection Procedures will not be impacted as the proposed wind farm is sufficiently far from the airport runways and the flight inspection procedures should already account for the existing obstacles in the vicinity of the proposed wind farm.

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Aeronautical Obstacle Warning Light Scheme

In the event of a grant of planning consent the IAA are likely to request lighting of the proposed wind turbines in the interest of aviation safe-guarding as the proposed development would be considered as an en-route obstacle. The IAA-ANSP will require wind turbine obstacles to be fitted with an Obstacle Warning Light System.

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1. Introduction

This section provides a brief summary of the proposed wind farm development at Ballinlee and of the nearest significant aviation installation at Shannon Airport.

1.1 Wind Farm Site Information

The proposed wind farm development is located in County Limerick approximately 32km southeast of Shannon Airport. Figure 1 shows the proposed wind farm site with respect to Shannon Airport and the IAA radar stations at Shannon and Woodcock Hill.



Figure 1. Location of proposed wind farm at Ballinlee

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1.2 Shannon Airport

Table 1 below shows the co-ordinates of Shannon Airport and the distance from the Airport reference Point (ARP) to the proposed wind farm site. Shannon Airport operates in Class C controlled airspace with Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) Flight rules.

Location	Installation	Description	Airport Ref. Point ARP	ARP Distance to Proposed Wind Farm
Shannon, Co Clare	International Airport	Single Asphalt Runway Airspace: Class C	52 42 07 N 008 55 29 W (Mid-point of Runway 06/24).	32.3 km

Table 1. Shannon Airport Details

The aeronautical navigation aids at the aerodrome include DVOR/DME, NDB, ILS LOC and ILS GP.

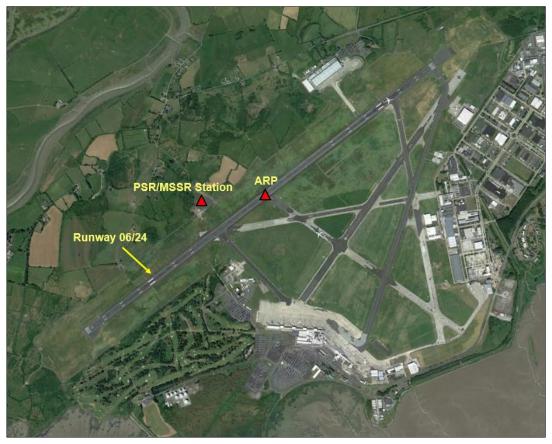


Figure 2. Shannon International Airport

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2. Aviation Review

In this section a review of the following Aviation topics is provided.

- Annex 14 Obstacle Limitation Surfaces (OLS)
- Annex 15 Aerodrome Surfaces
- Minimum Sector Altitudes (MSA)
- Instrument Flight Procedures
- Permitted Wind Farms in vicinity of proposed Wind Farm
- Communications, Navigation and Radar Surveillance Systems Safeguarding
- Flight Inspection and Calibration
- Aeronautical Obstacle Warning Light Scheme

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2.1 Annex 14 Obstacle Limitation Surfaces (OLS)

A review of the Annex 14 Obstacles Limitation Surfaces (OLS) was first was carried out by plotting the proposed turbines and the airport obstacle surfaces. The obstacle limitation surfaces for Shannon Airport are plotted based on the following:

- Annex 14 to the Convention on International Civil Aviation Aerodromes Volume I -Aerodrome Design and Operations Seventh Edition July 2016"
- Certification Specifications and Guidance Material for Aerodromes Design CS-ADR-DSN Issue 4, 8th of December 2017

Figure 3 below shows the OLS in relation to the proposed Ballinlee wind farm. The distance from the Shannon Airport ARP, runway centre-point, to the nearest point of the proposed wind farm is 32.3 km. The analysis of the OLS plots indicates that turbines at the proposed wind farm would not penetrate the Outer Horizontal Surface which extends to 15km from the Shannon Airport Reference Point (ARP) or runway centre-point.

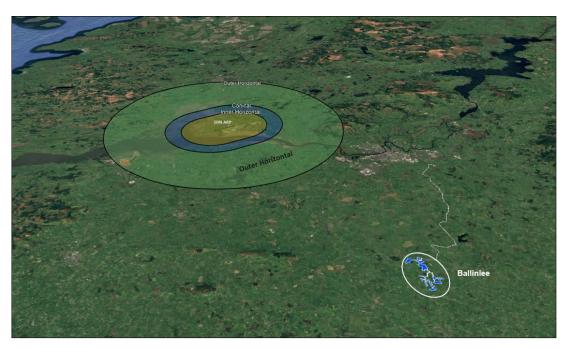


Figure 3. Ballinlee Wind Farm in relation to Shannon Airport OLS

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2.2 Annex 15 Aerodrome Surfaces

The proposed wind turbines would penetrate the ICAO Annex 15 Aerodrome Surface as shown in Figure 4. The "Terrain and obstacle requirements Area 1" is defined in ICAO Annex 15 as an area of 45km from the Aerodrome ARP. (An illustration of ICAO Annex 15 Area 1 Surface is provided in Appendix A).

As the proposed wind farm is at a distance of 32 km from Shannon ARP there is penetration of the Annex 15 surface. All obstacles, if they are more than 100 meters above terrain for a distance of 45km from Shannon ARP, need to be registered in the IAA Air Navigation Obstacle Data Set. This 45km area is known as the TMA area i.e. Total Maneuvering Area and is used for en-route circling and maneuvering and is shown in Figure 4.

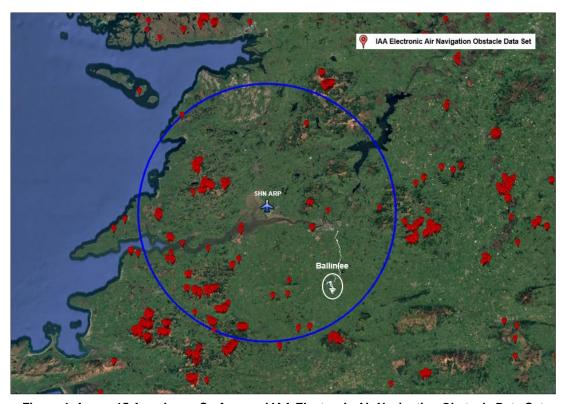


Figure 4. Annex 15 Aerodrome Surface and IAA Electronic Air Navigation Obstacle Data Set

There are other existing tall structures (wind turbines) within the TMA area. The wind turbines are part of the operational wind farms at Kilmeedy, Knockatallig and Castlepook and Telecommunications Masts at Killoughty and Ballyguilebeg. These existing wind turbines would be considered as aviation obstacles. All of these permitted obstacles under the IAA Electronic Air Navigation Obstacle Data Set are shown relative to the proposed wind farm in Figure 5.

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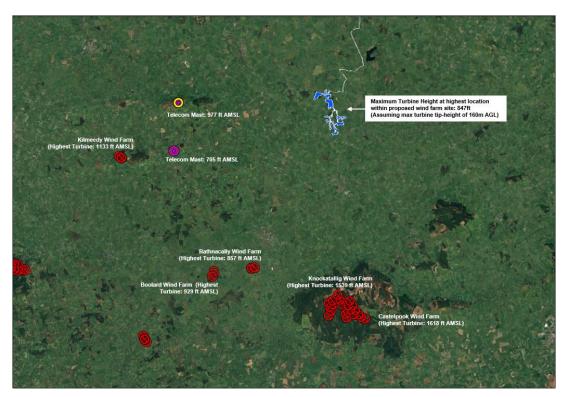


Figure 5. Permitted Obstacles in vicinity of Ballinlee Wind Farm

Although there are other obstacles in the vicinity of the proposed wind farm, all new obstacles must be considered and assessed to see if they cause a "hazard to air navigation" and all Terrain Obstacle Data (including man-made obstacles) have to be considered by the relevant Aviation Authorities.

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2.3 Minimum Sector Altitudes

A review of the Minimum Sector Altitudes (MSA) shows that the proposed wind farm is within 25 nautical miles from the VOR/DME at Shannon Airport. The MSA provides a minimum obstacle clearance of 1000 ft above the highest obstacle within specified sectors. The wind turbines are located within the Main Sector (MSA 3000 ft), as shown in Figure 6. According to the wind farm location, the maximum construction height for the site would be 2400 ft/731.52m AMSL (3400 ft MVA minus 1000 ft).

A 525ft (160m) turbine located at the highest point (322ft) within the proposed site boundary would result in an obstacle of 847ft AMSL. This is below the 2400ft threshold, therefore the MSA of the Main Sector will not be affected and there will be no impact on the published MSA altitude figures.

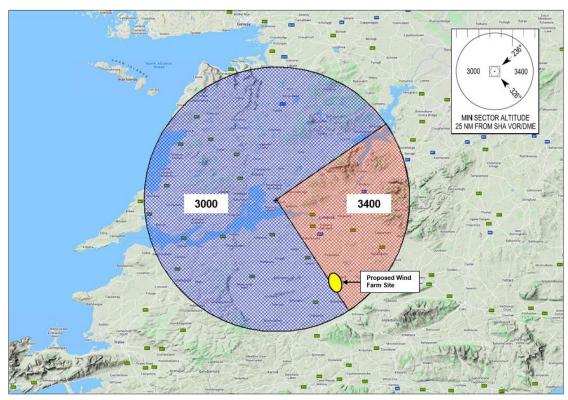


Figure 6. Shannon Airport (EINN) Minimum Sector Altitudes

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2.4 Instrument Flight Procedures

There are nine published Instrument and Visual Flight Procedures for departures and arrivals into Shannon Airport. Due to the distance of the proposed wind farm from Shannon Airport (and as there are existing obstacles in the vicinity of Ballinlee wind farm), it is unlikely that there will be any impacts on the Instrument Flight Procedures for flights to/from the Airport. Table 2 below lists the Instrument Flight Procedures for Shannon Airport.

AIP Chart	RWY	Procedure	Wind Farm Impacts
EINN AD 2.24-5	06	RNAV Standard Instrument Departure Chart RWY 06	No impacts.
EINN AD 2.24-6	24	RNAV Standard Instrument Departure Chart RWY 24	No impacts.
EINN AD 2.24-7	06	RNAV Standard Arrival Chart RWY 06	No impacts.
EINN AD 2.24-8	24	RNAV Standard Arrival Chart RWY 24	No impacts.
EINN AD 2.24-10	06	Instrument Approach Chart ILS or LOC RWY 06	No impacts
EINN AD 2.24-11	06	Instrument Approach Chart VOR RWY 06	No impacts
EINN AD 2.24-13	24	Instrument Approach Chart ILS CAT I & II or LOC 24	No impacts
EINN AD 2.24-14	24	Instrument Approach Chart VOR RWY 24	No impacts
EINN AD 2.24-15		Visual Approach Chart – ICAO	No impacts.

Table 2. Shannon Airport Instrument and Visual Flight Procedures

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2.5 Permitted Wind Farms in vicinity of Proposed Wind Farm

The Planning References for the permitted Wind Farms in the vicinity of the proposed wind farm are shown below in Table 3. None of these wind farms required a Full Assessment of Instrument Flight Procedures.

Wind Farm	Planning Reference	Description	
Kilmeedy PL13.238964 ABP Operational Wir		Operational Wind Farm	
Rathnacally	124446 CCC	Operational Wind Farm	
Boolard	125997 CCC	Operational Wind Farm	
Castlepook WF	11/4947 or PL04.240434	Operational Wind Farm	
Knocknatallig WF	13/5885	Operational Wind Farm	

Table 3. Permitted Wind Farms in vicinity of proposed Wind Farm

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2.6 Communication Navigation and Surveillance Systems

2.6.1 Communications and Navigation Systems

The AIP EINN AD 2-8 provides the information for communication and navigation facilities. EINN AD 2.18 shows that the ATS communications facilities operates on channel frequencies of 118MHz -130MHZ and EINN AD 2.19 shows that Radio Navigation and Landing Aids operates on channel frequencies of 339KHz – 330MHz. As the proposed wind farm is approximately 32km from the Localizer and transmitting antenna, it is very unlikely that the proposed wind turbines will have any impact on these ATS communications and radio navigational aids. Typically, interference to VHF communications systems will only occur when obstacles are in close proximity to the VHF transmitter. e.g. less than 500m.

2.6.2 Radar Surveillance Systems

The tables below show the Irish Aviation Authority Assessment Zone arrangement for the two types of aviation radar surveillance systems; Primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR).

Zone	Description	Assessment Requirements
Zone 1	0 - 500m	Safeguarding
Zone 2	500m - 15km and in radar line of sight	Detailed Assessment
Zone 3	Further than 15km and in radar line of sight	Simple Assessment
Zone 4	Not in radar line of sight	No Assessment

Table 4. PSR Zone Arrangements

Zone	Description	Assessment Requirements
Zone 1	0 - 500m	Safeguarding
Zone 2	500m - 16km but within maximum instrumented range and in radar line of sight	Detailed Assessment
Zone 4	Further than 16km or not in radar line of sight	No Assessment

Table 5. SSR Zone Arrangements

The EUROCONTROL Guidelines require a 16km safe distance for a "Zone 4 - No Assessment" condition and detailed assessments are required for any proposed wind within 16km of a secondary surveillance radar.

It should be noted that in the UK, NATS (Air Traffic Control) safeguards SSR to a distance of 10km. The guidelines used by NATS (*CAP 764: Chapter 2: Impact of wind turbines on aviation*) state that:

"Wind turbine effects on SSR are traditionally less than those on PSRs but can be caused due to the physical blanking and diffracting effects of the turbine towers, depending on the size of the turbines and the wind farm. These effects are typically only a consideration when the turbines are located very close to the SSR i.e. less than 10 km."

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2.6.2.1 Irish Aviation Authority (IAA) Radar Surveillance Sensors

To determine which Assessment Zones are applicable to the proposed wind farm a desktop assessment was carried out. The nearest radar surveillance sites to the proposed wind farm development are at Woodcock Hill and Shannon Airport.



Figure 7. Radar Surveillance Sites relative to Ballinlee Wind Farm

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2.6.2.1.1 Woodcock Hill SSR Radar Assessment

The radar surveillance site at Woodcock Hill consists of a SSR system housed in the dome-shaped structure shown in Figure 8.



Figure 8. Woodcock Hill Radar Station

Table 6 below shows the (EuroControl & NATS) assessment zone applicable to the nearest point where a turbine could potentially be located. The applicable assessment zone has been based on distance from the Radar Station and whether a radar line-of-sight condition exists.

ID	Distance to SSR	Radar LOS Assessment (EuroControl Guidelines)	Radar LOS Assessment (NATS Guidelines – UK)
Ballinlee WF	27.2 km	Detailed Assessment Not Required	Detailed Assessment Not Required

Table 6. EuroControl / UK Safeguarding Guidelines - Woodcock Hill SSR

As the table above show, the proposed wind farm is within Assessment Zone 4 as specified by the EUROCONTROL guidelines, which would indicate that a detailed technical assessment would not be required for the impact on the SSR at Woodcock Hill.

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2.6.2.1.2 Shannon Airport Radar Assessment

The radar surveillance site at Shannon Airport consists of a PSR and a SSR. The PSR and the SSR antennas are co-located on the same structure at Shannon Airport (Figure 9).



Figure 9. Shannon Airport Radar Station

Table 7 below shows the (EuroControl & NATS) assessment zone applicable to the nearest point where a turbine could potentially be located. The applicable assessment zone has been based on distance from the Radar Station and whether a radar line-of-sight condition exists.

ID	Distance to PSR/SSR	Radar LOS Assessment (EuroControl Guidelines)	Radar LOS Assessment (NATS Guidelines – UK)
Ballinlee WF	32.8 km	Detailed Assessment Not Required	Detailed Assessment Not Required

Table 7. EuroControl / UK Safeguarding Guidelines – Shannon PSR/SSR

As the tables above show, the proposed wind farm is within Assessment Zone 4 as specified by the EUROCONTROL guidelines, which would indicate that a detailed technical assessment would not be required for the impact on the PSR/SSR at Shannon Airport.

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2.7 Flight Inspection and Calibration

Flight checks are conducted annually to ensure that flight procedures and associated navigational aids are safe and accurate. These flight checks are carried out by an IAA approved Flight Inspection Service Provider. The checks are carried out during annual inspections consisting of radial and orbital test flights around Shannon Airport for calibration of instrument landing systems. It is unlikely that the Flight Inspection Procedures will be impacted as the proposed wind farm is sufficiently far from the airport runways and the flight inspection procedures should already account for existing obstacles.

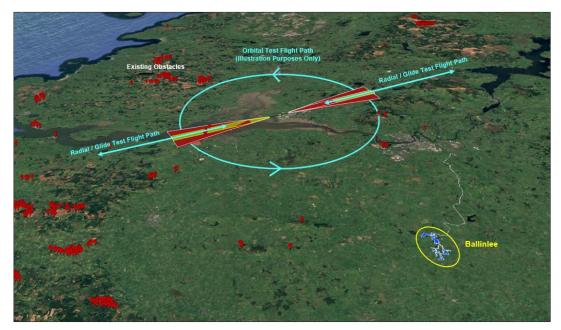


Figure 10. Flight Inspection and Calibration Test Procedure Flight Paths - Shannon Airport

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2.8 Aeronautical Obstacle Warning Light Scheme

In the event of a grant of planning consent the IAA-ANSP would require the lighting of the proposed wind turbines in the interest of aviation safe-guarding as the proposed development may be considered as an en-route obstacle. The developers of the proposed turbines would intend to implement an aeronautical obstacle warning light.

It is recommended that lighting requirements should be in accordance with Chapter Q – Visual Aids for denoting Obstacles; CS ADR.DSN.Q.851 and GM.ADR.DSN.Q.851 (Pages 557/558) of the EASA Easy Access Rules for Aerodromes (Reg (EU) No. 139/2014) where it states that

"where lighting is deemed necessary in the case of a wind farm (i.e. group of two or more wind turbines), the wind farm should be regarded as an extensive object and lights should be installed."

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3. Summary

A summary of the aviation review for the proposed wind farm at Ballinlee is provided in Table 8 below.

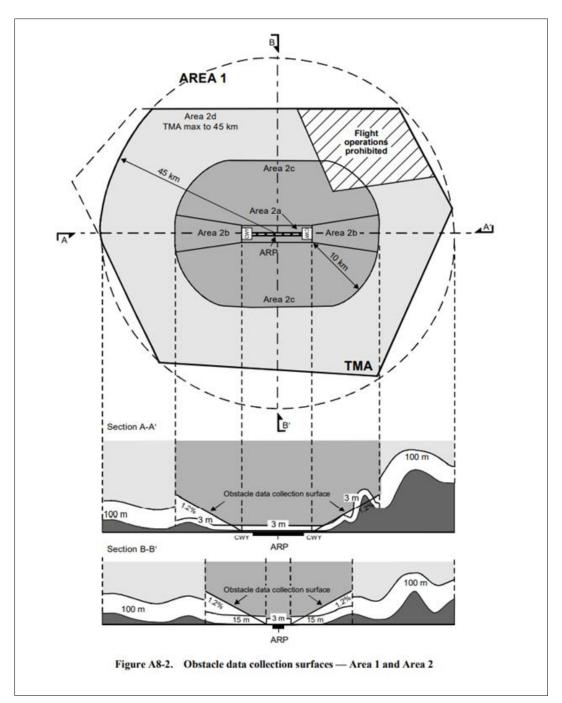
Item	Impact	Summary
Annex 14 - Obstacle Limitation	None	Outer Horizontal Surface: The proposed turbines are located 10km outside the Outer Horizontal Surface.
Surfaces (OLS)	None	Take-off and Approach Surfaces: Turbines at the proposed wind farm would be outside the take-off and approach surfaces.
Annex 15 - Aerodrome Surfaces	None	The proposed wind turbines would penetrate the ICAO Annex 15 Aerodrome Surface. All obstacles, if more than 100 meters above terrain for a distance of 45km from center point of Shannon Airport, need to be registered in the IAA Air Navigation Obstacle Data Set. The IAA may request that the turbines be included in the IAA Aeronautical Electronic Obstacle Data Sets. It should be noted that other existing tall structures in the vicinity of
		Ballinlee (e.g. existing turbines at Kilmeedy, Rathncally and Boolard) are also located within the ICAO Annex 15 Aerodrome Surface and are already listed in the IAA Aeronautical Electronic Obstacle Data Sets.
Minimum Sector Altitudes (MSA) None Wind farm is within 25 nautical mi Airport. The maximum allowable s 2400ft (AMSL). Turbines at the proposed wind fi threshold, therefore the MSA of the		A review of the Minimum Sector Altitudes (MSA) shows that the proposed wind farm is within 25 nautical miles from the VOR/DME at Shannon Airport. The maximum allowable structure in the applicable sector is 2400ft (AMSL). Turbines at the proposed wind farm would not exceed the 2400ft threshold, therefore the MSA of the applicable sector will not be affected and there will be no impact on the published MSA altitude figures.
Instrument Flight Procedures	No	A review shows that the proposed wind farm site is sufficiently far from Shannon Airport that the instrument flight procedures for approach and departure flights to/from the airports are unlikely to be impacted for precision aircraft.
Communication and Navigation Systems	None	As the proposed wind farm is approximately 32km from the Localizer and transmitting antenna at Shannon Airport, it is very unlikely that the proposed development will have any impact on these ATS communications and radio navigational aids.
Radar Surveillance Systems Safeguarding	Systems None (EuroControl guidelines) for SSR and PSR instruments and a detail	
Flight Inspection and Calibration	The proposed wind tarm as the proposed site is sufficiently far from the AR	
Aeronautical Obstacle Warning Light Scheme	None	If permitted, the wind farm should be fitted with Aeronautical Obstacle Warning Lights in accordance with civil aviation industry and regulatory standards. Subject to further consultation with the IAA.

Table 8. Ballinlee Wind Farm – Aviation Review Summary

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APPENDIX A - ICAO Annex 15 Area 1 Surface.



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