FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 16.1

Example Consultation

«AddressBlock»

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

Our Ref: P20-003/Lett/EH/JO

2 March 2021

Re: Proposed Fahy Beg Wind Farm Environmental Impact Assessment Report – Scoping & Consultation Request

Dear Sir/Madam

RWE Renewables intend to apply for planning permission for a renewable energy development referred to as the Fahy Beg Wind Farm, located in South East County Clare, near Bridgetown. The proposed project includes lands contained within the following townlands: Fahy Beg, Fahy More North, Ballymoloney, Ballyknavin and Ballyquin More.

This letter and enclosed scoping report is being issued to you as part of the consultation process for the project's Environmental Impact Assessment Report (EIAR). As part of the consultation process, we would be interested in receiving any comments you may have on the proposed development, relevant to your area of expertise. We respectfully ask that you forward all responses before the Friday the 9th of April 2021 to provide adequate time to consider all material. Your response may be forwarded by email or by post to the address below.

By Email: fahybegwindfarm@ftco.ie

By Post: Eamon Hutton, Fehily Timoney & Company, Core House, Pouladuff Road, County Cork, T12 D773

If you have no comments to make on the proposed project, I would be grateful if you would please acknowledge receipt of this correspondence. If you have any further queries regarding the project, please contact the undersigned.

Yours sincerely,

Eamon Hutton

Eamon Hutton
for and on behalf of **Fehily Timoney and Company**

Encl.

Cork: Core House, Pouladuff Road, Cork, T12 D773, Ireland
T: +353 21 496 4133
E: info@ftco.ie
www.fehilytimoney.ie

From: Fahy Beg Windfarm [fahybegwindfarm@ftco.ie]
Sent: Friday 05 March 2021 10:54
To: [insert operator address]
Subject: Fahy Beg Wind Farm - Telecommunications Assessment

Greetings,

RWE Renewables intend to apply for planning permission for a wind farm development in south east County Clare consisting of 8 no. wind turbines. As part of the telecommunications impact assessment we have been prompted to contact telecommunications companies operating in the area of the project site.

Wind turbines have potential to interfere with telecommunications and broadband services if built in proximity to or between links. I have listed the coordinates (ITM) of the turbines below and I have attached a KMZ file which can be opened in google earth.

I would appreciate it if you would review the turbine locations and notify us if there are any foreseeable impacts in relation to your company's infrastructure.

If you have any further queries please do not hesitate to contact me.

Turbine ID	ITM Coordinates			
	X	Y	Latitude	Longitude
T1	562986	670604	52.78518089978231	-8.548700580599327
T2	563203	670292	52.78239166984966	-8.545448838848365
T3	563773	669993	52.77974297701307	-8.5369669527551
T4	563811	669603	52.77624044007123	-8.536360642313054
T5	563936	670549	52.784750875574964	-8.534612269824708
T6	564235	670101	52.78074440719779	-8.530131172733055
T7	564565	670620	52.78543062232799	-8.525296097375115
T8	564669	670260	52.782201970978896	-8.5237156030248

Kind regards,
Eamon Hutton

Eamon Hutton
Project Planner

Fehily Timoney and Company
Core House, Pouladuff Road, Cork, T12 D773
t: +353 21 496 4133
www.fehilytimoney.ie

From: Fahy Beg Windfarm <fahybegwindfarm@ftco.ie>
Sent: Tuesday 2 March 2021 17:07
To: [insert operator address]
Subject: Scoping Report regarding the proposed Fahy Beg Wind Farm

Dear Sir or Madam,

Please find Scoping Report regarding the proposed Fahy Beg Wind Farm.

Yours sincerely,

Jennifer O'Hanlon
for Eamon Hutton

FEHILY TIMONEY

Jennifer O'Hanlon
Administrator

Fehily Timoney and Company
Core House, Pouladuff Road, Cork, T12 D773
t: +353 21 496 9573
www.fehilytimoney.ie

Attachments:

PDF
Fahy Beg Scoping Report.pdf

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 16.2

IFP and OLD Safeguarding Scoping Assessment Report

OSPREY
CONSULTING SERVICES

Shannon Airport – Safeguarding Scoping Report – Wind Turbines RWE Renewables Ireland

Scoping Assessment of Instrument Flight Procedures and Obstacle Limitation Surfaces

Date: 27th October 2022
Author: Daniel Figueras
Revision: V2
Osprey Ref: 71590 -001

The Hub, Fowler Avenue, Farnborough Business Park, Farnborough, GU14 7JP
01420 520200 / enquiries@ospreycsl.co.uk
Registered in England and Wales under No: 06034579

Document Details

Reference	Description
Document Title	Shannon Airport – Safeguarding Scoping Report – Wind Turbines RWE Renewables Ireland
	Assessment of Instrument Flight Procedures and Obstacle Limitation Surfaces
Document Ref	71590 -001
Issue	V2
Date	27th October 2022
Client Name	RWE Renewables Ireland
Classification	Commercial in Confidence

Issue	Amendment	Date
Issue 1	Initial Issue	17h June 2021
Issue 2	Review Against Updated Turbine Layout	27th October 2022

Approval Level	Authority	Name
Author	Osprey CSL	Daniel Figueras
Technical Reviewer	Osprey CSL	Liam Clarke (IAPD)
Release Reviewer	Osprey CSL	Mark Wakeman

Executive Summary

Osprey CSL has been commissioned by RWE Renewables Ireland to assess the potential impact of 8 Wind Turbines in the vicinity of Shannon Airport, with a height of 170m Above Ground Level (AGL).

This report is a high-level assessment of the potential impact the Wind Turbines may have in relation to the Airports Obstacle Limitation Surfaces (OLS) and Instrument Flight Procedures (IFPs) for Shannon Airport.

Impact on the OLS

It is not anticipated that there would be any effects on the Obstacle Limitation Surfaces.

Impact on the IFPs

It is not anticipated that there would be any effects on the Instrument Flight Procedures.

Issue 2 Statement (27/10/22)

A review has been carried out for an updated turbine layout where, although there is no change to the windfarm site boundary, the turbine locations are slightly different and the maximum tip height has increased from 170m to 176.5m.

The updated turbine layout data was received by e-mail on the 26/10/22 and details are specified in the below table:

Turbine	Radius of operation (m)	Ground Elevation (m)	Maximum tip height (AGL) (m)	Maximum tip elevation (AMSL)(m)	WGS84 Latitude	WGS84 Longitude
T1	176.5	116.27	176.5	292.77	52.785257	-8.547886
T2	176.5	143	176.5	319.5	52.782556	-8.544799
T3	176.5	221.23	176.5	397.73	52.784965	-8.534926
T4	176.5	193.56	176.5	370.06	52.786030	-8.525926
T5	176.5	187.517	176.5	364.017	52.783356	-8.531097
T6	176.5	156.78	176.5	333.28	52.782413	-8.524785
T7	176.5	125.55	176.5	302.05	52.776011	-8.535439
T8	176.5	154.45	176.5	330.95	52.779445	-8.537260

Additionally, the below image shows the new situation of the 8 turbines (in yellow) compared to the originally assessed layout (in red):

After detailed review, Osprey CSL can confirm that the new updated obstacle lay-out and elevations as per the above table, do not change the fundamental conclusions of the previous study:

Impact on the OLS

It is not anticipated that there would be any effects on the Obstacle Limitation Surfaces.

Impact on the IFPs

It is not anticipated that there would be any effects on the Instrument Flight Procedures.

NOTE: Calculations, text and figures documented in the body of the report relate to the original assessment, but we have carried a detailed review and are able to confirm that the original conclusions remain valid.

Table of Contents

Table of Figures

1 Introduction

1.1 Background

Osprey CSL has been commissioned by RWE Renewables Ireland to assess the potential impact of 8 Wind Turbines in the vicinity of Shannon Airport, with a height of 170m Above Ground Level (AGL).

1.2 Scope of the Assessment

This report is a high-level assessment of the Wind Turbines in relation to the Obstacle Limitation Surfaces (OLS) and Instrument Flight Procedures (IFPs) and has been completed with the use of the Airport information from AIP Ireland (EINN AD 2-1 AIRAC 10 SEP 2020).

1.3 Data Provided by Client

Email dated 09/06/2021 provided theWGS84 Latitude, Longitude and Maximum Working Height.

Data provided by client was used to define the Ground Elevation (AOD).

Turbine	Radius of operation (m)	Ground Elevation (m)	Maximum working height (AGL) (m)	Maximum working elevation (AMSL)(m)	WGS84 Latitude	WGS84 Longitude
T1	170	104	170	274	52.785424	-8.5491362
T2	170	130	170	300	52.782805	-8.5458773
T3	170	159	170	329	52.780300	-8.5380131
T4	170	125	170	295	52.776367	-8.5360926
T5	170	223	170	393	52.785180	-8.5352772
T6	170	168	170	338	52.781520	-8.5316938
T7	170	196	170	366	52.785946	-8.5263830
T8	170	159	170	329	52.782786	-8.5250312

Table 1 – Wind Turbine Details

This data was converted using Grid InQuest II to be used in AutoCAD and with PDToolkit software.

1.4 Orientation

The Wind Turbines were added to the AutoCAD Model:

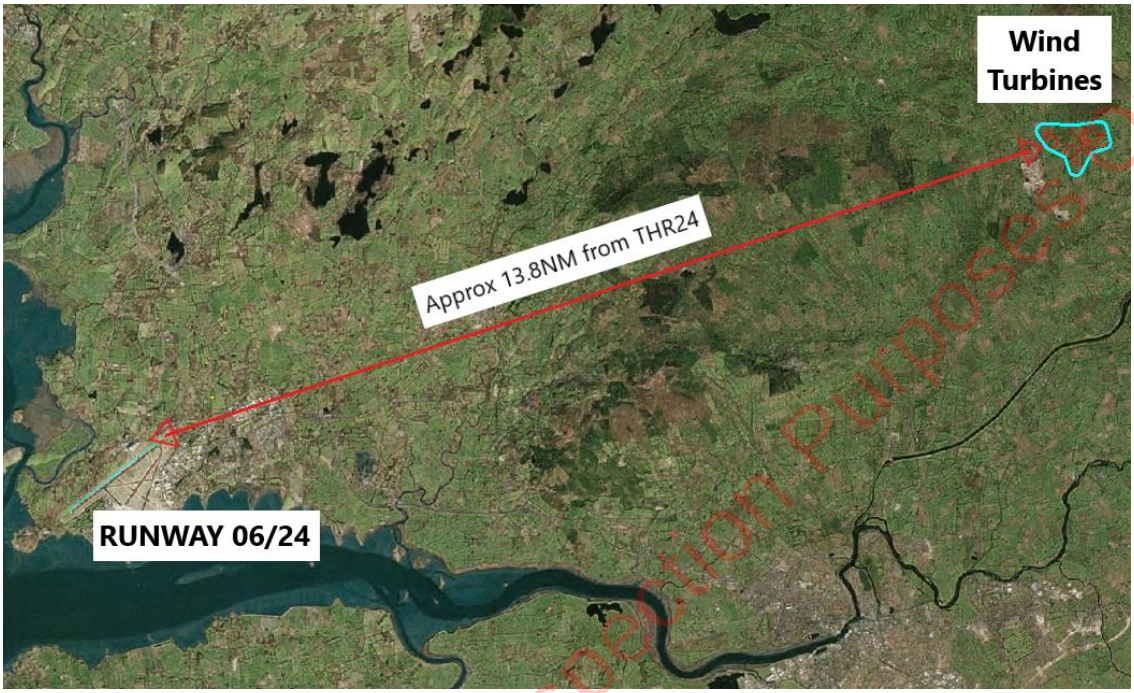

Figure 1 – Location of Wind Turbines in Relation to Airport

2 OLS Analysis

1.1 Runway 06/24

The Wind Turbines are outside all the Obstacle Limitation Surfaces (OLS), shown in the following diagram.

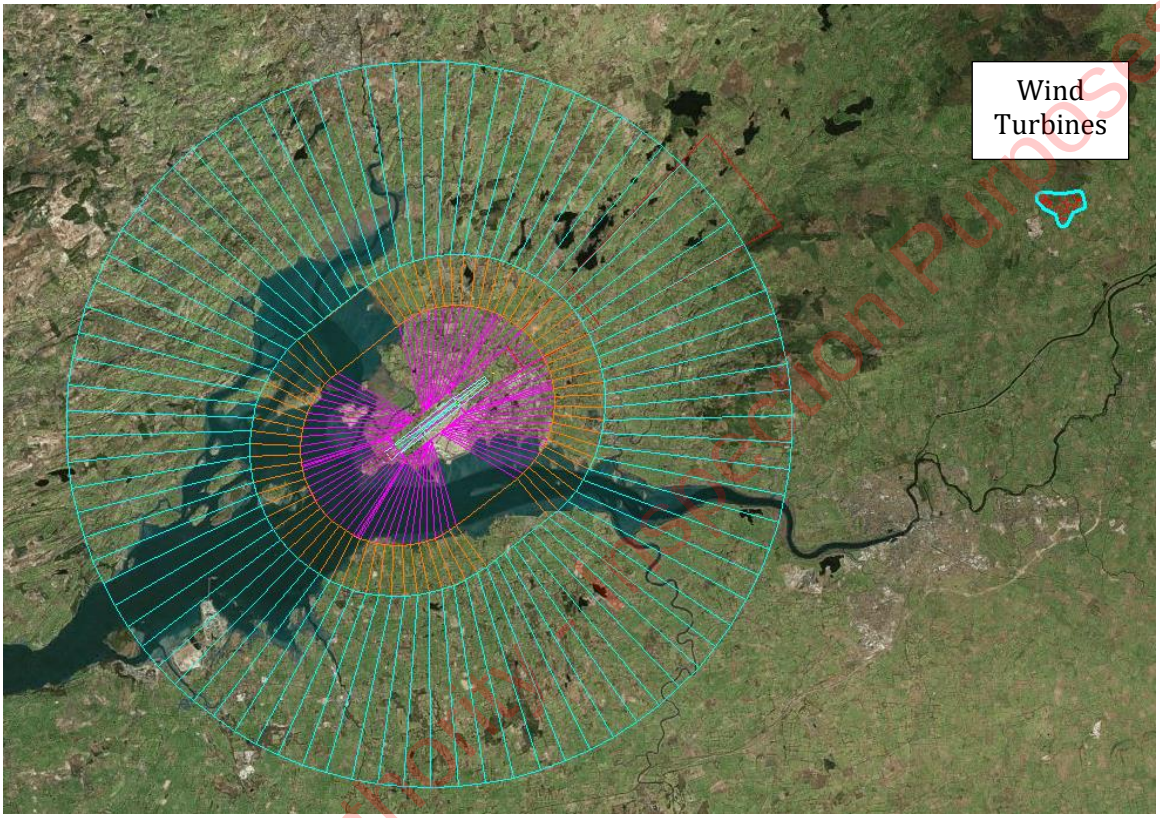

Figure 2 – Wind Turbines with OLS Surfaces

It is not anticipated that the Wind Turbines would have any effect on the OLS.

3 IFP Safeguarding

2.1 General

A high-level assessment has been conducted against the following IFPs:

AIRAC Effective 10 Sep 2020

- EINN AD2.24-5.1 RWY 06 SIDs (31 Jan 2019):
  - UNBEG 3A
  - ERABI 3A
  - MOMIN 3A
  - AGINI 3A
  - DIGAN 3A
  - TOMTO 3A
  - ABAGU 3A
  - KURUM 3A
  - LUNIG 3A
- EINN AD2.24-6.1 RWY 24 SIDs (31 Jan 2019):
  - AGINI 3B
  - AGABU 3B
  - KURUM 3B
  - BUNON 3B
  - LUPOR 3B
  - UNBEG 3B
  - ERABI 3B
  - MOMIN 3B
  - PELIG 3B
  - OSGAR 3B
  - LUNIG 3B
- EINN AD2.24-7.1 RWY 06 STARs (31 Jan 2019):
  - AGINI 2E
  - RIKUL 2E
  - DIGAN 2E
  - TIPUR 2E
  - KURUM 2E
  - BUNON 2E
  - LUPOR 2E
  - UNBEG 2E
  - ERABI 2E
  - MOMIN 2E
- EINN AD2.24-8.1 RWY 24 STARs (06 Dec 2018):
  - AGINI 2D
  - RIKUL 2D
  - DIGAN 2D
  - TIPUR 2D
  - KURUM 2D
  - BUNON 3D
  - LUPOR 3D
  - UNBEG 3D

- ERABI 3D
- MOMIN 3D

- EINN AD2.24-10.1 ILS OR LOC RWY 06 (06 Dec 2018)
- EINN AD2.24 11.1 VOR RWY 06 (06 Dec 2018)
- EINN AD2.24-13.1 ILS CAT I AND II OR LOC RWY 24 (06 Dec 2018)
- EINN AD2.24 14.1 VOR RWY 24 (06 Dec 2018)

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surface
- Minimum Sector Altitudes

2.2 High-level Assessment

2.2.1 SIDs RWY 06

Overview

The Wind Turbines are located within some of the SIDs nominal tracks departing RWY 06.

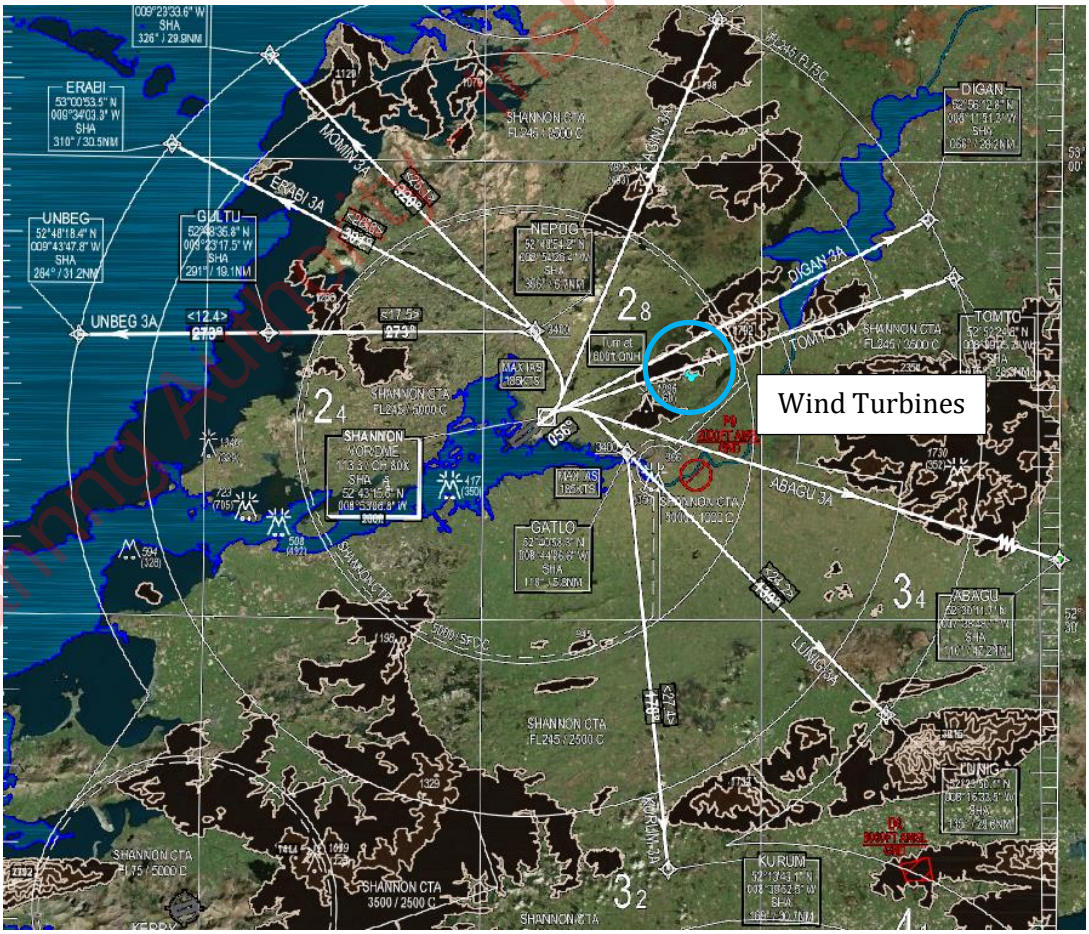

Figure 3 – RWY 06 SIDs vs Turbines

The potentially affected SIDs are AGINI 3A, DIGAN 3A, TOMTO 3A, ABAGU 3A, LUNIG 3A and KURUM 3A.

However, further calculations have deemed that a maximum turbine elevation (T5) of 393m (AMSL) would be cleared with more than 300m MOC with a 3.3% PDG (Procedure Climb Gradient) after the turn at 600ft QNH.

This is based on a shortest distance to KK-line of 19784.1m, which places any aircraft at a minimum altitude of 835.75m against the 693m required over the obstacle.

It is not anticipated that the Wind Turbines would have any effect on the RWY 06 SIDs.

2.2.2 SIDs RWY 24

Overview

The Wind Turbines are not located within any of the SIDs nominal tracks departing RWY 24.

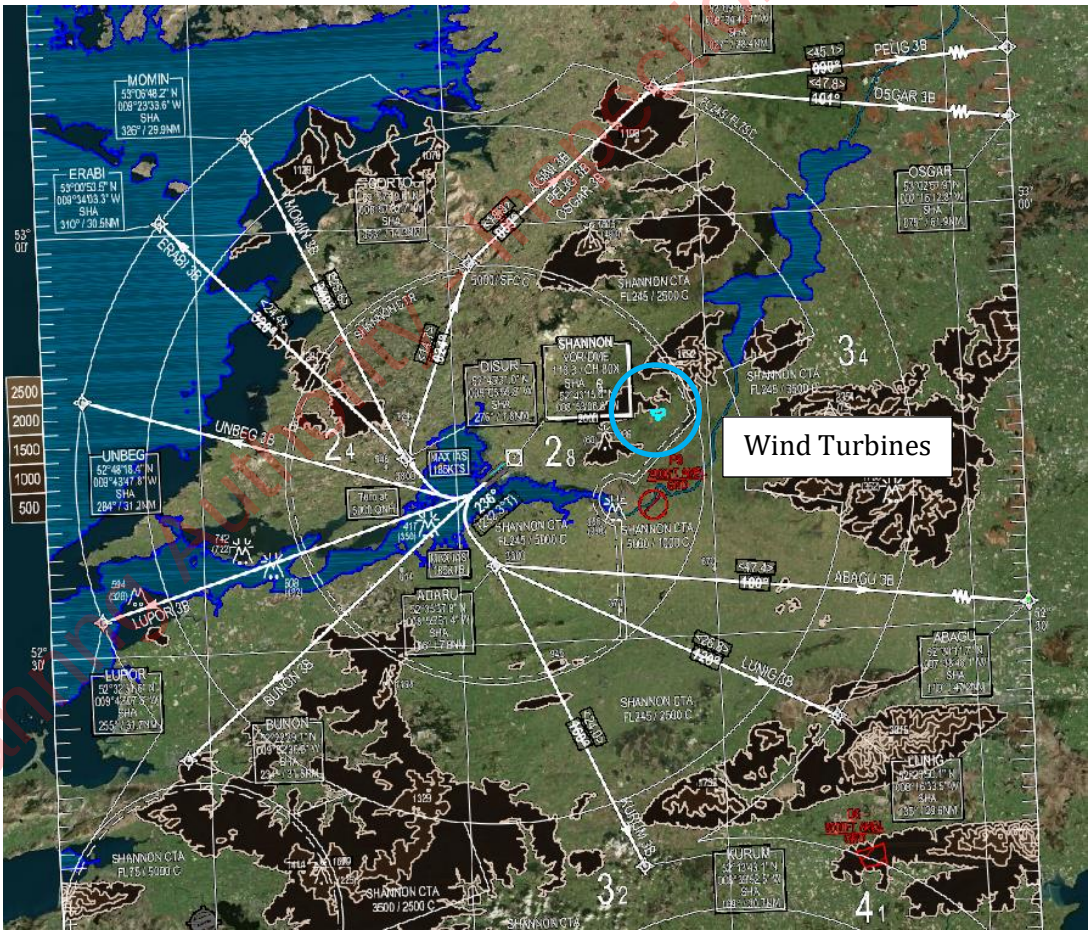

Figure 4 – RWY 24 SIDs vs Turbines

It is not anticipated that the Wind Turbines would have any effect on the RWY 24 SIDs.

2.2.3 STARs RWY 06

All STARS terminate at or above 3000ft.

Maximum Wind Turbine elevation (T5) plus the MOC of 300m is:

393m + 300m = 693m / 2274ft

This is below the termination altitude of the STARs for RWY06.

It is not anticipated that the Wind Turbines would have any effect on the published STARs for Runway 06.

2.2.4 STARs RWY 24

All STARS terminate at or above FL060 (With at or above 3500ft at EKNIS Hold and at or above 3000ft at DERAG Hold).

Maximum Wind Turbine elevation (T5) plus the MOC of 300m is:

393m + 300m = 693m / 2274ft

This is below the termination altitude of the STARs for RW24.

It is not anticipated that the Wind Turbines would have any effect on the published STARs for Runway 24.

2.2.5 ILS or LOC RWY 06

Overview

The Wind Turbines would be outside the Final Approach Segment Obstacle Assessment Surfaces (OAS) but could potentially be located within the turning Missed Approach Areas (MATP NN005 D9.5 SHA).

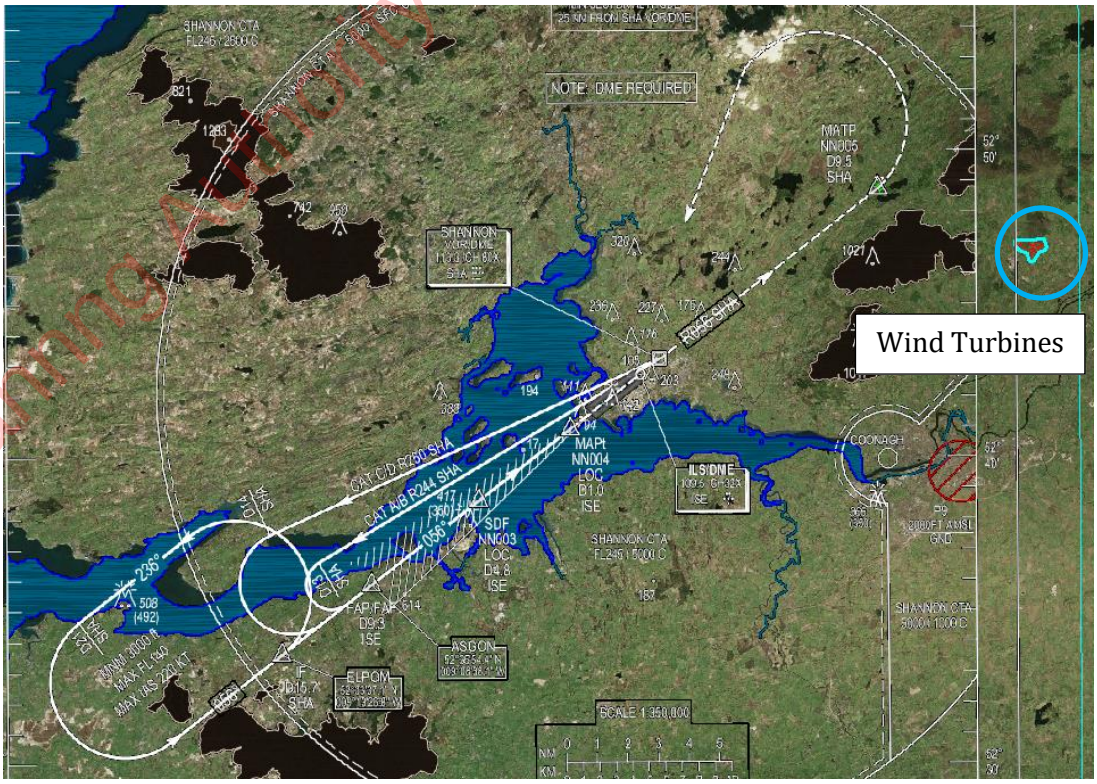

Figure 5 – ILS or LOC RWY 06

ILS

If the Wind Turbines were located inside the turning Missed Approach Areas, and assuming a worst case SOC positioned 900m after THR and at THR elevation (14m), the turning altitude at fix NN005 will be no lower than 1800ft with a 2.5% Missed Approach Climb Gradient.

This is above the Maximum Wind Turbine elevation (T5) plus the MOC of 50m:

393m + 50m = 443m / 1454ft

LOC

If the Wind Turbines were located inside the turning Missed Approach Areas, and assuming a worst case SOC positioned 2NM after MAPt and at OCA (350ft), the turning altitude at fix NN005 will be no lower than 2000ft with a 2.5% Missed Approach Climb Gradient.

This is above the Maximum Wind Turbine elevation (T5) plus the MOC of 50m:

393m + 50m = 443m / 1454ft

It is not anticipated that the Wind Turbines would have any effect on the published ILS or LOC for Runway 06

2.2.6 VOR RWY 06

Overview

The Wind Turbines would be outside the Final Approach Segment Protection Areas but could potentially be located within the turning Missed Approach Areas (MATP NN005 D9.5 SHA).

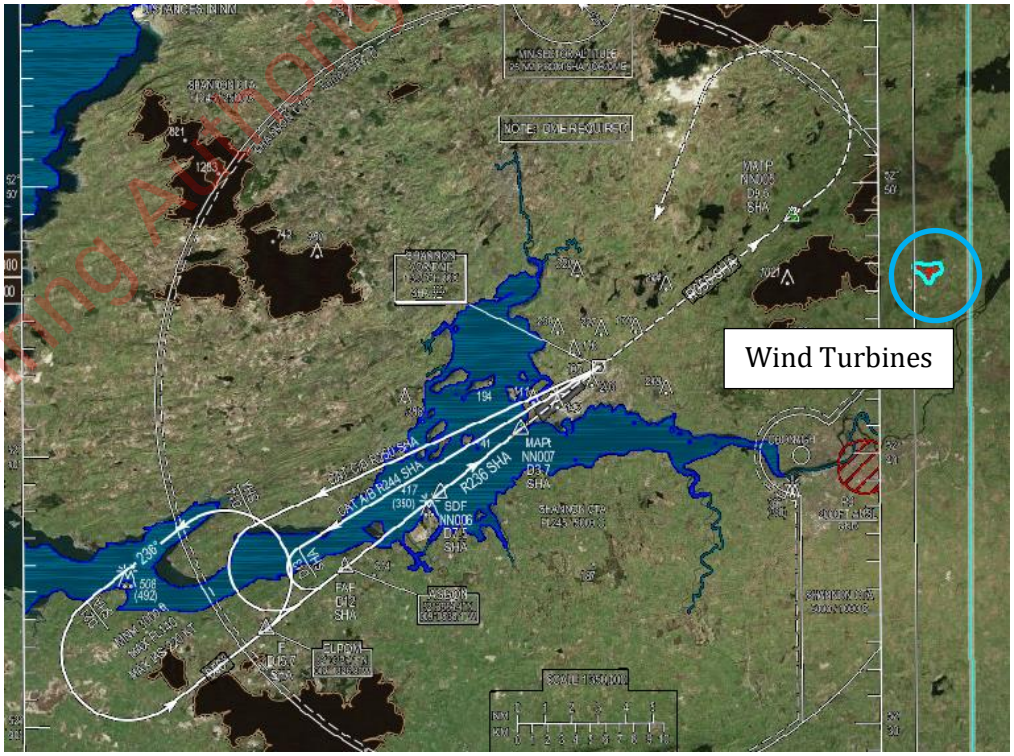

Figure 6 – VOR RWY 06

If the Wind Turbines were located inside the turning Missed Approach Areas, and assuming a worst case SOC positioned 2NM after MAPt and at OCA (360ft), the turning altitude at fix NN005 will be no lower than 2000ft with a 2.5% Missed Approach Climb Gradient.

This is above the Maximum Wind Turbine elevation (T5) plus the MOC of 50m:

393m + 50m = 443m / 1454ft

It is not anticipated that the Wind Turbines would have any effect on the published VOR for Runway 06.

2.2.7 ILS CAT I AND II or LOC RWY 24

Overview

The Wind Turbines would be outside the Final Approach Segment Obstacle Assessment Surfaces (OAS) but could potentially be located within the Intermediate Segment and Initial Segment (Base Turn) Protection Areas, as well as within the DERAG Holding Areas

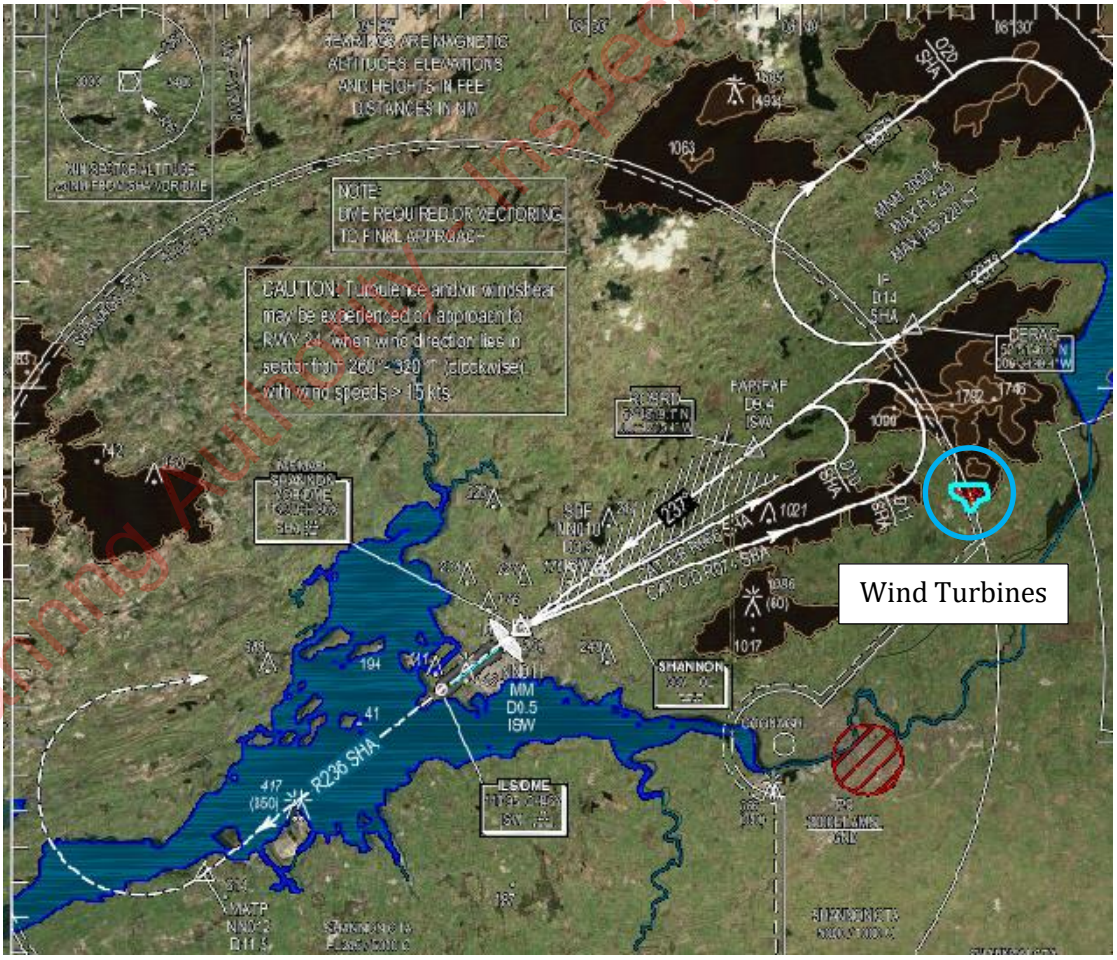

Figure 7 – ILS or LOC RWY 24

Initial Approach Segment

If the Wind Turbines were located inside the Base Turn Initial Approach Protection Areas, the lowest turning altitude on the outbound turn is 3000ft.

This is above the Maximum Wind Turbine elevation (T5) plus the MOC of 300m:

393m + 300m = 693m / 2274ft

The hold at DERAG is above 3000ft so would also be safe.

Intermediate Approach Segment

If the Wind Turbines were located inside the Intermediate Approach Segment Protection Areas, the MOCA for the segment is 2400ft.

This is above the Maximum Wind Turbine elevation (T5) plus the MOC of 150m:

393m + 150m = 543m / 1790ft

It is not anticipated that the Wind Turbines would have any effect on the published ILS CAT I and II or LOC for Runway 24.

2.2.8 VOR RWY 24

Overview

The Wind Turbines would be outside the Final Approach Segment Protection Areas but could potentially be located within the Intermediate Segment and Initial Segment (Base Turn) Protection Areas, as well as within the DERAG Holding Areas.

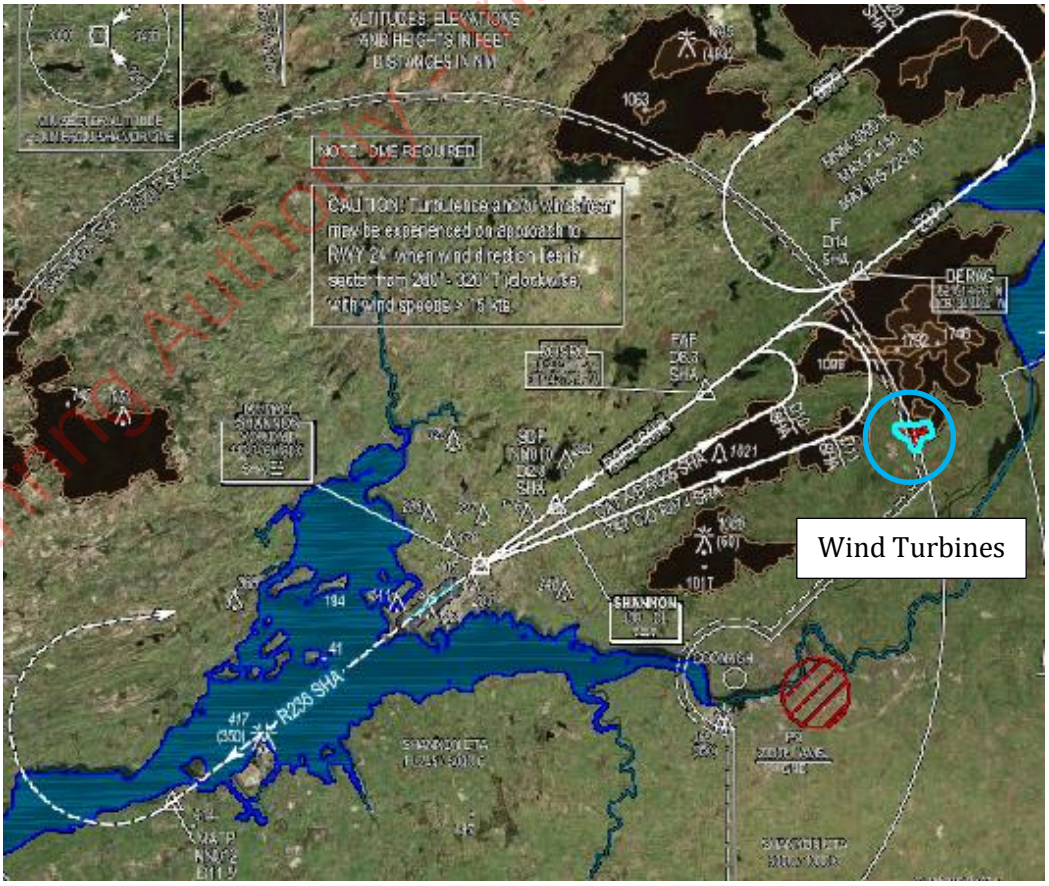

Figure 8 – VOR RWY 24

Initial Approach Segment

If the Wind Turbines were located inside the Base Turn Initial Approach Protection Areas, the lowest turning altitude on the outbound turn is 3000ft.

This is above the Maximum Wind Turbine elevation (T5) plus the MOC of 300m:

393m + 300m = 693m / 2274ft

The hold at DERAG is above 3000ft so would also be safe.

Intermediate Approach Segment

If the Wind Turbines were located inside the Intermediate Approach Segment Protection Areas, the MOCA for the segment is 2400ft.

This is above the Maximum Wind Turbine elevation (T5) plus the MOC of 150m:

393m + 150m = 543m / 1790ft

It is not anticipated that the Wind Turbines would have any effect on the published VOR for Runway 24.

2.2.9 Visual Circling

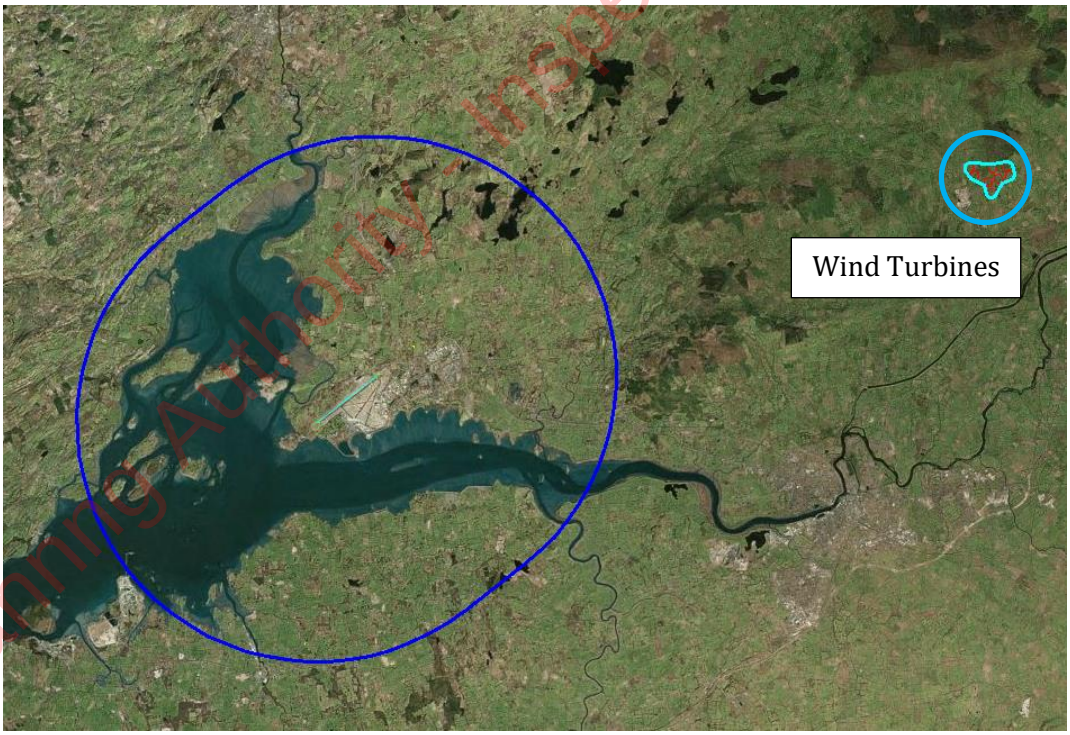

Figure 9 – Visual Circling

The Wind Turbines lie outside all the Visual Circling (VM(C)) Obstacle Protection Areas.

It is not anticipated that the Wind Turbines would have any effect on the Visual Circling.

2.2.10 Holding

With a maximum MOC of 300m the Wind Turbines would not affect the hold.

- 393m + 300m MOC = 693m / 2274ft.
- Existing Lowest Holding Altitude (LHA) = 3500ft (EKNIS) and 3000ft (ELPOM, DERAG)

It is not anticipated that the Wind Turbines would have any effect on the Hold for all procedures.

2.2.11 Visual Segment Surface (VSS)

The Wind Turbines lie outside the lateral confines of the Rwy 06 and Rwy 24 VSS.

It is not anticipated that the Wind Turbines would have any effect on the VSS for Runways 06 and 24.

2.2.12 Minimum Sector Altitudes

The Wind Turbines lie within with the lateral confines of the Minimum Sector Altitudes (MSAs) and produces an OCA of 393m + 300m = 693m / 2274ft. This is below the lowest MSA which has an OCA of 3000ft.

It is not anticipated that the Wind Turbines would have any effect on the published MSAs.

Conclusions

Impact on the OLS

It is not anticipated that there would be any effects on the Obstacle Limitation Surfaces.

Impact on the IFPs

It is not anticipated that there would be any effects on the Instrument Flight Procedures.

Issue 2 Statement (27/10/22)

A review has been carried out for an updated turbine layout where, although there is no change to the windfarm site boundary, the turbine locations are slightly different and the maximum tip height has increased from 170m to 176.5m.

The updated turbine layout data was received by e-mail on the 26/10/22 and details are specified in the below table:

Turbine	Radius of operation (m)	Ground Elevation (m)	Maximum tip height (AGL) (m)	Maximum tip elevation (AMSL)(m)	WGS84 Latitude	WGS84 Longitude
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T8	176.5	154.45	176.5	330.95	52.779445	-8.537260

Additionally, the below image shows the new situation of the 8 turbines (in yellow) compared to the originally assessed layout (in red):

After detailed review, Osprey CSL can confirm that the new updated obstacle lay-out and elevations as per the above table, do not change the fundamental conclusions of the previous study:

Impact on the OLS

It is not anticipated that there would be any effects on the Obstacle Limitation Surfaces.

Impact on the IFPs

It is not anticipated that there would be any effects on the Instrument Flight Procedures.

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 16.3

ILS Impact Assessment

FLIGHT CALIBRATION SERVICES LTD

FAHY BEG WIND FARM

IMPACT ON ILS FLIGHT INSPECTION

Prepared For:	Fehily Timoney and Company
Author:	John Wilson
Reviewed by:	David Bartlett
Reference:	FCSL 0137.02
Issue:	2
Date:	29 November 2022

FAHY BEG WIND FARM

Impact on ILS Flight Inspection

TABLE OF CONTENTS

ABBREVIATIONS

AIP	Aeronautical Information Publication
AMSL	Above Mean Sea Level
ARP	Aerodrome Reference Point
DME	Distance Measuring Equipment
FCSL	Flight Calibration Services Ltd
FIP	Flight Inspection Procedure
GP	Glide Path
GPS	Global Positioning System
ha	hectare
IAA	Irish Aviation Authority
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
ITM	Irish Transverse Mercator
LOC	Localiser
NM	Nautical Miles
WGS	World Geodetic System

1 INTRODUCTION

Fahy Beg Wind Farm is a proposed renewable energy project in County Clare located approximately 6 km south west of Killaloe and 1.5 km north of Bridgetown. The proposed wind farm site is approximately 15 NM east-northeast of Shannon Airport.

The Irish Aviation Authority (IAA) has requested that an assessment be performed to establish any adverse effect the proposed wind farm may have on flight inspection procedures and profiles associated with the Shannon Airport Runway 24 Instrument Landing System (ILS).

This report provides an assessment of the impact of terrain and obstacles on ILS flight inspection procedures. It does not provide an assessment of any impact the proposed wind farm may have on the integrity of the Runway 24 ILS guidance signals.

2 DETAILS OF PROPOSED WIND FARM

The proposed Fahy Beg Wind Farm comprises 8 wind turbines and associated infrastructure including turbine foundations, access tracks, an electricity substation, underground cabling and ancillary works located in an area of approximately 320 ha as shown in Figure 2.1 below. Figure 2.2 below shows the location of the wind farm in relation to Shannon Airport.

The proposed wind turbine coordinates are shown in Table 2.1 below.

The maximum height of the proposed wind turbines (to blade tip) is 176.5 m (579 ft) above ground level. Ground height at the highest turbine (T3) is 221.23 m (726 ft) AMSL.

The height of the highest turbine (to blade tip) is therefore 398 m (1,305 ft) AMSL.

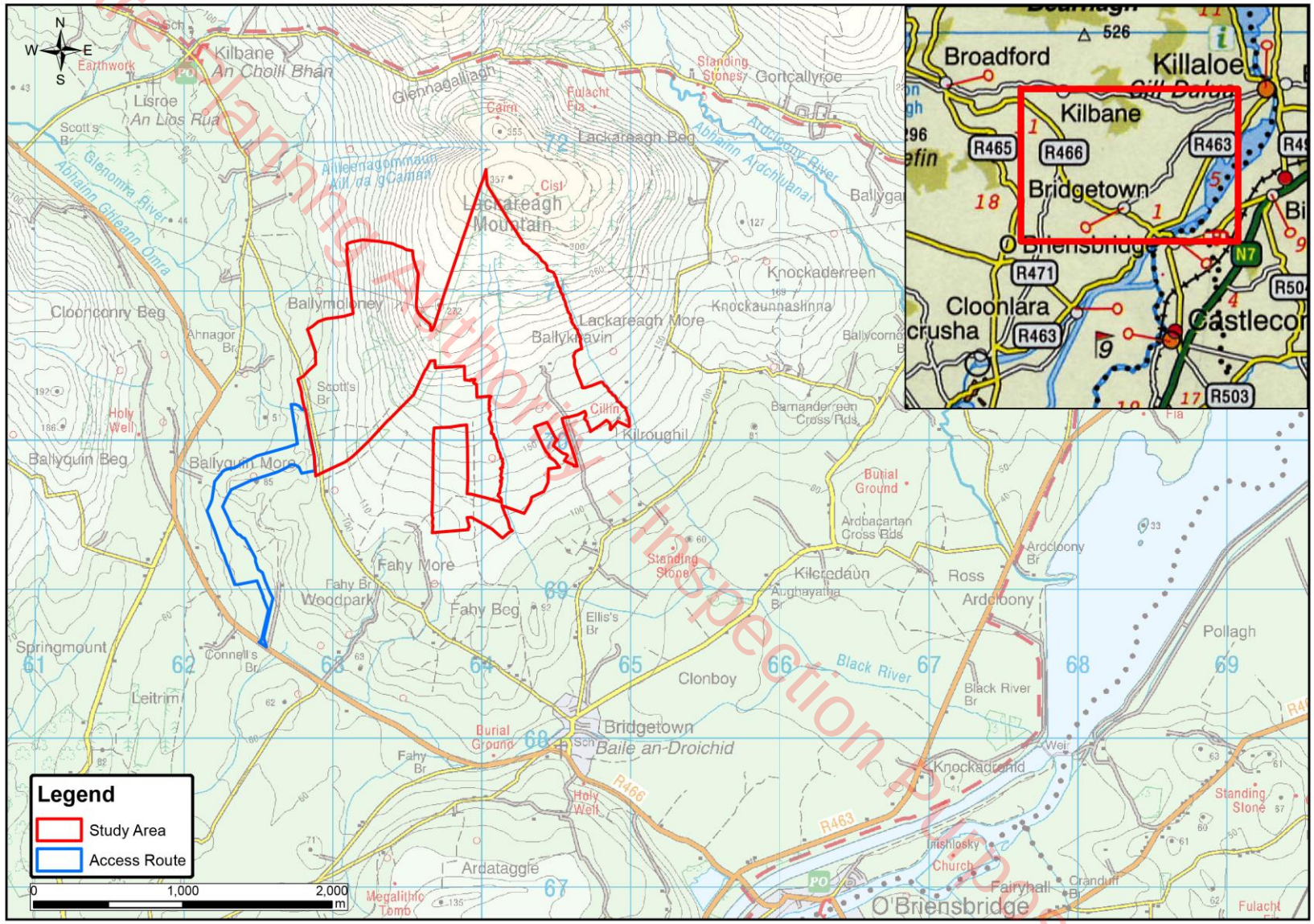


Figure 2.1 - Proposed Fahy Beg Wind Farm Location Map

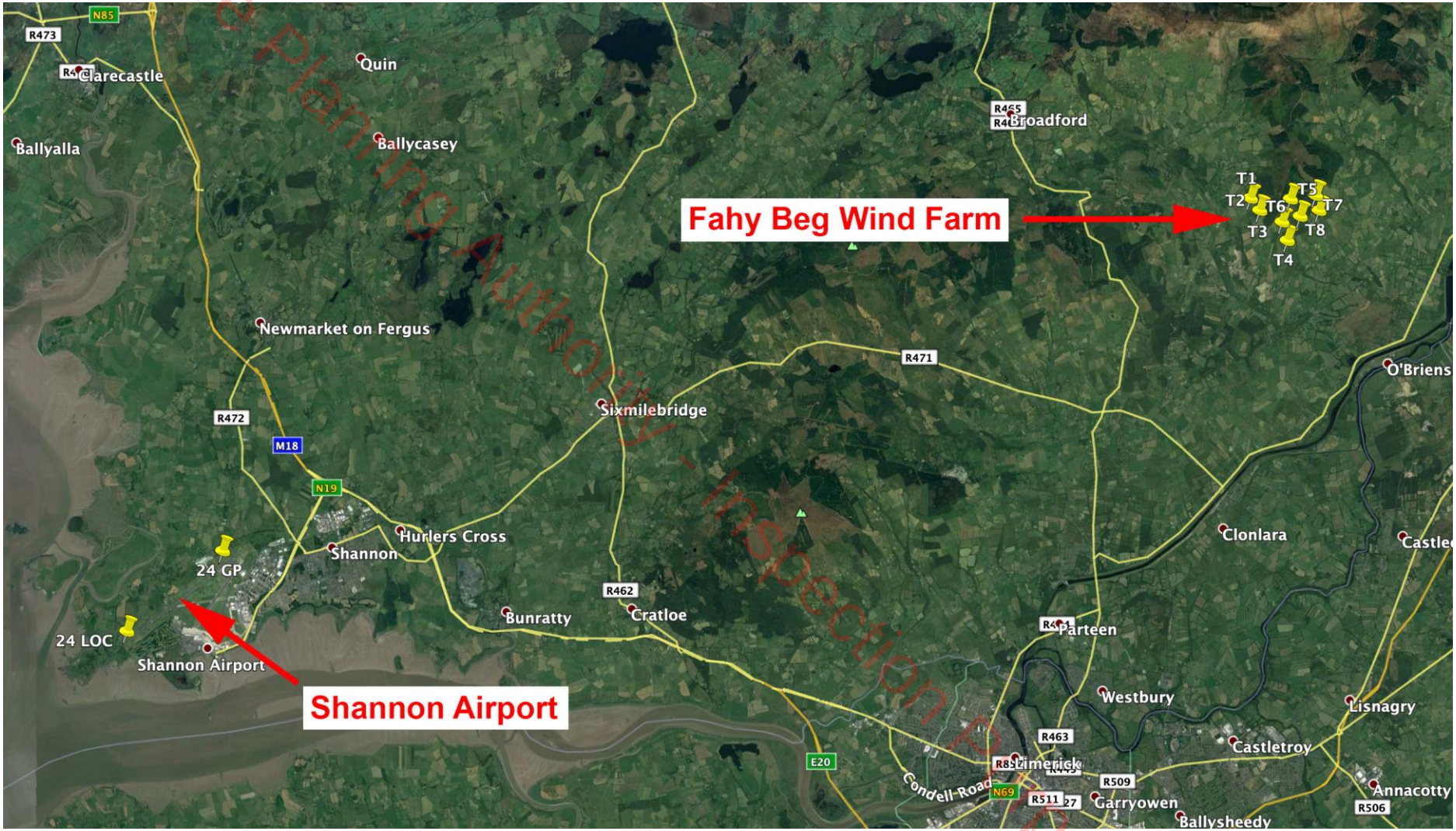


Figure 2.2 – Location of Proposed Fahy Beg Wind Farm and Shannon Airport

Turbine	ITM Coordinates		WGS-84 Coordinates		Ground Level AMSL (m)
	X	Y	Latitude	Longitude	
1	563041.149	670612.697	52.785257	-8.547886	116.27
2	563247.141	670310.705	52.782556	-8.544799	143
3	563915.848	670573.421	52.784965	-8.534926	221.23
4	564523.843	670687.676	52.786030	-8.525926	193.56
5	564172.847	670392.467	52.783356	-8.531097	187.517
6	564597.222	670284.263	52.782413	-8.524785	156.78
7	563873.129	669577.773	52.776011	-8.535439	125.55
8	563753.408	669960.628	52.779445	-8.537260	154.45

Table 2.1 - Proposed Turbine Coordinates

3 ILS INFORMATION

3.1 ILS Site Information

The Runway 24 ILS provides radionavigation information to aircraft in the initial and final approach phases of flight towards Runway 24 within 25 NM of Shannon Airport. The ILS ground installation comprises:

- Localiser equipment (providing lateral guidance to the runway centreline) located on the extended runway centreline approximately 300 m from the stop end of Runway 24.
- Glide Path equipment (providing vertical guidance to a 3.0° glide path) located approximately 130 m offset from runway centreline and backset 360 m from Runway 24 threshold.
- Distance Measuring Equipment (DME) transponder (providing distance to runway threshold information). The DME antenna is mounted on the Glide Path mast.

ILS Localiser, Glide Path and DME antenna coordinates are shown in the extract from AIP Ireland shown in Figure 3.1 below.

3.2 ILS Coverage Information

International Standards and Recommended Practices (SARPS) for ILS are published by the International Civil Aviation Organization (ICAO). ICAO Annex 10 Chapter 3.1 defines ILS Localiser and Glide Path lateral coverage sectors as described below.

3.2.1 Localiser Coverage

The Localiser coverage sector shall extend from the centre of the localiser antenna system to distances of:

- 46.3 km (25 NM) within plus or minus 10 degrees from the front course line;
- 31.5 km (17 NM) between 10 degrees and 35 degrees from the front course line;
- 18.5 km (10 NM) outside of plus or minus 35 degrees from the front course line if coverage is provided.

Figure 3.2 below shows ILS Localiser lateral coverage sector as defined in ICAO Annex 10.

Figure 3.3 below shows the Runway 24 ILS Localiser lateral coverage sector in relation to the proposed Fahy Beg Wind Farm.

3.2.2 Glide Path Coverage

The Glide Path equipment shall provide signals sufficient to allow satisfactory operation of a typical aircraft installation in sectors of 8 degrees in azimuth on each side of the centre line of the ILS glide path, to a distance of at least 18.5 km (10 NM).

Figure 3.4 below shows ILS Glide Path coverage as defined in ICAO Annex 10.

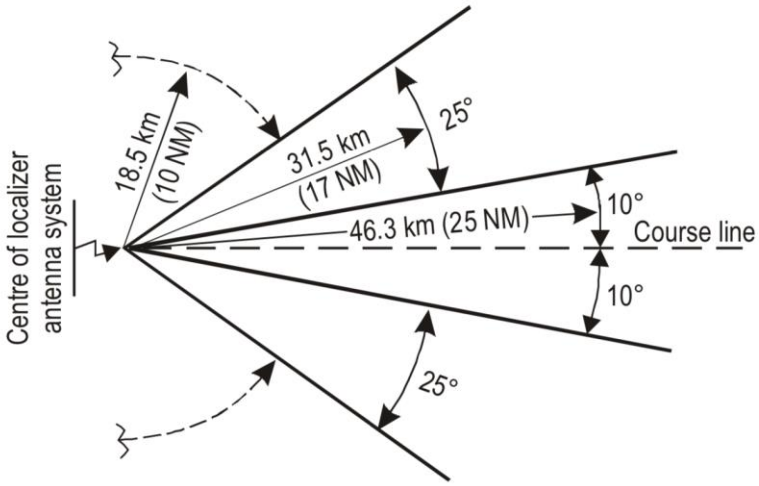
Figure 3.5 below shows the Runway 24 ILS Glide Path lateral coverage sector in relation to the proposed Fahy Beg Wind Farm.

3.2.3 DME Coverage

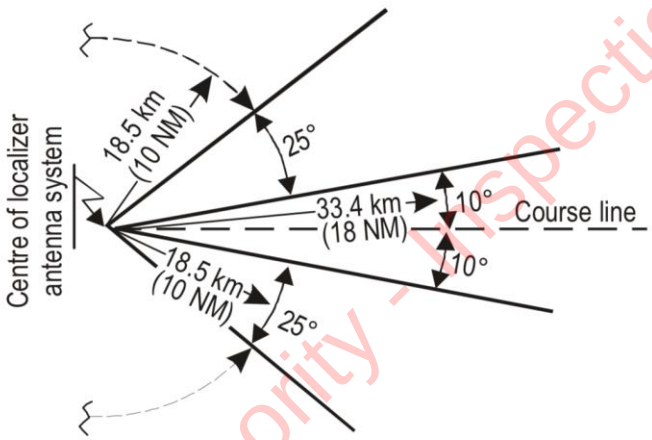
The DME equipment shall provide aircraft with distance to threshold information throughout the Localiser coverage sector as defined in 3.2.1 above.

Type of aid, MAG VAR, Type of supported OP (for VOR/ILS/ MLS/GNSS/ SBAS and GBAS, give declination)	ID	Frequency	Hours of operation	Position of transmitting antenna coordinates	Elevation of DME transmitting antenna or SBAS: ellipsoid height of LTP/FTP	Service Volume Radius from the GBAS Reference Point	Remarks
1	2	3	4	5	6	7	8
ILS DME RWY 06	ISE	CH32X (109.5 MHz)	H24	524147.2N 0085623.1W	100ft		DME Zero ranged to THR 06. DME zero range is displaced from DME antenna by 445M.
ILS LOC RWY 24 CAT II 4° W 2017	ISW	110.95MHz	H24	524129.4N 0085649.6W *			Coverage restricted to 35° either side of the course line. Signals received outside coverage sector, (including back beam radiation), should be ignored. No LOC coverage below 3000ft MSL AT 25 NM EINN *Data whose accuracy has not been quality assured.
ILS GP RWY 24		330.65MHz	H24	524232.1N 0085447.7W			GP Angle 3° RDH 59ft
LO RWY 24	OL	339 kHz	H24	524456.4N 0084926.0W			Designated Operational Coverage 15NM
OM RWY 24	2 Dashes per sec	75 MHz	H24	524455.5N 0084927.0W			
MM RWY 24	Dots and Dashes	75 MHz	H24	524254.8N 0085347.9W			
ILS DME RWY 24	ISW	CH46Y (110.95 MHz)	H24	524232.1N 0085447.7W	100ft		DME Zero ranged to THR 24. DME zero range is displaced from DME antenna by 391M.

Figure 3.1 - AIP Ireland



When topographical features dictate or operational requirements and alternative navigation facilities permit, the following coverage may be provided:



Note.— If coverage as prescribed in Chapter 3, 3.1.3.3.1 is required outside the plus or minus 35-degree sector, this is provided to 18.5 km (10 NM), as indicated by the broken arc above.

Figure 3.2 - ILS Localiser Lateral Coverage Sector

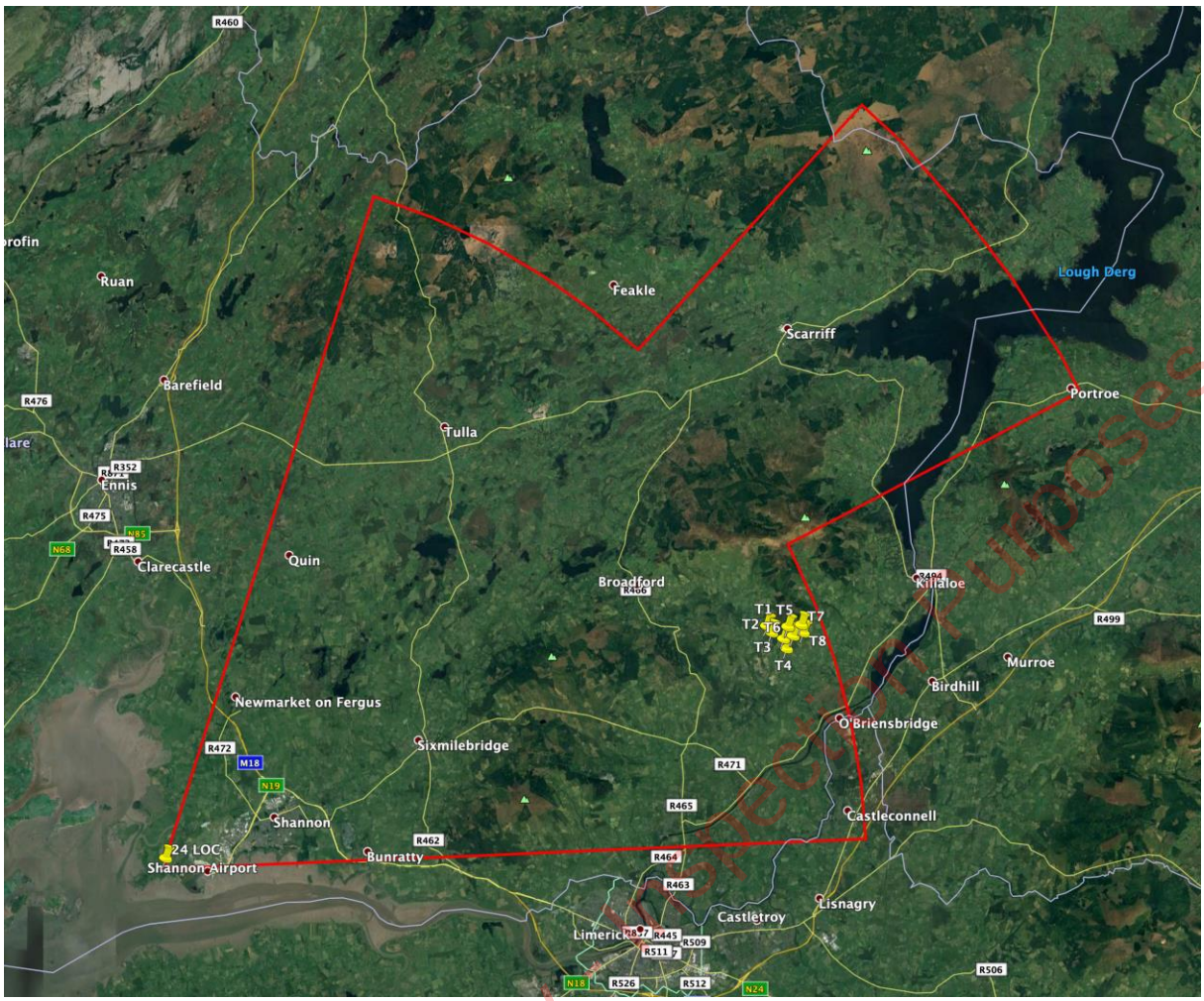


Figure 3.3 - Runway 24 ILS Localiser Lateral Coverage Sector

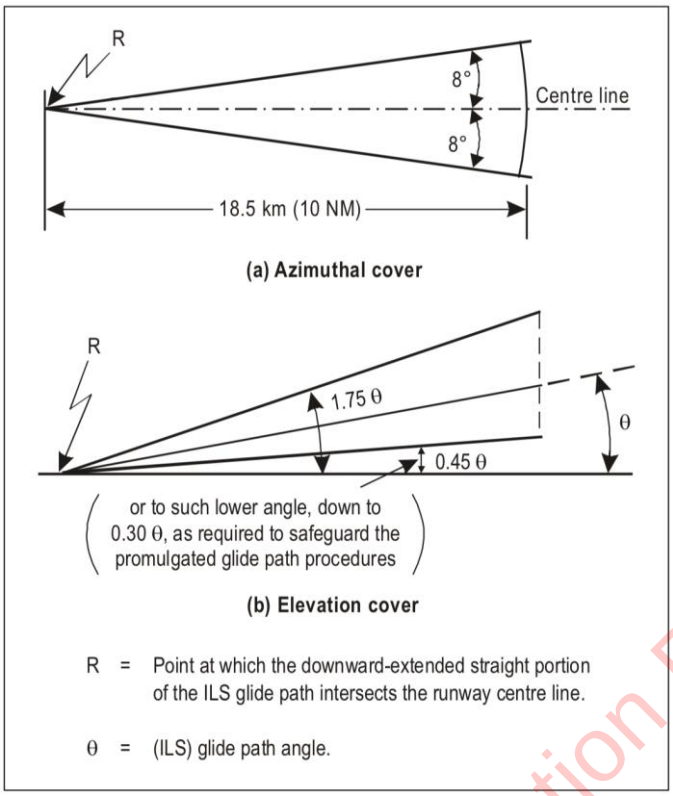


Figure 3.4 - ILS Glide Path Coverage

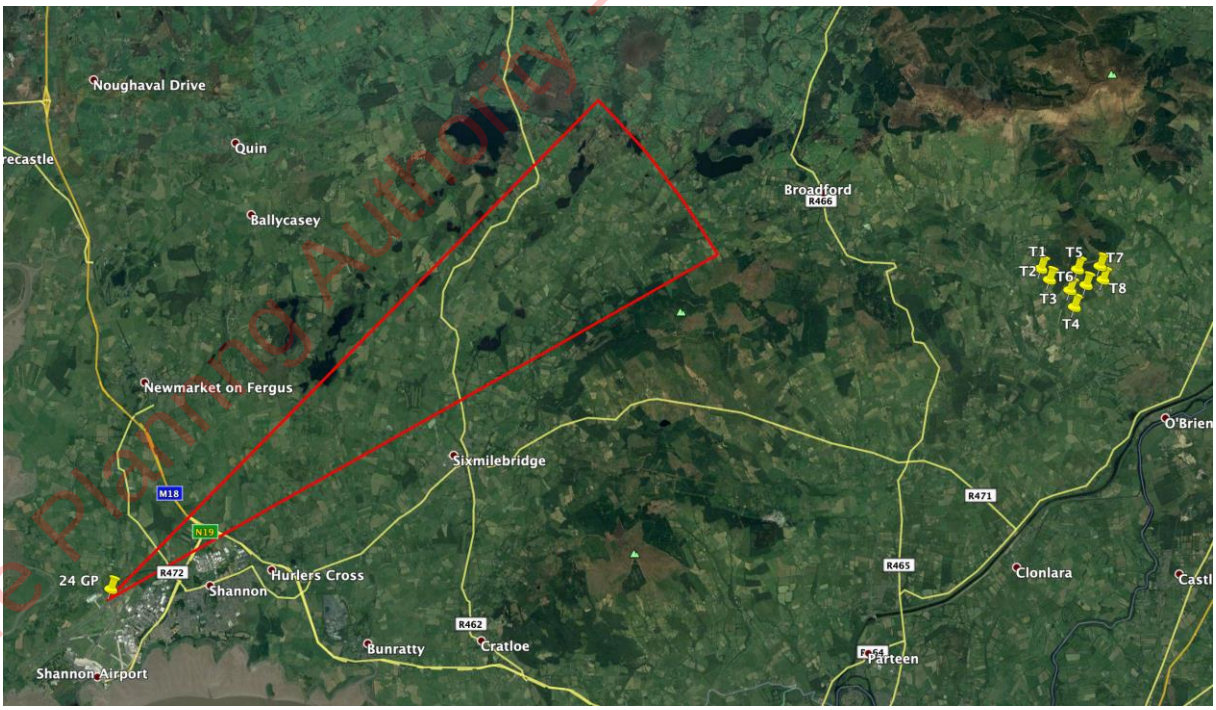


Figure 3.5 - Runway 24 ILS Glide Path Lateral Coverage Sector

4 ICAO ILS FLIGHT INSPECTION RECOMMENDATIONS

International Standards and Recommended Practices (SARPS) for ILS are published by the International Civil Aviation Organization (ICAO). Guidance material on factory, ground and flight testing of ILS installations is published in ICAO Doc 8071 Volume I. The purpose of ICAO Doc 8071 Volume I is to provide general guidance on the extent of testing and inspection normally carried out to ensure that radio navigation systems meet the SARPS published by ICAO.

To verify guidance signal accuracy within the ILS coverage volume, ICAO Doc 8071 recommends that a normal centreline approach should be flown, using the glide path, where available. For a Category II and III Localisers, the aircraft should cross the threshold at approximately the normal design height of the glide path and continue downward to normal touchdown point.

To verify that the ILS Localiser and Glide Path guidance signals provide the correct information to the user throughout the area of operational use, coverage checks should be performed. At periodic inspections, it is necessary to check coverage only at 31.5 km (17 NM) and 35 degrees either side of the course, unless use is made of the localiser outside of this area. Arc (part orbit) profiles may be flown at distances closer than this, provided an arc profile is flown at the same distance and altitude during the commissioning inspection to establish reference values.

5 FCSL FLIGHT INSPECTION PROCEDURES

FCSL have developed company procedures for commissioning and routine flight inspection of ILS Localiser and Glide Path facilities. Customer flight inspection requirements are initially captured on a Client Facility Data Sheet (Form 101). Form 101 records the technical details of the navigation aid to be flight checked and the specified interval between flight checks. For the Runway 24 ILS, the interval between flight checks is 180 days.

In the case of the Runway 24 ILS, the ILS is flight checked in accordance with FCSL Flight Inspection Procedure (FIP) FIP 23 (ILS Flight Inspections GPS Southern Ireland).

FIP 23 specifies that approach and part orbit profiles are flown as defined in FCSL Form 102 (Flight Profile Chart). Figures 5.1 and 5.2 below show the flight profiles to be flown during ILS flight inspection.

The start points, heights and distances for each flight profile are decided by the FCSL Flight Inspector in conjunction with the pilots to ensure correct and sufficient data is recorded while taking into account local terrain and obstacle clearance requirements.

FCSL FIP 23 states that flight inspection pilots will not fly within 1,000 ft of the ground in IMC (unless on centreline and edge approaches) and commissioning flights should be carried out in sight of the surface at all times. FIP 23 also states that Inspection Pilots will not fly within 1,000 ft of the highest obstacle within 5 NM either side of track in IMC.

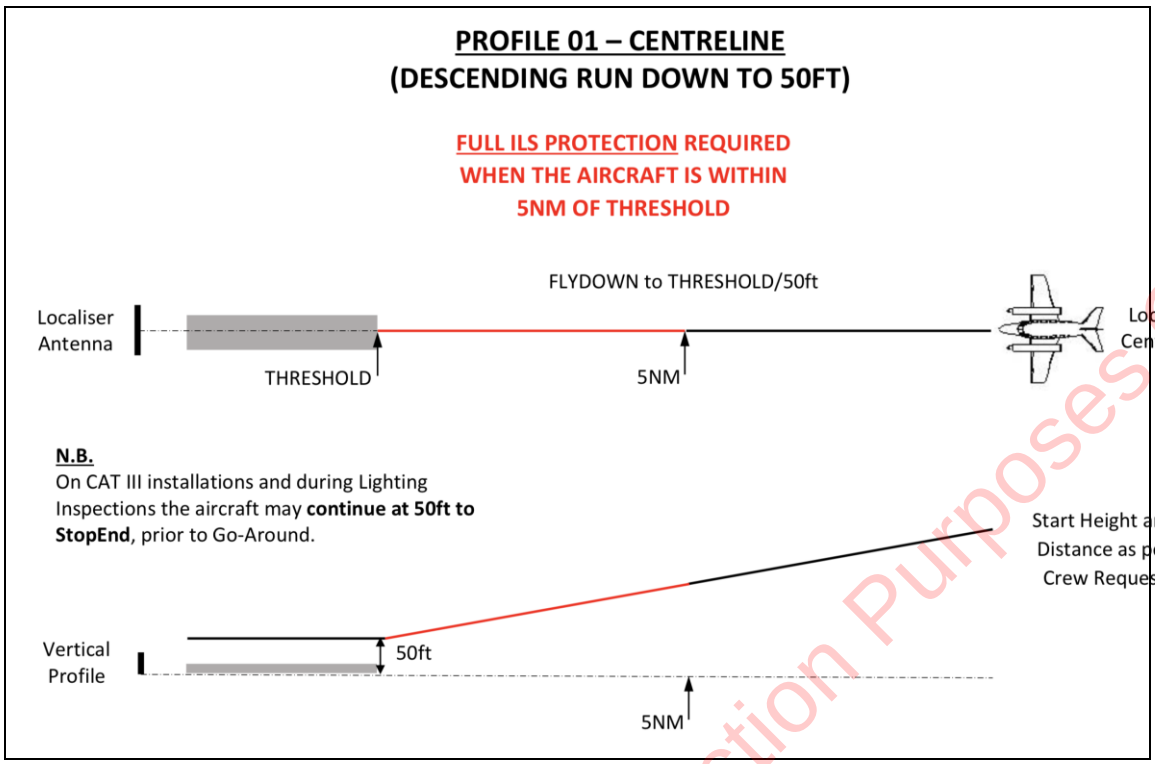


Figure 5.1 - Centreline Approach Flight Profile

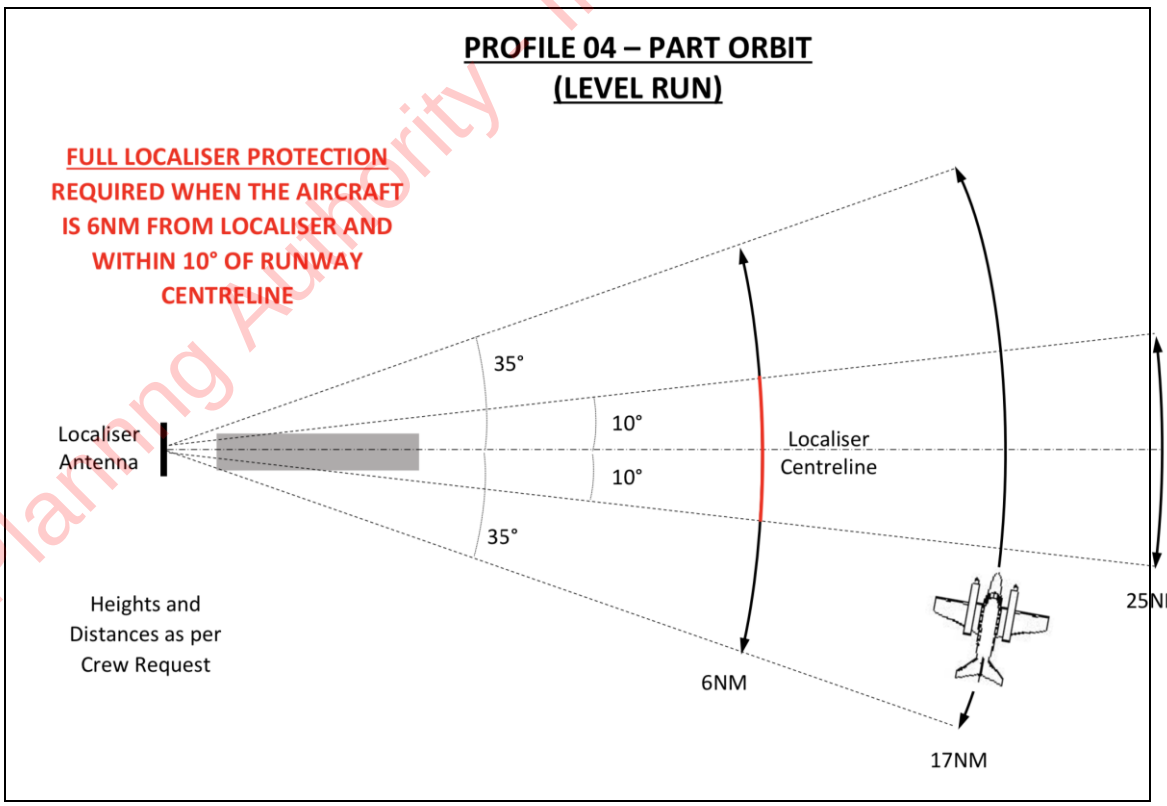


Figure 5.2 – Part Orbit Flight Profile

6 IMPACT ASSESSMENT

6.1 ILS Centreline Approach Flight Profile

For ILS centreline approach flight profiles, heights and distances are decided by the FCSL Flight Inspector in conjunction with the pilots to ensure correct and sufficient data is recorded while taking into account local terrain and obstacle clearance requirements.

For the seven most recent routine Runway 24 ILS flight inspections conducted by FCSL, centreline approaches were flown from a range of 25 NM.

6.1.1 Horizontal Obstacle Clearances

For a centreline approach profile, the flight inspection aircraft will be approximately 4.3 NM laterally from the nearest wind turbine (T1) at a point on the extended runway centreline closest to the wind farm. This distance is less than the minimum clearance required from any object in IMC, as defined in FIP 23.

6.1.2 Vertical Obstacle Clearances

For a centreline approach on a 3.0° glide path, the flight inspection aircraft will pass above, but 4.3 NM laterally distant from, the proposed Fahy Beg Wind Farm site. The flight inspection aircraft vertical clearance above the highest turbine (T3) can be estimated as follows (see Figure 6.1):

Horizontal distance from 24 Glide Path antenna (on boresight) to Turbine T3

= 25,588 m

Assume ground height at 24 Glide Path Antenna = ARP height = 46 ft = 14 m

Clearance (h) above highest turbine (T3)

= (25,588 m × tan 3.0°) − (221.23 m − 14 m) – 176.5 m = 957.28 m = 3,141 ft

This height exceeds the minimum clearance required above terrain and obstacles in IMC.

6.2 ILS Part Orbit Flight Profile

For ILS part orbit flight profiles, heights and distances are decided by the FCSL Flight Inspector in conjunction with the pilots to ensure correct and sufficient data is recorded while taking into account local terrain and obstacle clearance requirements.

For the six most recent routine Runway 24 ILS flight inspections conducted by FCSL, part orbits were flown at a range of 6 NM from the Localiser antenna and a height of 1,500 ft AMSL.

The track of the 6 NM part orbit profile is shown in Figure 6.2 below. Figure 6.3 below shows the terrain elevation profile for the 17 NM part orbit.

6.2.1 Horizontal Obstacle Clearances

For a 6 NM part orbit flight profile, the flight inspection aircraft will be at least 9.6 NM from the nearest wind turbine at a point on the part orbit track closest to the wind farm site.

For a 17 NM part orbit flight profile, the flight inspection aircraft will pass overhead and close to the proposed wind farm.

6.2.2 Vertical Obstacle Clearances

In accordance with FCSL FIP 23, pilots must not fly within 1,000 ft of the ground in IMC. The 17 NM part orbit flight must therefore be flown at a height of at least 1,000 ft above the highest obstacle to be encountered.

Figure 6.3 shows that a flight inspection aircraft flying a 17 NM part orbit will pass overhead and close to the summit of Moylussa mountain (1,745 ft). The 17 NM part orbit must therefore be flown at a height of at least 2,745 ft AMSL to remain at least 1,000 ft clear of the summit of Moylussa mountain.

The maximum height of the highest wind turbine (T3) can be estimated as:

Ground height + maximum turbine height = 221.23 m + 176.5 m = 398 m (1,305 ft).

For an orbit height of 2,745 ft AMSL, a flight inspection aircraft will therefore have a clearance of 1,440 ft above the highest wind turbine. This height exceeds the minimum clearance required above terrain and obstacles in IMC.

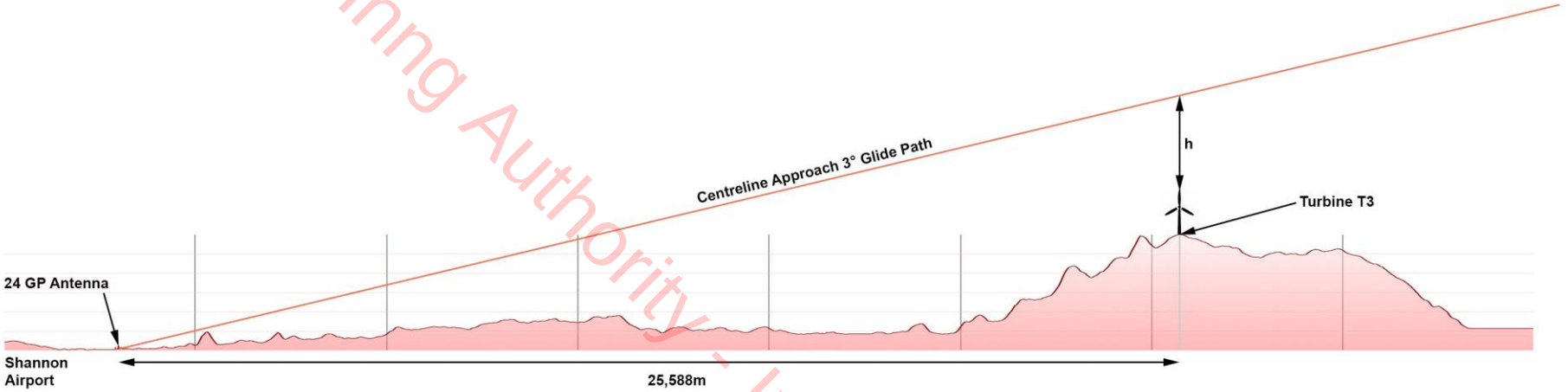


Figure 6.1 – ILS Centreline Approach Profile

(Not to scale)

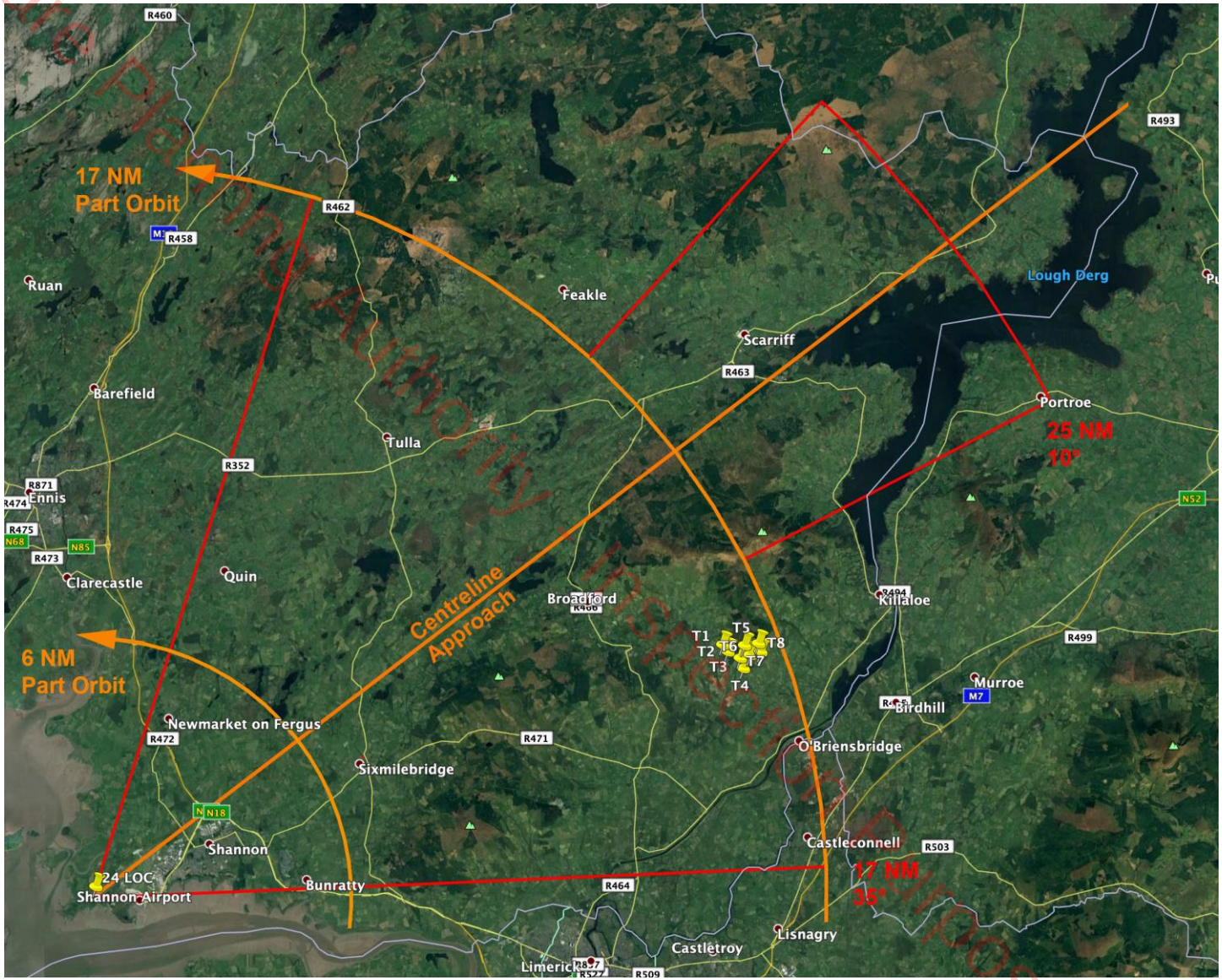


Figure 6.2 – ILS Centreline Approach and Part Orbit Tracks

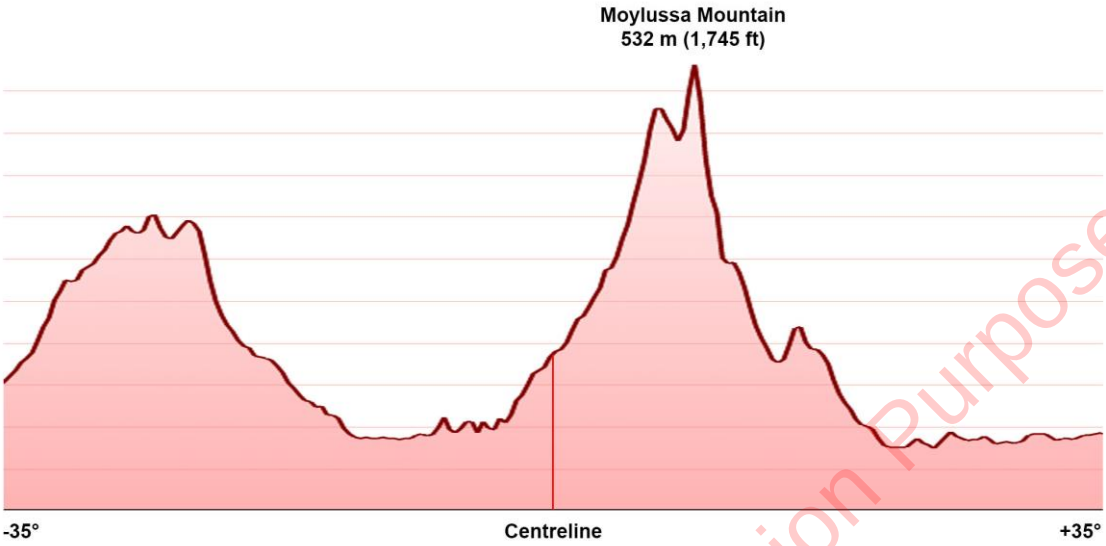


Figure 6.3 – 17 NM Part Orbit Terrain Elevation Profile

7 CONCLUSIONS

The assessment presented in Section 6 above has shown that a flight inspection aircraft flying centreline and part orbit flight profiles associated with the Shannon Airport Runway 24 ILS will remain sufficiently clear of the proposed Fahy Beg Wind Farm site.

The proposed Fahy Beg Wind Farm will therefore have no adverse effect on flight inspection procedures and profiles associated with the Runway 24 ILS.

This report provides an assessment of the impact of terrain and obstacles on ILS flight inspection procedures. It does not provide an assessment of any impact the proposed wind farm may have on the integrity of the ILS guidance signals.

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