

	Procedure: 001	Rev: 6.0
Title: Gortyrhilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

Report

Gortyrhilly Wind Farm Telecommunications Impact Study

Document Number:

Author: David. McGrath.

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Executive Summary

Ai Bridges was commissioned to evaluate the possible impacts that the proposed wind farm development at Gortyrhilly, Co. Cork could have on a number of telecom networks which have been identified as possibly being impacted by the proposed development.

Based on consultations made prior to the commencement of this report, Vodafone Ireland have and 2RN have telecommunications links in the vicinity of the proposed windfarm.


ID	Operator	Link Description
1	Vodafone	13 GHz PTP Microwave radio transmission link from Mullaghanish to Ballingeary
2	Vodafone	11GHz PTP Microwave radio transmission link from Mullaghanish to Bantry
3	Vodafone	11 GHz PTP radio link from Inchee to Cashelmore
4	2RN	474 MHz UHF radio link from Mullaghanish to Bantry
5	2RN	474 MHz UHF link from Mullaghanish to Mt Gabriel
6	2RN	90MHZ FM link from Mullaghanish to Bantry
7	Enet	13 GHz PTP Microwave radio transmission link from Mullaghanish to Bantry

Table 1. Telecommunications links in the vicinity of the proposed wind farm.

To assess the possible impacts of the proposed turbines on these telecommunications links, a detailed consultation process and network analysis was undertaken. A summary of the network analysis is provided in Table 2 below detailing “Impact \ No Impact” scenarios and mitigation measure solutions, where agreed.


ID	Operator	Link	Impact of wind farm
1	Vodafone	PTP radio link from Mullaghanish to Ballingeary	No impacts
2	Vodafone	PTP radio link from Mullaghanish to Bantry	No impacts
3	Vodafone	PTP radio link from Inchee to Cashelmore	No impacts
4	2RN	UHF radio link from Mullaghanish to Bantry	No impacts
5	2RN	UHF link from Mullaghanish to Mt Gabriel	No impacts
6	2RN	FM link from Mullaghanish to Bantry	Impact. Mitigation Measures have been agreed to eliminate potential impacts.
7	Enet	PTP radio link from Mullaghanish to Bantry	No impacts

Table 2. Impact of proposed wind farm on Telecommunications links.

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Please note that this report was completed and subsequently a turbine was removed (referred to as T1 in this report). The below table is included for reference purposes.

Original Turbine ID used in this report	Updated Turbine ID used in the planning application
T1	-
T2	T1
T3	T2
T4	T3
T5	T4
T6	T5
T7	T6
T8	T7
T9	T8
T10	T9
T11	T10
T12	T11
T13	T12
T14	T13
T15	T14


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Section 1 - Wind Farm Site Information

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1. Introduction

In this section a brief summary of the wind farm site is provided. Details regarding the site’s geographic location and the proposed wind turbine dimensions are presented.

1.1 Wind Farm Site Information

The proposed wind farm development is located in County Cork approximately 4km north of Ballingeary. The proposed hub heights and rotor diameters of the turbines are shown below in Table 1. The proposed turbine co-ordinates are provided in Appendix A.

Wind Farm	Number of Turbines	Turbine Hub Height	Turbine Rotor Diameter
Gortyrhilly	15	107.5 m	155 m

Table 3. Gortyrhilly Wind Farm - Proposed Turbine Details

The location of the proposed Gortyrhilly wind farm development is shown below in Figure 1.

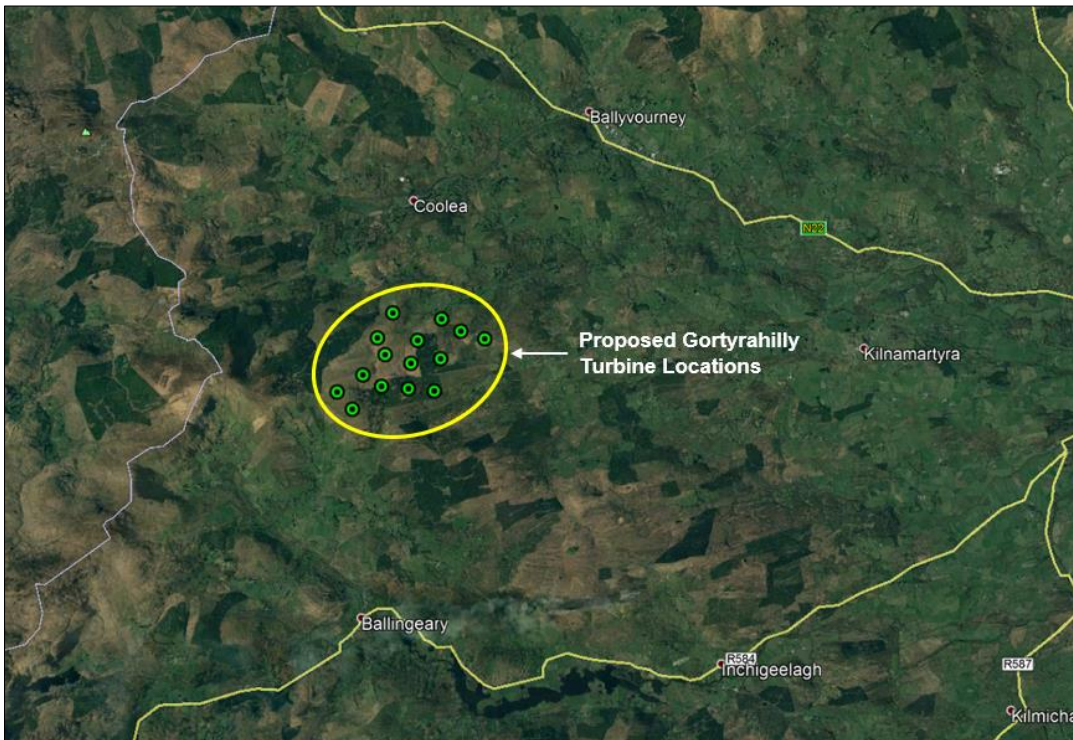




Figure 1. Location of Gortyrhilly Wind Farm, County Cork.

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Section 2 - Methodology

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2. Introduction

In this section a brief summary of the Telecommunication Impact Study Methodology is provided.

2.1 Methodology

There are four primary stages in preparing and compiling a communication impact study:

- Telecom Operator Consultations
- Field Surveys
- Desktop Survey Network Modeling and Analysis
- Report Generation

A summary of each of these stages is provided below:

Telecom Operator Consultations

Consultations are commenced with relevant telecom operators who are requested to raise any concerns they have regarding the impact of the proposed wind farm on their networks. The consultation process is used to assist in identifying telecoms infrastructure that could be impacted by the proposed wind farm development.

Field Surveys

Field surveys (when required) are undertaken and the co-ordinates of communication masts are recorded. During the field surveys of the communication sites, approximations of antenna size, bearing and height are made for the antennas installed on each of the masts surveyed.

Desktop Survey and Analysis

A desktop survey is carried out to plot the wind turbines in a radio planning tool. The radio planning tool uses GIS and terrain mapping databases to enable accurate modelling. Relevant mast-site coordinates are then obtained imported into the radio planning tool. This provides a means of graphically showing telecommunications sites in the vicinity relative to the proposed wind farm at Gortyrahilly. Where additional technical analysis is required, cross-sectional analysis of the impacts is carried out. 3D software tools are employed to provide accurate visualisations for operators to finalise operator consultation outcomes.

Figure 2 below shows the proposed wind turbines plotted in the radio planning tool. There are two telecommunication mast-sites within 8km of the proposed wind farm. The mast-sites have been plotted relative to the proposed wind and are also shown in Figure 2.

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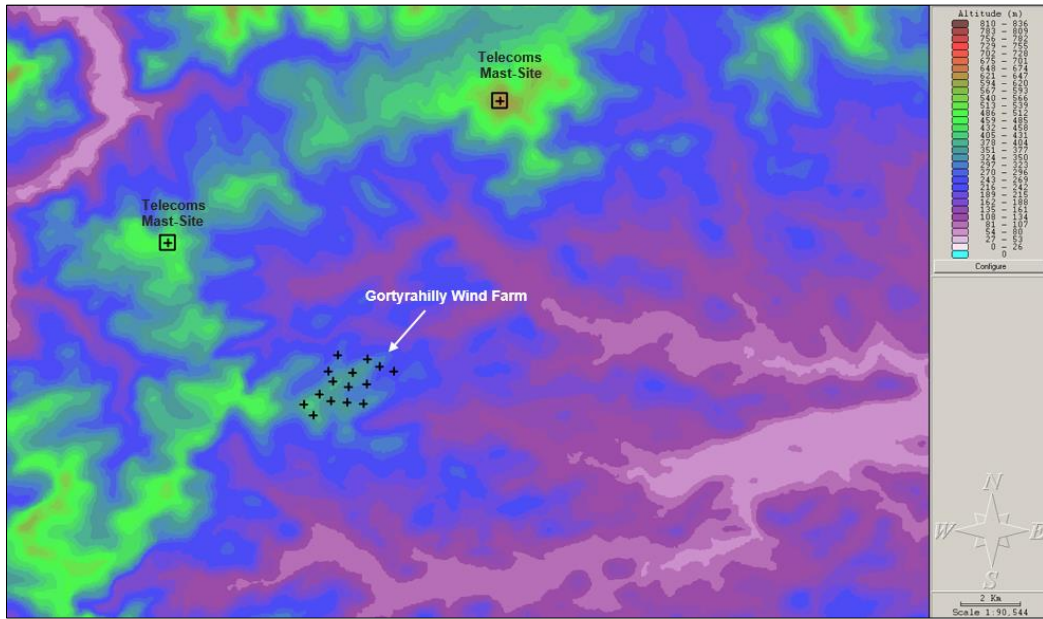


Figure 2. Proposed Gortyrhilly Wind turbines plotted in Radio Planning Software

The findings from the consultations and desktop surveys are collated and the communications networks requiring further analysis are identified. 3D network modeling is used to assess the impact of the turbines on the communications networks. The results from the network modeling are used to determine if mitigation measures are required. Figure 3 below shows an example of a microwave radio link that passes through the proposed wind farm modelled in radio planning software.

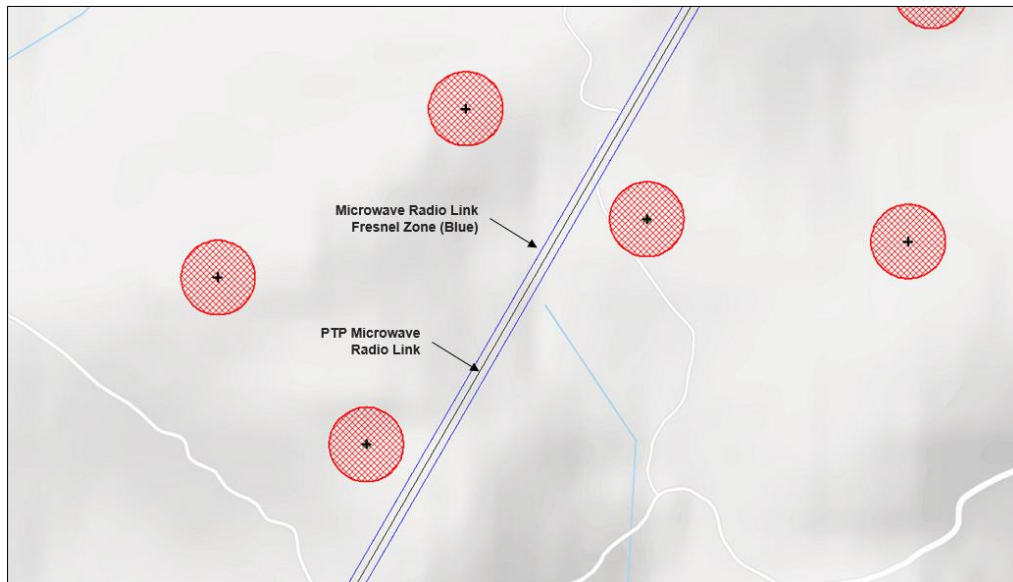



Figure 3. Example of a microwave radio link through the proposed wind farm modelled in radio planning software.

Report Generation

The final stage of the communications impact study process is to collate the data and present the findings & analysis into a report for submission.

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Section 3 - Telecom Operator Consultations

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3. Introduction

In this section the consultation process undertaken with telecom operators is described. The response received from each operator is also provided.

3.1 Telecom Operator Consultations

Consultations beginning in December 2020 were undertaken with the relevant telecom network operators to assist in assessing telecommunication infrastructure that could be impacted by proposed wind farm. The operators were requested to raise any concerns they may have regarding impacts to their networks due to the proposed wind farm development. Table 3 lists the telecom operators contacted and the issues raised by the operators. The responses received from each of the Telecom Operators are provided in Sections 3.1.1 to 3.1.3.

ID	Operator	Response Received (Yes/No)	Issues raised by Operator \ Observations.
1	Vodafone Ireland	Yes	Vodafone Ireland raised concerns regarding 3 PTP radio links. Consultations have concluded that it is unlikely that there will be any impacts on the Vodafone network. Vodafone accepted the 3D EMI impact assessment analysis that there would be no impacts to the Vodafone network.
2	2RN	Yes	Consultations with 2RN have been closed and a mitigation measure process has been agreed in the event of the impacts on the Mullaghanish – Bantry communications link.
3	Enet	Yes	Enet raised concerns regarding potential impacts to one point to point radio link. Consultations have concluded that it is unlikely that there will be any impacts on the Enet network. Enet accepted the 3D EMI impact assessment analysis that there would be no impacts to the Enet network.

Table 4. Telecom Operators Consulted

3.1.1 Vodafone Ireland Consultations

The consultations between Vodafone Ireland and Ai Bridges Ltd are provided below.

14/12/20 – Consultation Request sent by Ai Bridges to Vodafone Ireland


Hello Gavin,

We are contacting you in relation to your recent correspondence with Jennings O Donavan & Partners Ltd who are preparing an Environmental Impact Assessment Report for a proposed wind farm development at Gortyrahilly in County Cork.

As you have indicated that Vodafone Ireland have a number of microwave links in the vicinity of the development, we have been asked to undertake a detailed telecommunications network analysis and to model the Vodafone links relative to the proposed turbines.

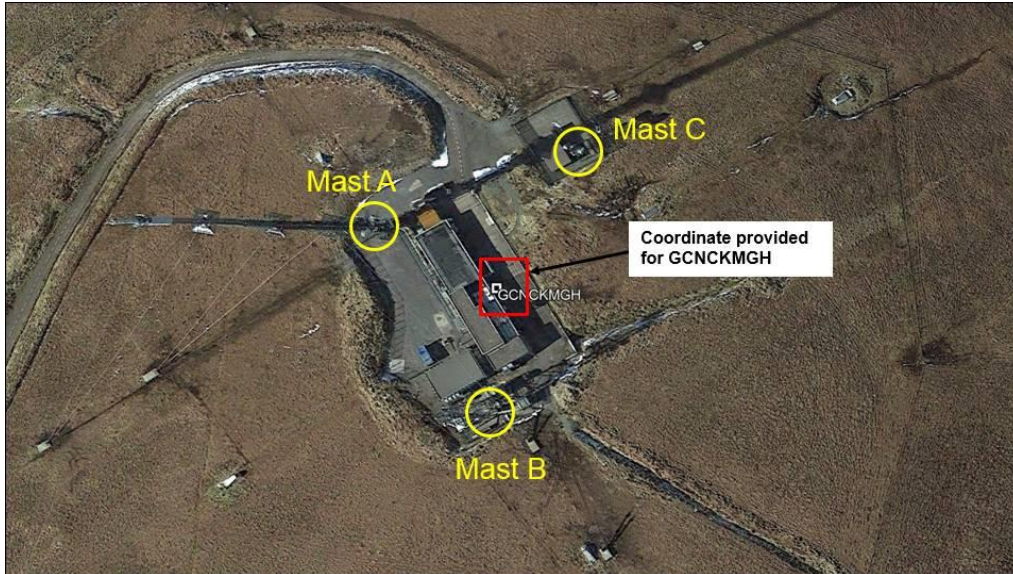
We have been provided with the link information you forwarded to Jennings O Donavan & Partners Ltd; however there appears to be an issue with some of the radio link coordinates provided.

e.g. The coordinates listed for B-End “GCNCKMGH” (Mullaghanish) are 51.98321, -9.1437, but these coordinates appear to be centred on the entrance to the main site-building and not on a Telecoms Mast (See screengrab below).

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We would appreciate it if you could confirm if the radio antenna is actually installed on the New 2RN Mast (Mast A), the Old 2RN Mast (Mast B) or the ESB Telecoms Mast (Mast C). We have added a column to the Table with our comments.

LinkID	Link Description Type	Radio Config. Status	SW - Act Mast	Freq Band	Max. Licensed Capacity (MHz)	B-End ID	B-End Freq (MHz)	B-End Lat/Long	B-End Bearing	A-End ID	A-End Freq (MHz)	A-End Lat/Long	A-End Bearing	Radio Aggregation	Access RAN Site Designator	Height (m)	All Bridges Ltd Comments		
GCNCKMGS2RN2RN_3D	Corporate	2x0 3PC	40MHz-120GAM	13 GHz	588	GCNCKMGSHT20	465-50	53.98321	-9.3437	30.34	GCNCKSRN703	465-50	53.88604	-9.44215	220.3	Corporate	40.35	The coordinate provided for "GCNCKMGS" (Malleghearn's) appear to be centred on the entrance to the main site-building (and not on a Telecoms Mast). Could you confirm if the antenna is installed on Mast A, B or C? The coordinate provided for "GCNCKSRN" do not fall on an exact mast location.	
GCNCKMGS2RN2RN_3D	Access	1x0 2x0	2x40MHz-160GAM	13 GHz	170	GCNCKMGSHT20	465-50	53.98321	-9.3437	19.36	GCNCKSRN703	465-50	53.88604	-9.22705	199.20	1	CK371	17.34	The coordinate provided for "GCNCKMGS" (Malleghearn's) appear to be centred on the entrance to the main site-building (and not on a Telecoms Mast). Could you confirm if the antenna is installed on Mast A, B or C? The coordinate provided for "CK371" do not fall on an exact mast location.
KYRECKM_MFR	Trunk Radio	4-0	40MHz	13GHz	1220	KYRE150	M558	53.94056	-9.30586	127.21	CKM4150	M558	53.90772	-8.81312	307.58	MPLS Trunk	42.72		



So that we can model the Vodafone links as accurate as possible, we would be grateful if you could provide us with :

- The correct coordinates for each of the A-End and B-End sites listed in the table above.
- Antenna Install heights for each of the A-End and B-End sites listed in the table above.


Again we would be grateful if you could provide the above details as soon as possible as we are looking to complete and submit our analysis.

If you have any queries regarding this project, please contact our offices at:

Ai Bridges Ltd.,
 UNIT 9, BLOCK B,
 Quin Rd. Business Park,
 Ennis, Co. Clare,
 Ireland.
 Tel : +353 65 6848768
 FAX : +353 65 6848769
 Web : www.aibridges.ie

Yours sincerely,

Kevin Hayes

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For and on behalf of **Ai Bridges Limited**

15/12/20 – Vodafone Ireland Response

Hi David,

That's a centre point co-ordinate by the looks of it. Possibly because the radio panels are spread out through the site and we use the radio co-ordinates, I'm not sure? But the dishes are on the tower at: 51.983378, -9.144229, all at varying heights.

Currently, we have 9 microwaves installed at RTE and there is potentially a 10th to be built towards Macroom Exch

15/12/20 – Consultation Response sent by Ai Bridges to Vodafone Ireland

Hello Gavin

We have carried out our analysis based on the main RTE Transmission tower .
We will send on our 3D analysis to you later this evening

Best Regards,
Kevin Hayes,
Ai Bridges Ltd.,
...Total Communications Solutions...

15/12/20 – Consultation Response sent by Ai Bridges to Vodafone Ireland

Hello Gavin,

I am following up from our email earlier.

We have completed our 3D link analysis on the link information that you provided in relation to the Gortarahilly Wind Farm.


We are seeing that there is clearance on all the 3 links that we have analysed.

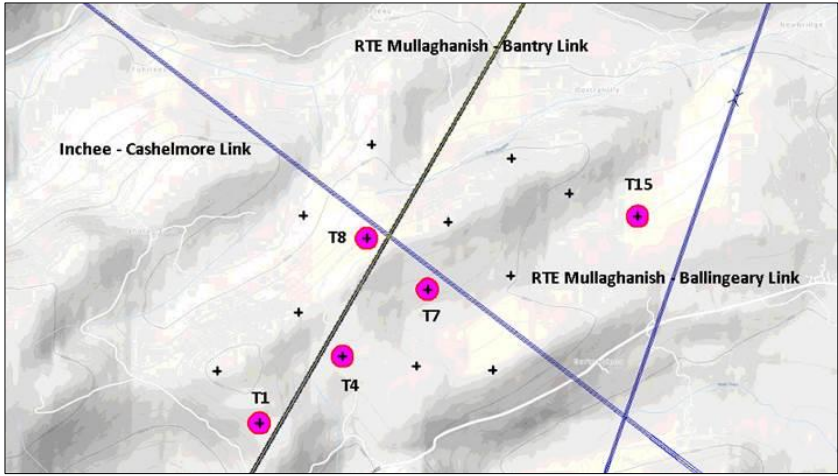
There is clearance on all three Links as follows (reference the 3D analysis screenshot shown below)

- RTE Mullaghanish – Bantry : clearance of 31.92m , closest turbine T1 (with T8 clearance of 55m and T4 clearance of 104 m)
- RTE Mullaghanish – Ballingearry : clearance of 295m, closest turbine T15
- Inchee – Cashelmore, Bandon : clearance of 47.19m, closest turbine T8


Note : All clearances based on the 1st Fresnel Zone, All links clear the specified 30m buffer required, Mullaghanish Tower selected in the 2RN main Transmission Tower.

Would you be available tomorrow for a brief call to discuss our findings as you have indicated that there are 9 existing links and we have conducted an analysis on 3 links.

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Best Regards,
 Kevin Hayes,
 Ai Bridges Ltd.,
 ...Total Communications Solutions...

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23/12/20 – Consultation Response sent by Ai Bridges to Vodafone Ireland

Hello Gavin,

I am following up from our detailed 3D analysis that we have completed for the proposed Gortarahilly Wind Farm. Please find the details below based on 2nd Fresnel zones i.e. the 2nd Fresnel diameters at the mid-point of the link are extrapolated along the link for worst case calculations. We would expect the clearances to increase if we were to apply 1st Fresnel diameters and the actual Fresnel diameter at the turbine location along the link

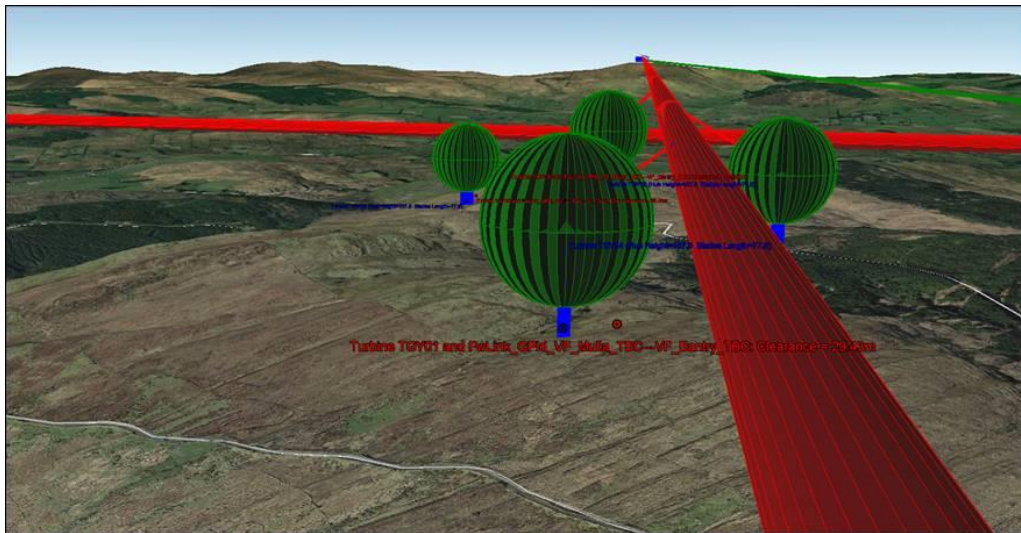
We are seeing the following clearances below

Would you be able to confirm that these worst case clearances below would be acceptable?


Vodafone :

The nearest turbines to the Vodafone network are Turbines 01,08, & 04. The clearance distances from these turbines are listed in the table below. A plot in 3D of the Vodafone links relative to these turbines is also shown below.

Turbine Ident	Turbine Lat	Turbine Long	Turbine Blade Length (m)	Turbine Hub Height AGL (m)	Link ident	Fresnel Number (nth)	Fresnel Freq. (MHz)	Clearance(m)
TGY08	51.89897	9.22554	77.5	107.5	FwLink_GPId_VF_Mulla_TBC---VF_Bantry_TBC	1	11000	32.54
TGY04	51.89312	9.22654	77.5	107.5	FwLink_GPId_VF_Mulla_TBC---VF_Bantry_TBC	1	11000	108.13
TGY01	51.88888	9.23511	77.5	107.5	FwLink_GPId_VF_Mulla_TBC---VF_Bantry_TBC	1	11000	29.43



Best Regards,
Kevin Hayes,
Ai Bridges Ltd.,
...Total Communications Solutions...
UNIT 9, BLOCK B,

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23/12/20 – Vodafone Ireland Response

Hi Kevin,

Have you only analysed the 11GHz link between Mullaghanish RTE and Scartbaun? This is a corporate link used by the GCN. If this is blocked we have no LOS alternative from Scartbaun for the GCN service, which will isolate critical GCN services for Bantry.

The other 11GHz link between Inchee and Cashelmore is a high priority trunk microwave and runs quite close to Turbine 6 and Turbine 8. Did you analyse these? This trunk microwave would have a major impact to our network and again is straddled by Turbine 6 and Turbine 8, which makes me very nervous.

At this moment, the risks are too high and could impact on too many critical services. The layout should attempt to remove this straddling or increase the gap if possible.

04/01/21 – Consultation Response sent by Ai Bridges to Vodafone Ireland

Hello Gavin,

Happy New Year to you.

I am following up from your email below Just to confirm that our reference for Scarbaun is Bantry.

As there has been a change in turbine co-ordinates we have re-plotted these i.e. showing “old” and “new” turbine locations. Based on these new turbine locations we have found the following

Inchee – Cashelmore 11GHz Link :

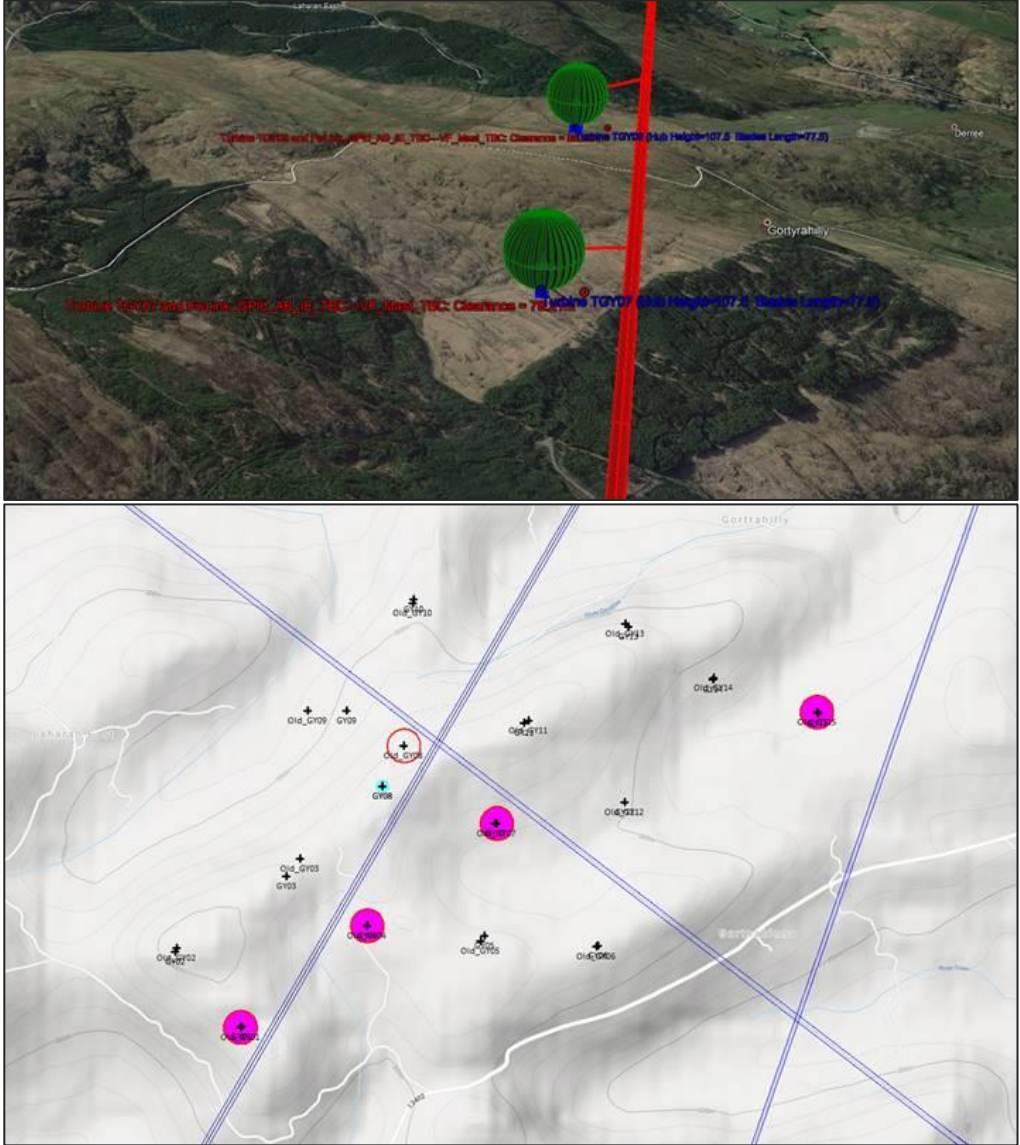
Based on the new turbine co-ordinates the new location for T8 has been moved away from the link, the location of T9 has been moved closer and the location of T7 has remained the same, shown in screenshots of analysis below.

- New T9 Clearance : 86.56m
- Existing T7 Clearance : 76.21m
- New T8 : did not require additional analysis as it is sufficiently far enough away

Based on these clearances above on the critical Inchee – Cashelmore Link would you be able to confirm that the proposed new locations for the turbines would be acceptable to avoid wind turbine interference?

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Inchee - Cashelmore



Old and New Turbine Layout

14/01/21 – Vodafone Ireland Response

Hi Kevin,

As stated before, the trunk radio between Inchee and Cashelmore is of critical importance to our network in the South West. The turbine locations indicated are acceptable. Is this though, the full picture?

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08/03/21 – Consultation Response sent by Ai Bridges to Vodafone Ireland

Hello Gavin,

I am just following up from the email correspondence below in relation to Gortarahilly Wind Farm.

We can confirm that based on the final turbine co-ordinate layout that there will be buffer zones of 86.56m and 76.21m from the final locations of T9 and T7 respectively i.e. this is the “full picture” or final analysis.

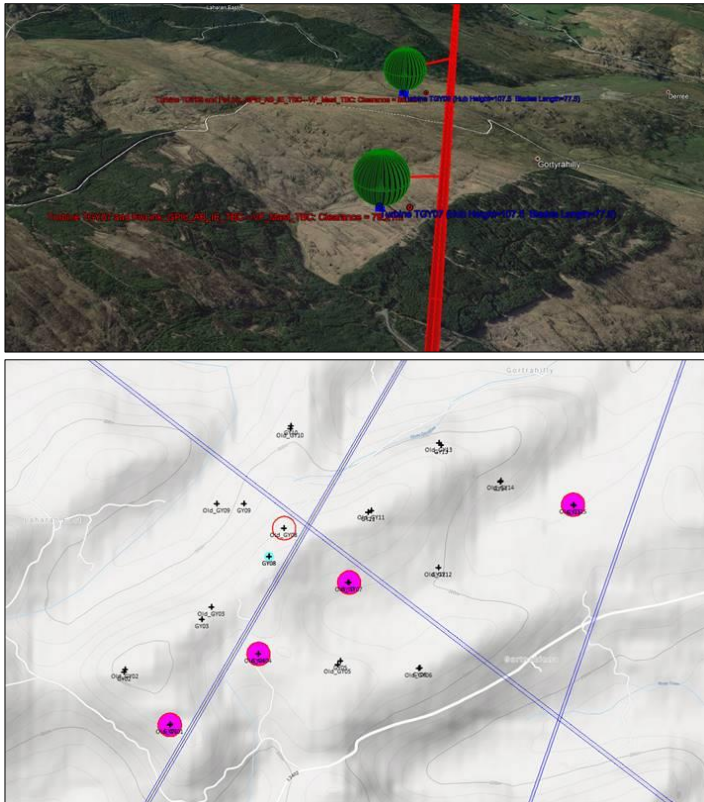
Inchee – Cashmore 11GHz Link :

Based on the new turbine co-ordinates the new location for T8 has been moved away from the link , the location of T9 has been moved closer and the location of T7 has remained the same, shown in screenshots of analysis below.

- New T9 Clearance : 86.56m
- Existing T7 Clearance : 76.21m
- New T8 : did not require additional analysis as it is sufficiently far enough away


Based on these clearances above on the critical Inchee – Cashmore Link would you be able to confirm that the proposed new locations for the turbines would be acceptable to avoid wind turbine interference ?

Old and New Turbine Layout



09/03/21 – Vodafone Ireland Response

Thanks for the update Kevin. That will be sufficient clearance. If there’s anything else you need let me know.

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April - May 2021 – Consultation Response sent by Ai Bridges to Vodafone Ireland

Hello Gavin,

I am following up from the voicemail that I left for you earlier

Our client has reverted to us earlier today and it appears that there is a land boundary issues i.e. another constraint that requires the T07 wind turbine to be micro-sited. This has caused the planning application from being submitted. We have advised our client that Vodafone specifically requested to be notified of any changes thus we are raising this as a possible concern for Vodafone.

We have conducted our analysis based on the new turbine co-ordinates and we are seeing that the clearance from the Inchee-Cashelmore link has been reduced from 78.21m to 45.26m. The revised co-ordinates that we have received for T07 are

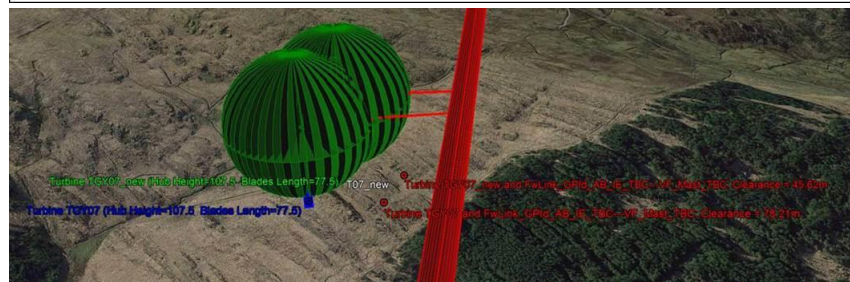
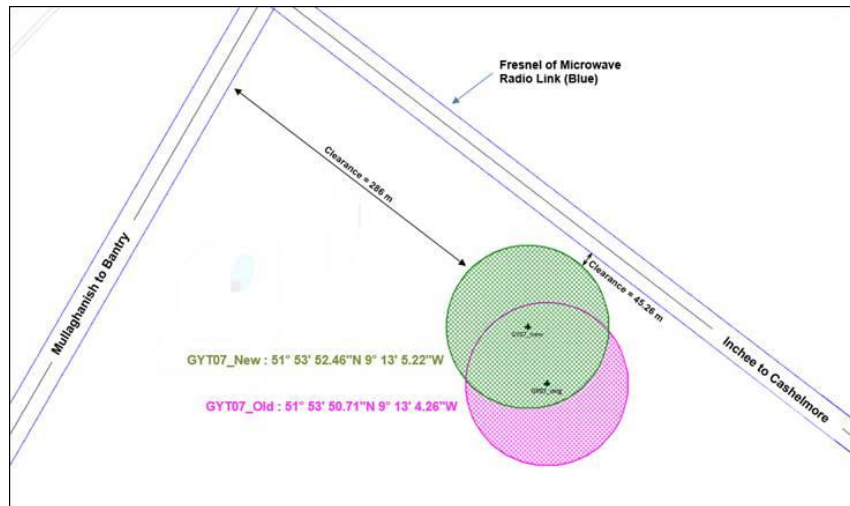
- The revised coordinates for T7 are ITM E516168.645 N572451.468.

These co-ordinates are converted and show below in our analysis.

We would be grateful if you could review and confirm that this clearance would be acceptable i.e. outside the 30m buffer from the 1st Fresnel by 15m

Link ID	Clearance Distance	
	T07_Old	T07_New
Inchee – Cashelmore (VF)	78.21 m	45.26 m
Mullaghanish – Bantry (VF)	329 m	286 m

Vodafone Network - Plan View




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April - May 2021 – Vodafone Ireland Response

Hi Kevin,

Thank you for the update. This new position should be fine, with usual caveats including assumption that all co-ordinates are accurate.

*Happy that the new position should not interfere.
If you need anything else, please let me know*

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3.1.2 2RN Consultations

The consultations between 2RN and Ai Bridges Ltd are provided below.

05/01/21 – Consultation Request sent by Ai Bridges to Vodafone Ireland

Hello Johnny,

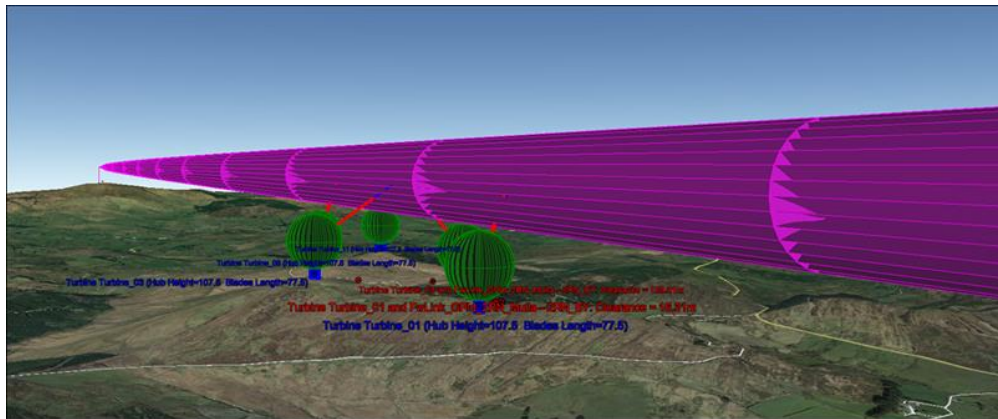
I am just following up in relation to a detailed analysis that we have been requested to carry out by an EIAR Consultant in relation to proposed wind farm development at Gortarahilly and the potential impacts on telecoms operator networks. We have been provided a finalized set of wind turbine locations following a recent micro-siting of proposed turbines carried out by the developer. We have carried out our analysis on the telecoms operator networks and we have identified that there are three links operated by 2RN.. The results of our analysis for these links are shown below

Would you be available for a call to discuss our analysis findings below


Link ID	Operator	Link Description
4	2RN	UHF link from Mullaghanish to Bantry
5	2RN	UHF link from Mullaghanish to Mt Gabriel
6	2RN	FM link from Mullaghanish to Bantry

Link 4 - 2RN UHF Link from Mullaghanish to Bantry :

The screenshot below shows a 3D view of the 2RN link relative to the nearest of the proposed turbines (T01, T04, T08, T03 & T11). Desktop analysis indicates that there is a clearance distance of 16m between the 2nd Fresnel Zone of the microwave radio link and the blade-tip of the nearest turbine (T01). Clearances for all of the other turbines are also provided in the table below.

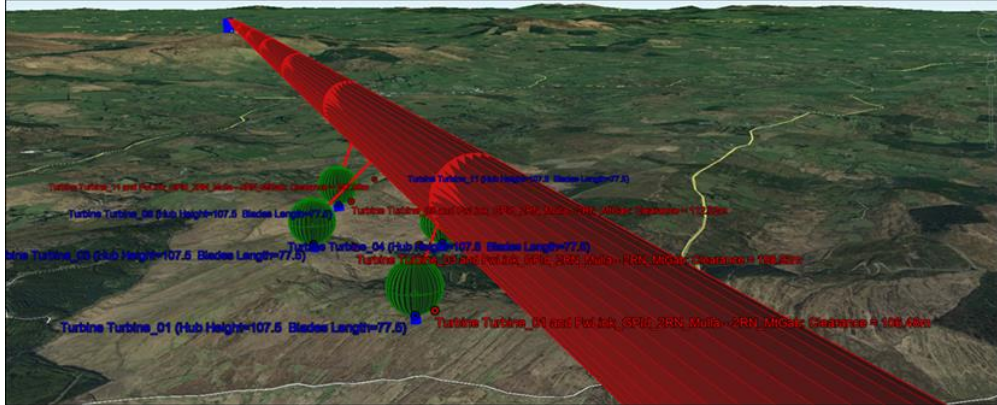


Turbine Ident	Turbine Lat	Turbine Long	Turbine Blade Length (m)	Turbine Hub Height AGL (m)	Turbine Ground Altitude ASL (m)	Link Ident	Fresnel Number (nth)	Fresnel Freq. (MHz)	Clearance(m)
Turbine_01	51.888881	-9.235111	77.5	107.5	377.29	FwLink_GPIid_2RN_Mulla---2RN_BY	2	474	16.31
Turbine_04	51.893122	-9.226539	77.5	107.5	359.9	FwLink_GPIid_2RN_Mulla---2RN_BY	2	474	102.46
Turbine_08	51.898967	-9.225536	77.5	107.5	384.29	FwLink_GPIid_2RN_Mulla---2RN_BY	2	474	30.84
Turbine_03	51.895203	-9.232075	77.5	107.5	395.57	FwLink_GPIid_2RN_Mulla---2RN_BY	2	474	129.01
Turbine_11	51.901628	-9.215886	77.5	107.5	381.87	FwLink_GPIid_2RN_Mulla---2RN_BY	2	474	225.6

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Link 5 – 2RN UHF Link from Mullaghanish to Mt Gabriel :

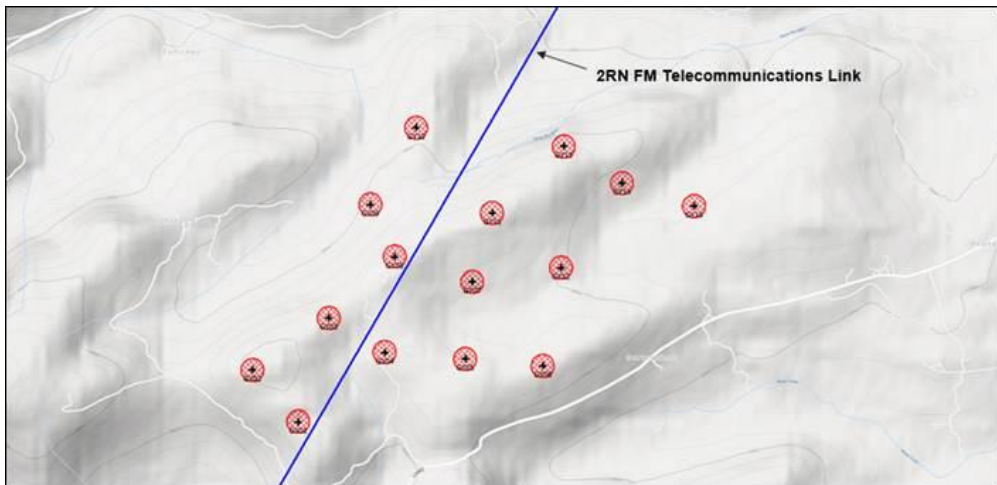
The screenshot below shows a 3D view of the 2RN link relative to the nearest of the proposed turbines (T01, T04, T08, T03 & T11). Desktop analysis indicates that there is a clearance distance of 106m between the 2nd Fresnel Zone of the microwave radio link and the blade-tip of the nearest turbine (T01). Clearances for all of the other turbines are also provided in the table below.



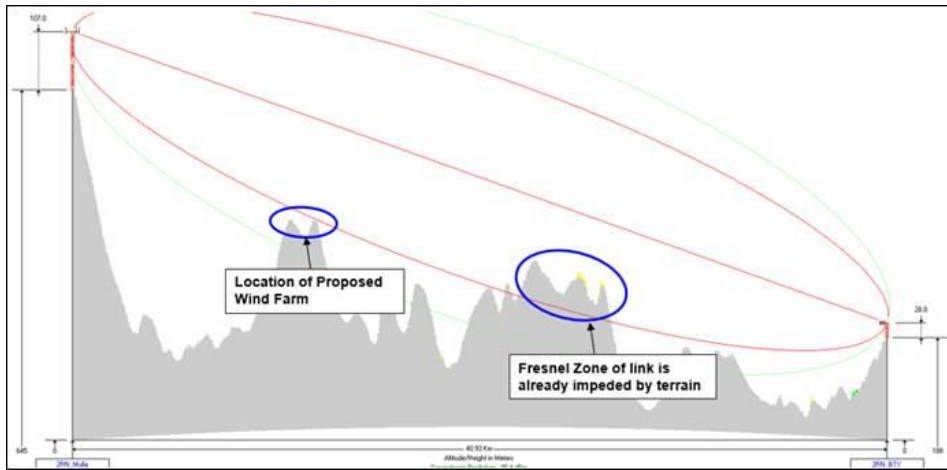
Turbine Ident	Turbine Lat	Turbine Long	Turbine Blade Length (m)	Turbine Hub Height AGL (m)	Turbine Ground Altitude ASL (m)	Link Ident	Fresnel Number (nth)	Fresnel Freq. (MHz)	Clearance(m)
Turbine_01	51.888881	-9.235111	77.5	107.5	377.29	FwLink_GPID_2RN_Mulla---2RN_MtGab	2	474	106.48
Turbine_04	51.893122	-9.226539	77.5	107.5	359.9	FwLink_GPID_2RN_Mulla---2RN_MtGab	2	474	152.85
Turbine_08	51.898967	-9.225536	77.5	107.5	384.29	FwLink_GPID_2RN_Mulla---2RN_MtGab	2	474	112.02
Turbine_03	51.895203	-9.232075	77.5	107.5	395.57	FwLink_GPID_2RN_Mulla---2RN_MtGab	2	474	198.93
Turbine_11	51.901628	-9.215886	77.5	107.5	381.87	FwLink_GPID_2RN_Mulla---2RN_MtGab	2	474	247.98

Link 6 – 2RN FM link from Mullaghanish to Bantry :

The screenshot below shows a Plan View of the 2RN link between Mullaghanish and Bantry. The nearest of the proposed turbines to the 2RN link are (T01, T04 & T08). The path profile below shows that while the 2nd Fresnel Zone FM link from Mullaghanish to Bantry would be obstructed by the proposed turbines it can also be seen that there is existing terrain blocking on the 2nd Fresnel Zone 15km out from the Bantry site. The turbine obstructions are 11 km from Mullaghanish and 30km from Bantry and the main boresight of the link does not appear to be impacted.



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Best Regards,
Kevin Hayes,
Ai Bridges Ltd.,
...Total Communications Solutions...
UNIT 9, BLOCK B,
Quin Rd. Business Park,
Ennis, Co. Clare,
Ireland.


05/01/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

Thank you for taking my call earlier. Here are the finalised turbine XY co-ordinates (including Lat\Long conversions) that we used for our analysis, along with the turbine dimensions

Wind Farm	Number of Turbines	Turbine Hub Height	Turbine Rotor Diameter
Gortyrally	15	107.5 m	155 m

WTG No.	X	Y
1	514982	571467
2	514676	571822
3	515203	572167
4	515580	571929
5	516129	571873
6	516658	571817
7	516186	572397
8	515660	572578
9	515500	572935
10	515821	573451
11	516329	572863
12	516794	572484

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13	516826	573306
14	517219	573051
15	517708	572887

WTG No.	Latitude	Longitude
1	51° 53' 19.965"N	9° 14' 6.401"W
2	51° 53' 31.282"N	9° 14' 22.717"W
3	51° 53' 42.733"N	9° 13' 55.465"W
4	51° 53' 35.239"N	9° 13' 35.541"W
5	51° 53' 33.726"N	9° 13' 6.784"W
6	51° 53' 32.199"N	9° 12' 39.073"W
7	51° 53' 50.710"N	9° 13' 4.261"W
8	51° 53' 56.280"N	9° 13' 31.929"W
9	51° 54' 7.743"N	9° 13' 40.611"W
10	51° 54' 24.612"N	9° 13' 24.276"W
11	51° 54' 5.864"N	9° 12' 57.190"W
12	51° 53' 53.852"N	9° 12' 32.540"W
13	51° 54' 20.464"N	9° 12' 31.581"W
14	51° 54' 12.425"N	9° 12' 10.804"W
15	51° 54' 7.379"N	9° 11' 45.086"W

Best Regards,
Kevin Hayes,


07/01/21 – 2RN Response

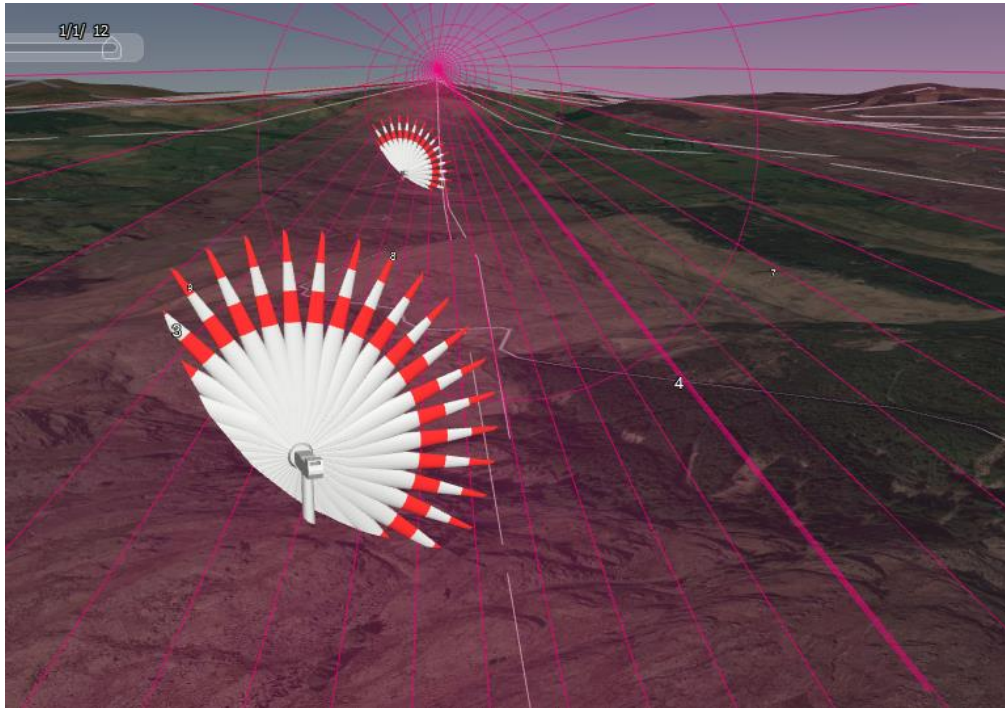
Hi Kevin, thanks for the updated coordinates and your analysis. We've check the new turbine coordinates also. Unfortunately we still have two problem turbines.

With these locations – as with your analysis – we are now really only concerned with the FM link from Mullaghanish to Bantry. Given that the direct path is not obstructed by turbines – or terrain – we think that keeping all parts of the turbines outside of 0.6 of the 1st Fresnel zone is probably sufficient and would limit the risk here. We would like to see the two nearest turbines to this path moved away so that no part could be with the 0.6 zone.

The plot below shows the turbines encroaching on the 0.6 Fresnel zone. We are aware that terrain on these long links often encroaches the Fresnel zones, in a couple of cases our direct path is even blocked by terrain and we rely on a diffracted path. We want to avoid adding in new intermittent reflecting objects to any paths.

*Happy to discuss further.
Regards, Johnny*

 <i>Total Broadband Solutions</i>	Procedure: 001	Rev: 6.0
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*Johnny Evans
Head of Projects and Coverage Planning
2RN
Block B, Cookstown Court, Old Belgard Road, Tallaght, Dublin 24, Ireland
D24 WK28*

07/01/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

Thank you for the prompt response on this.

Would you be able to give an indication which turbines are encroaching the 0.6 F1 of this FM link . We should be able to then calculate the worst case scenario encroachment of each of these turbines into the 0.6 F1 . We would then be able to recommend a micro-siting distance to the wind farm designers.

Also can you just confirm that the new turbine locations do not impact the off-air UHF links ?

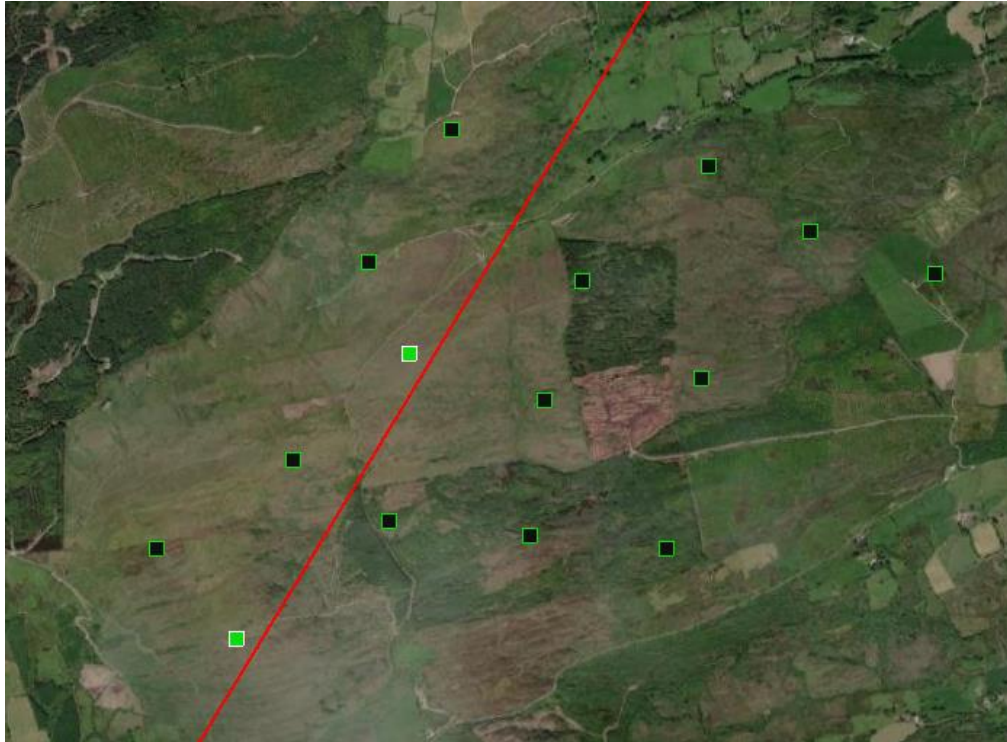
Best Regards,
Kevin Hayes,

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07/01/21 – 2RN Response

*Turbines 1 and 8 from the latest list you sent – the two highlighted in green below.
Regarding the UHF links – yes, we think there is a low enough risk of interference to these links with the latest turbine locations.*

Regards, Johnny



*Johnny Evans
Head of Projects and Coverage Planning
2RN*

20/01/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

We have re-run our analysis based on the new co-ordinates that have been provided to us by the wind farm developer. The screenshot below shows the 2RN link (1st Fresnel (to 0.6)) relative to Turbines T01 and T08. The analysis shows that there is now a Clearance Condition to each of the turbines. There were a number of turbine layout iterations that we have completed our analysis for and the co-ordinates provided below allow for the best coverage service coverage
Would you be available for a brief call to discuss later today ?

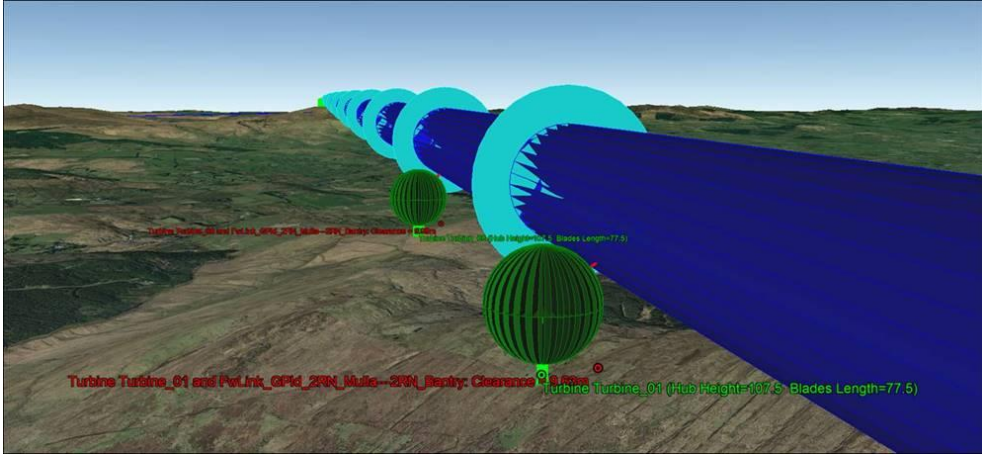
FM Link Analysis based on new co-ordinates for T01 and T08 :

The Revised Turbine Coordinates for T01 and T08 are

- T01: 51°53'19.40"N 9°14'11.34"W
- T08: 51°53'57.61"N 9°13'29.75"W
- T01: Clearance 9.63 m

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T08: Clearance 9.99 m



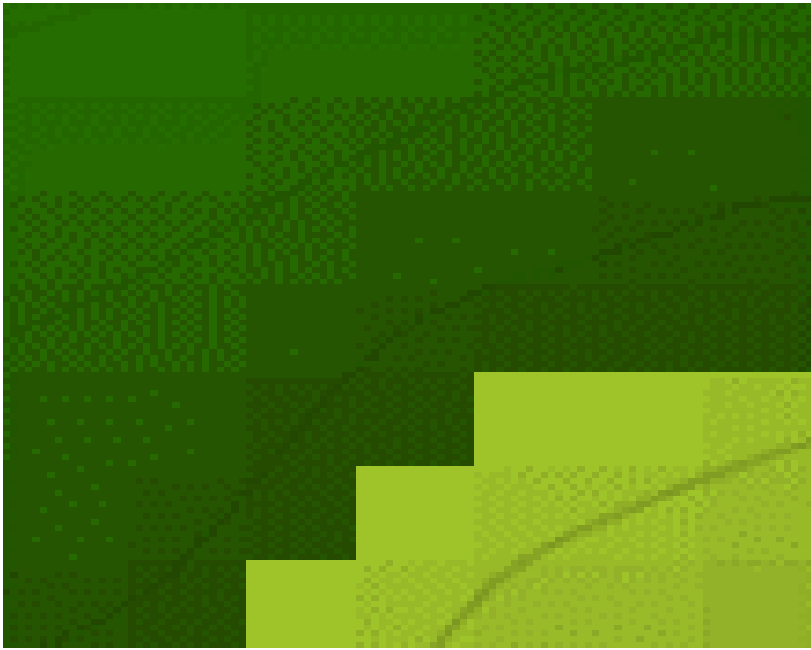
Best Regards,
Kevin Hayes,

20/01/21 – 2RN Response


Hi Kevin, thanks for this.

Can you recheck the new coordinate for T08 for me please? I'm seeing it about the same/slightly closer to the link than the last coordinates you sent.

Thanks, Johnny



*Johnny Evans
Head of Projects and Coverage Planning*

	Procedure: 001	Rev: 6.0
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20/01/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

It looks like we sent out the incorrect co-ordinate for T8 earlier. Please see the final co-ordinates below.

Final Turbine Coordinates for T01 and T08 :

T01: 51°53'19.40"N 9°14'11.34"W

T08: 51°53'58.64"N 9°13'32.61"W

Best Regards,
Kevin Hayes,

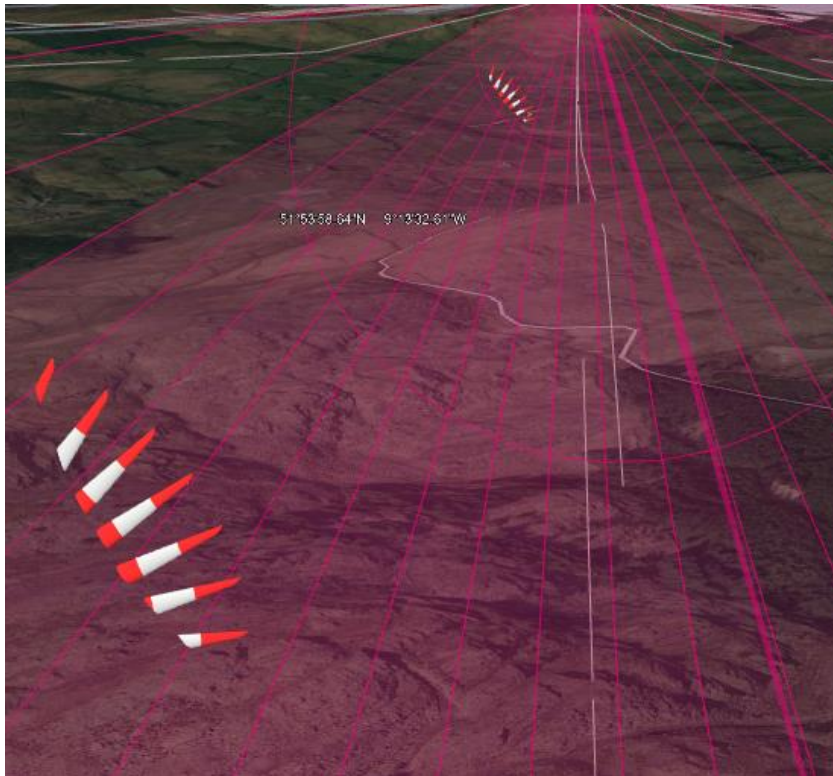
20/01/21 – 2RN Response


Hi Kevin,

We are still seeing a slight incursion into the 0.6 Fresnel at 90MHz (the lowest frequency in use at Mullaghanish) with these new coordinates. Are you working at 90MHz?

Thanks, Johnny

*Johnny Evans
Head of Projects and Coverage Planning
2RN*



	Procedure: 001	Rev: 6.0
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21/01/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

We are re-running our analysis and would like to compare our output to the results you are seeing via the online tool, www.radiofresnel.com

Could you confirm that you are using the values as shown below for the Fresnel Calculation.



Best Regards,
David McGrath.

Ai Bridges
...Total Communications Solutions...

20/01/21 – 2RN Response

*Hi David, yes 90MHz for the worst case, and 0.6 of the 1st Zone.
Thanks, Johnny*

*Johnny Evans
Head of Projects and Coverage Planning
2RN*

22/01/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

I am just following up in relation to our latest calculations.


We have compared the Fresnel Zones outputted by the AiBridges Software and the Radiofresnel.com online software and there does seem to be a discrepancy when calculating 60% of F1. To illustrate the discrepancy we have used the centre-point of the 90MHz radio link in the example below.

F1

F1 (at the center-point) of the radio link is 185m.

Both the AiBridges software and the *radiofresnel.com* software seem to model this correctly.

Formula Used in AiBridges Fresnel Calculations

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The formula below has been used for the AiBridges Fresnel Calculations. This has been used on multiple other EMI projects and the results outputted by this formula match all of the online calculators that we have checked.

which can be solved for r_n .^[3]

$$r_n = \sqrt{n \frac{d_1 d_2}{D} \lambda}, \quad d_1, d_2 \gg n\lambda,$$

F1 at Centre of radio link (AiBridges Software Fresnel Circle #16)

- Fresnel Circle #15 (radius = 183.8 m)
- Fresnel Circle #16 (radius = 184.6 m)
- Fresnel Circle #17 (radius = 184.6 m)
- Fresnel Circle #18 (radius = 183.8 m)

Online Fresnel Calculator (F1 = 185m)

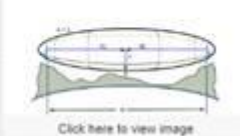
Fresnel Zone Calculator

Radio frequency line of sight is defined by Fresnel Zones which are ellipse shaped areas between any two radio antennas. This calculator calculates the radius of the Fresnel Zone at its widest point. The distance between the two radio antennas and the frequency of operation are required to compute the radius of the Fresnel Zone.

Calculate the Radius of the Fresnel Zone

Distance Between Antennas (D) km

Frequency (f) MHz



Click here to view image

Result

Radius: Feet

Radius: m


60% of F1

60% of F1 is 111m (185 x 0.6)
The AiBridges model reflects this correctly.

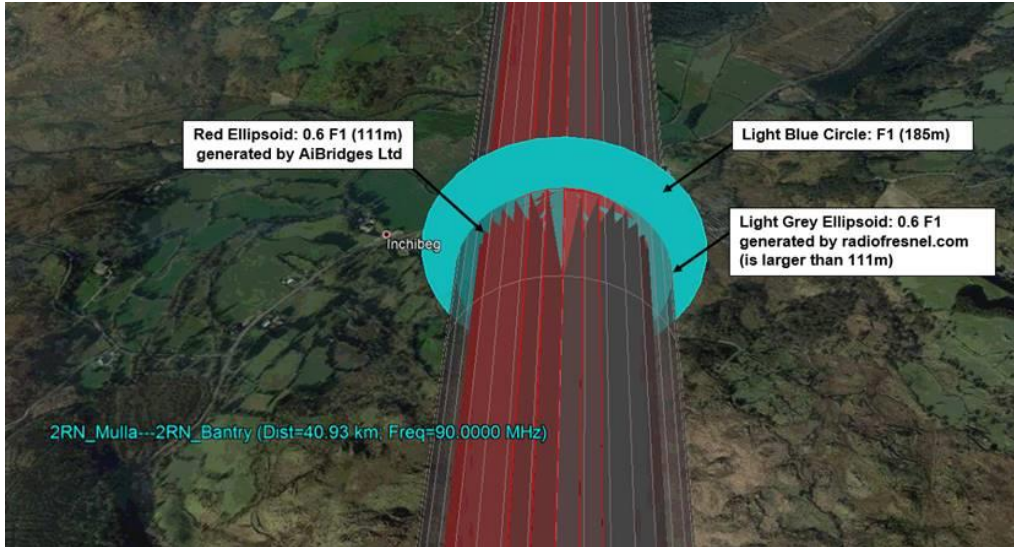
AiBridges Software Fresnel Circle #16

- Fresnel Circle #15 (radius = 110.3 m)
- Fresnel Circle #16 (radius = 110.8 m)
- Fresnel Circle #17 (radius = 110.8 m)
- Fresnel Circle #18 (radius = 110.3 m)

However, the *radiofresnel.com* software seems to over-calculate the radius for 0.6 F1 (by approx 10-15m) (See image below).

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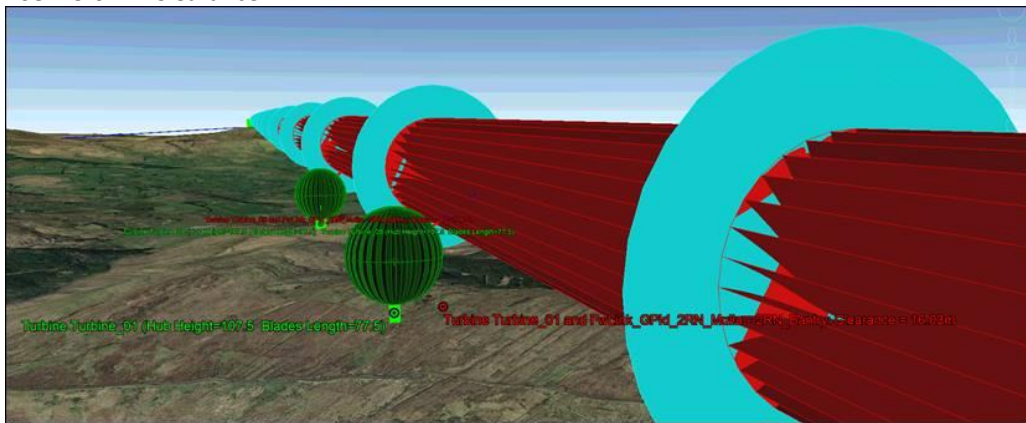
It maybe that the calculations used by the online tool works ok for F1, F2, F3 etc. but are not so accurate for Fresnel Zones that are less than 1.0



Turbine Clearance Calculations

Using the AiBridges Calculations for 0.6 F1 there is a Clearance Condition to each of the turbines (T01 & T08 as shown below)

- T01: 16.03 m Clearance
- T08: 15.67 m Clearance




Best Regards,
Kevin Hayes,

22/01/21 – 2RN Response

Hi David

Hi Kevin, David, thanks for looking into this – the formula is certainly correct, and is how I would do it by hand. I don't know how Radiofesnel.com does it, but I think we may be seeing a difference

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due to semantics. We are seeking clearance of the “0.6 Fresnel Zone” – rather than 60% of the 1st Fresnel zone radius. The difference being that the term “n” in the formula should be 0.6 (i.e. and needs to be square rooted), rather than multiplying the 1st Fresnel zone radius by 0.6. Your implementation would be 0.77 of ours (i.e. square root of 0.6)

So for your mid point example the formula using 0.6 for the Fresnel Zone is 143m, whereas 0.6 x the 1st Fresnel zone (185m) would be 111m.

In line with Turbines 1 and 8, at their latest locations, we would like clearance of 131m and 126m from our link path respectively.

You’ll see it done both ways. I can’t honestly say which is “correct” – only that this is really more of a rule of thumb as I understand it, so I think we should be erring on the side of caution given that we should really be looking at 1st of 2nd zone clearance for fairly reflective surfaces like turbine blades.

Note that once we solve this part, we may have some relatively small differences over earth curvature to resolve since we are so close.

Regards, Johnny

Johnny Evans
Head of Projects and Coverage Planning
2RN

25/01/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

I am just following up from your email below. Would you be able to confirm that this FM link is a point to point or if this is an point to multipoint system from Mullaghanish

We have been modelling on the basis of a point to point FM link with a directional antenna

Best Regards,
Kevin Hayes,
Ai Bridges Ltd.,

25/01/21 – 2RN Response

Hi Kevin,
I’m not sure what works best for your modelling. Strictly speaking it is actually a broadcast service. But for the purposes here I would consider it a point to point link – given that the receive antenna at Bantry is directional, and we are only interested in this point to point path. Hope that helps. Regards, Johnny

Johnny Evans
Head of Projects and Coverage Planning
2RN

	Procedure: 001	Rev: 6.0
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25/01/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

So this is a broadcast service for the south west from Mullaghanish ? i.e. thus you had concerns in relation to possible conflicts with BBC in the event of an antenna height increase

Best Regards,
Kevin Hayes,

25/01/21 – 2RN Response

Correct. If we wanted to change antenna height at Mullaghanish we would have to ask ComReg to negotiate and agree the new height with their counterparts in the UK, and France. There would also be significant engineering effort to move this antenna which is made up of 24 2.5m x 2m panels. Regards, Johnny

*Johnny Evans
Head of Projects and Coverage Planning
2RN*

05/02/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

I am following up in relation to the analysis we have been conducting based on new proposed turbine locations.


We are now seeing a clearance on T1 of 8.47m however there is a 4.78m interference for T8.

The location for T8 cannot be re-located any further due to a windtake issue and also as it would encroach on a public road (our understanding is that the other side of the road is outside the wind farm boundary)

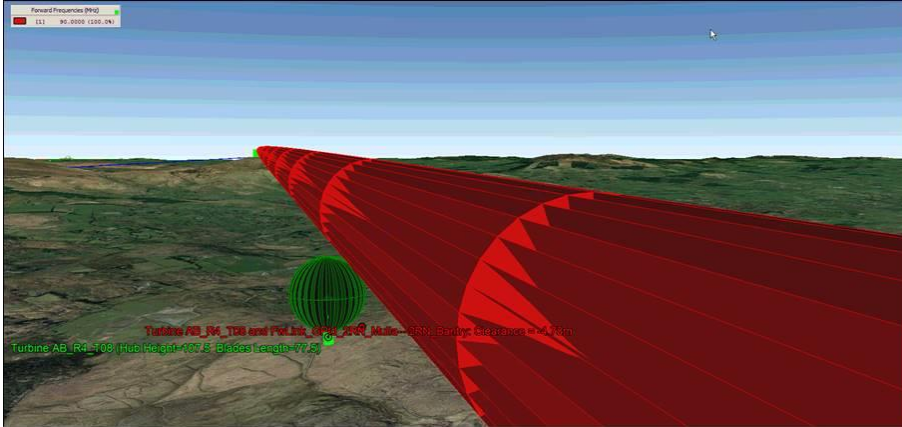
Please see our revised calculations for your reference. We would be grateful if you could review

Turbine 8 - 90 MHz FM Link (0.6 Fresnel)

Turbine	AB Co-ordinates	Interference to 2RN FM Link (0.6 F)
T08	51°53'59.40"N 09°13'32.42"W	-4.78 m

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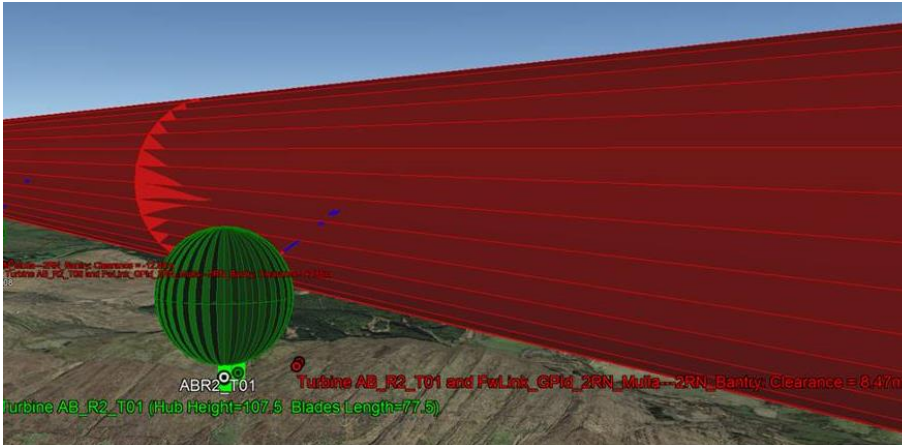
Interference : - 4.78 m



Turbine 1 - 90 MHz FM Link (0.6 Fresnel)

Turbine	AB Co-ordinates	Interference to 2RN FM Link (0.6 F)
T01	51 53 19.35 N 09 14 12.90 W	8.47 m

Clearance : 8.47m



Best Regards,
Kevin Hayes,


09/02/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

I am just following up from our call yesterday.

I would be grateful if you could give an indication of the bandwidth capacity of the off-air FM link so that we can propose a specification for the mitigation measure of the 1.4GHz point to point link.

Best Regards,
Kevin Hayes,

	Procedure: 001	Rev: 6.0
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10/02/20 – 2RN Response

Hi Kevin, I think the bare minimum for just the radio services would be about 10Mbps – I will need to confirm.

I spoke with some of the network guys here and the strong preference would be for a fibre though. Couple of reasons:

- 1. Less additional equipment to maintain.*
- 2. It could also easily carry the UHF service (without any further equipment) if there was a problem there*
- 3. Unknown performance of the 1.4GHz link.*
- 4. No additional mast occupancy*

With either a fibre or radio link solution, we'd need interface equipment at Bantry for the FM radio services. Very rough estimate is that this would cost about 25k excluding installation. I will investigate space at Bantry for this equipment (about 1 rack's worth) in the cabin, and whether there is capacity on the mast for the link dish.

There would be a smaller amount of interface equipment needed at Mullaghanish for the radio link case – estimate < 5k. And none required for the fibre solution.

Regards, Johnny

*Johnny Evans
Head of Projects and Coverage Planning
2RN*

19/02/21– Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

I am just following up from our call last week.


I would be grateful if you could confirm as discussed that

1. The current interference of T8 on the link would be allowable on the condition that a mitigation measure solution would be implemented during the operational phase of the wind farm and also on the condition that the wind farm developer would cover the mitigation costs or a point to point radio link installation from Mullaghanish to Bantry.

I would be grateful if you could confirm that 2RN would be agreeable to the to the above to allow the wind farm developer to satisfy the requirements for for a planning application.

Also one of our engineers has suggested During the construction phase of the project the turbine could be yawed so that the blade tip would be aligned into the worst case position so that the potential interference impacts on the FM link could be assessed

Best Regards,
Kevin Hayes,

	Procedure: 001	Rev: 6.0
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22/02/21 – 2RN Response

Hi Kevin,

I would reword along the following lines – see what you think:

“2RN believes that there is a high risk of interference from T8 (and a relatively lower risk from T1) to its broadcast FM radio services (RTÉ Radio 1, 2FM, RnaG, Lyric FM) in the Bantry area. 2RN is satisfied that the risk could be mitigated by providing an alternative source of distribution to 2RN’s Bantry transmitter site either by fibre broadband connection to the Bantry transmitter site or a dedicated point to point radio link between 2RN’s sites at Mullaghanish and Bantry. 2RN agrees that if interference is detected – either during construction/commissioning or during operation of the turbines – that the developer would cover the cost of the installation of the mitigation link and any additional ongoing operational costs associated with the operation of the link.”

I haven’t looked at the cost or capability of accommodation the radio link yet – will need to get one of our guys to survey our Bantry site to see how much space there is.

That is a good idea about turning the turbines during construction/commissioning so that we can do tests.

Regards, Johnny

Johnny Evans
Head of Projects and Coverage Planning
2RN

09/03/21– Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,


Apologises for the delay in getting back to you. Please find the quotation options with indicative pricing for the 1.4GHz band radio point to point links.. This quotations give indicative pricing and equipment specifications

Also I would be grateful if you could advise your engineers have surveyed the Bantry Mast for available mast space ? If not, could we suggest that we could survey the mast from ground level on the bearing to Mullaghanish and send on a site photomontage for your own internal review.

Option 1 :

In the first option that we have provide is based on the Aprisa manufactured 4RF radio equipment

- *three alternative antenna sizes for your consideration.*
- *radio with 1MHz channel size which means that 16QAM would give you E1+1168kbps capacity; the radio modulation can be set to QPSK, 16QAM, 32QAM or 64QAM. The next supported wider channel size on the 1.4GHz band is 1.75MHz where you might have enough capacity using QPSK, for a more robust link and/or smaller antennas.*
- *the relevant interface cards, radio terminal has an integrated 4-port Ethernet switch by default, but can be equipped with the quoted QETH interface card for added features.*
- *Equipment datasheets \ antenna specifications*

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Option 2 :

In the second option we have provided is based on Westica manufactured equipment and we only have provided indicative pricing and the equipment specification is subject to design

Best Regards,
Kevin Hayes,

10/03/21 – 2RN Response

Hi Kevin, thanks for sending on this information. I will have a look at the technical details. Will take a look for mast space now using those dish sizes – this is desk work first – will get on it. I might be misunderstanding the details (at a glance) but is this just a single E1 system? We need an E1 for each of the 4 radio services – which I rounded up to 10Mbit/s. Is this accommodated here?

Thanks, Johnny

10/03/21– Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

I am just following up from your email below.
Based on the proposed solution

- For 10Mbps at least 3.5MHz channel size is required which provides 11.4Mbps using 16QAM RF modulation. For a more robust link you could choose 7MHz channel size which supports 11.8Mbps with the lowest (most robust) RF modulation QPSK.
- The achievable capacity depends on the allocated channel size by ComReg, and what RF modulation can be used for the link

10/03/21 – 2RN Response


Thanks

*Johnny Evans
Head of Projects and Coverage Planning
2RN*

11/03/21– Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

I am just following up with you in relation to our call earlier this morning.
As discussed I would be grateful if you could provide a brief outline of indicative mitigation measure models (point to point link under managed service arrangement, fibre broadband , satellite etc) and also costs that would need to be considered for each model.

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Thank you for your co-operation on this

Best Regards,
Kevin Hayes,

April - May 2021 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

I am just following up with you in relation a minor turbine layout change that the wind farm developer has to make to one of the turbine locations at T7 due to other third party constraints mapping.

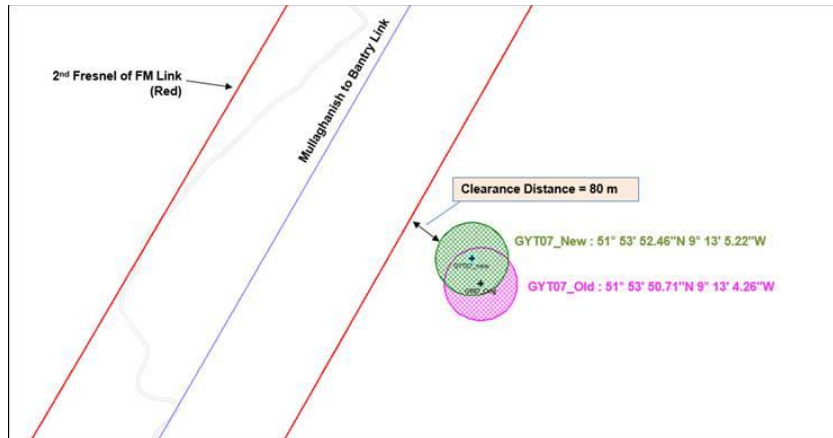
The original location of T7 showed that there was a clearance from the 2nd Fresnel of the Mullaghanish to Bantry FM link of 123m. Based on the re-location of T7 the clearance of the blade tip to the 2nd Fresnel of the link would be 80m.

Would you be able to confirm that this clearance would be acceptable to 2RN

2RN Network Analysis

Link ID	Clearance Distance	
	T07_Old	T07_New
Mullaghanish – Bantry (2RN)	123 m	80 m


2RN Network - Plan View



April - May 2021 – 2RN Response

Hi Kevin, thanks for the updated info. – and appreciate you checking with us. Yes, T7 is fine in this new location. Regards, Johnny

*Johnny Evans
Head of Projects and Coverage Planning
2RN*

	Procedure: 001	Rev: 6.0
Title: Gortyrally Telecommunications Impact Study	Approved: KH	Date: 21/07/22

18/05/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

I am just following up from in relation to the email below.
Would you be able to confirm that you have completed your desktop review of the mast space.

We are looking to close out the details of the mitigation measure options to that we can close out for the planning application submission.

I look forward to hearing from you.

Best Regards,
Kevin Hayes,

From: Kevin Hayes
Sent: 11 March 2021 12:23
To: Johnny Evans <Johnny.Evans@2rn.ie>
Subject: RE: Gortarahilly Wind Farm Development

Hello Johnny,

I am just following up with you in relation to our call earlier this morning.

As discussed I would be grateful if you could provide a brief outline of indicative mitigation measure models (point to point link under managed service arrangement, fibre broadband , satellite etc) and also costs that would need to be considered for each model.

Thank you for your co-operation on this

Best Regards,
Kevin Hayes,


19/05/21 – 2RN Response

Hi Kevin,

Limited progress here. From desk study there is currently space on the Bantry structure, however a 2.4m dish would bring the structural loading well over 90%. There is a risk that this space/capacity would be gone by the time it is needed.

We have not yet figured out how to deal with this in terms of the provision of a service and charging for access to the structure. From this perspective the fibre solution would be far more preferable.

Regards, Johnny

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19/05/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

A 2.4m dish will not be required at Bantry. It is more likely that a 0.9m dish would suffice which would reduce the loading.

Would it be possible that a fee structure could be prepared so that a space could be reserved to that the wind farm developer would have an option to book the space required

As previously discussed we would include both options for mitigation based on radio and fibre. As there is no timeline available for fibre availability the radio mitigation option could be managed well in advance of construction \ operation of the wind farm and risks of delay could be would be more easily controlled.

Best Regards,
Kevin Hayes,

01/06/21 – Consultation Response sent by Ai Bridges to 2RN

Hello Johnny,

I am just following up from our recent communications in relation to the proposed mitigation measures for mitigating the potential impacts of turbine T8 on the Mullaghanish to Bantry FM link.

As discussed would you be able to confirm that the proposed mitigation measure options of microwave radio link solution or a fibre broadband solutions would be technically acceptable to 2RN subject to the agreement of commercial details.

I would be grateful if you confirm at your earliest possible convenience so that we can close this final remaining telecoms consultation with respect to a planning application submission by the wind farm developer.


Best Regards,
Kevin Hayes,

02/06/21 – 2RN Response

Hi Kevin, sorry I missed you yesterday.

I can confirm that a suitable microwave link or fibre broadband solution would be technically acceptable in the event that our link from Mullaghanish to Bantry was impacted by the proposed turbines at Gortarahilly.

Regards, Johnny

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3.1.3 Enet Consultations

The consultations between Enet and Ai Bridges Ltd are provided below.

04/03/21 – Consultation Request sent by Ai Bridges to Enet

Hello Peter

We have been requested by Jennings O’Donovan & Partners Ltd., the EIAR Consultants for the Gortarahilly Wind Farm Development, to carry out a detailed technical assessment of the potential for interference on the eNet network.

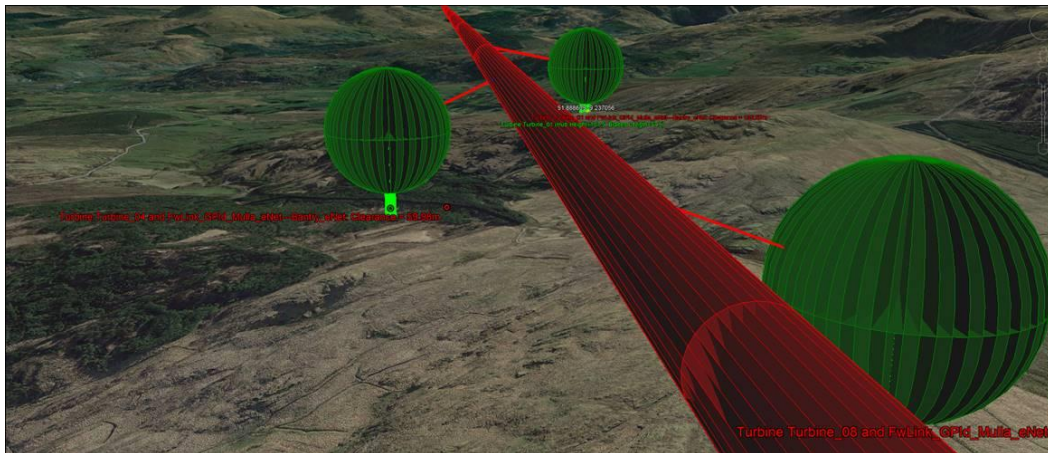
We have conducted a 3D analysis showing that T04 is the nearest turbine to the radio link and that there is a **59.98m clearance** between the turbine blade-tip and the 2nd Fresnel of the radio link.

Based on our analysis we do not expect that there will be any impacts on the eNet link due to the proposed wind farm development. The standard buffer that we use with mobile operators is 30m from the 2nd Fresnel and in some cases 30m from the 1st Fresnel.

Would you be able to confirm that the clearances provided below are acceptable ?

Gortrahilly Wind Farm :

A-End Coordinates (Bantry)	A-End Antenna Height	B-End Coordinates (Mullaghanish)	B-End Antenna Height	Link Frequency
51°39'56.86"N 9°26'35.11"W	15m	51°58'58.46"N 9° 8'37.17"W	15m	13GHz



Best Regards,
Kevin Hayes,

10/02/20 – Enet Response

Hi Kevin,

Based on your analysis we should be fine for this link so,

Best Regards,
Peter

	Procedure: 001	Rev: 6.0
Title: Gortyrahilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

April - May 2021 – Consultation Request sent by Ai Bridges to Enet

Hello Peter,

I am just following up with you in relation a minor turbine layout change that the wind farm developer has to make to one of the turbine locations at T7 due to other third party constraints mapping.

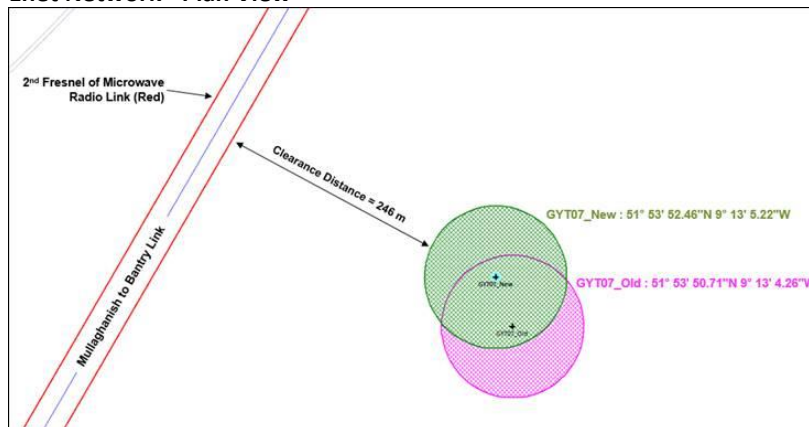
The original location of T7 showed that there was a clearance from the 2nd Fresnel of the Maullaghanish to Bantry FM link of 290m. Based on the re-location of T7 the clearance of the blade tip to the 2nd Fresnel of the link would be 246m.

Our engineers have concluded that this would not cause any impact on the existing eNet Link. We would be grateful if you could confirm that this clearance would be acceptable to you ?

Enet Network Analysis :

Link ID	Clearance Distance	
	T07_Old	T07_New
Mullaghanish – Bantry (Enet)	290 m	246 m

Enet Network - Plan View



April - May 2021 – Enet Response


Hi Kevin,

246m is still plenty of clearance, so should be good from our side,

Regards,
Peter

 <i>Total Broadband Solutions</i>	Procedure: 001	Rev: 6.0
Title: Gortyrahilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

Section 5 - Desktop Survey Analysis

	Procedure: 001	Rev: 6.0
Title: Gortyrahilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

4. Introduction

Based on the information provided to Ai Bridges (by Jennings O'Donovan & Partners) and on the findings from the consultation process, an analysis of the Vodafone, 2RN & Enet networks operating in the vicinity of the proposed wind farm at Gortyrahilly was carried out. The findings of the network analysis are presented in Sections 4.1 to 4.3 that follow.

4.1 Vodafone Licensed Transmission Networks

Table 5 below lists the licensed transmission radio links that required a desktop analysis. The links are also shown relative to the proposed wind farm in Figure 4 below. The results of the desktop analysis* for these links are provided in Sections 4.1.1 to 4.1.3.

Link ID	Operator	Link Description
1	Vodafone Ireland	PTP microwave radio link from Mullaghanish - Ballingeary
2	Vodafone Ireland	PTP microwave radio link from Mullaghanish to Bantry
3	Vodafone Ireland	PTP microwave radio link from Inchee – Cashelmore

Table 5. Vodafone Telecommunications Links requiring Analysis

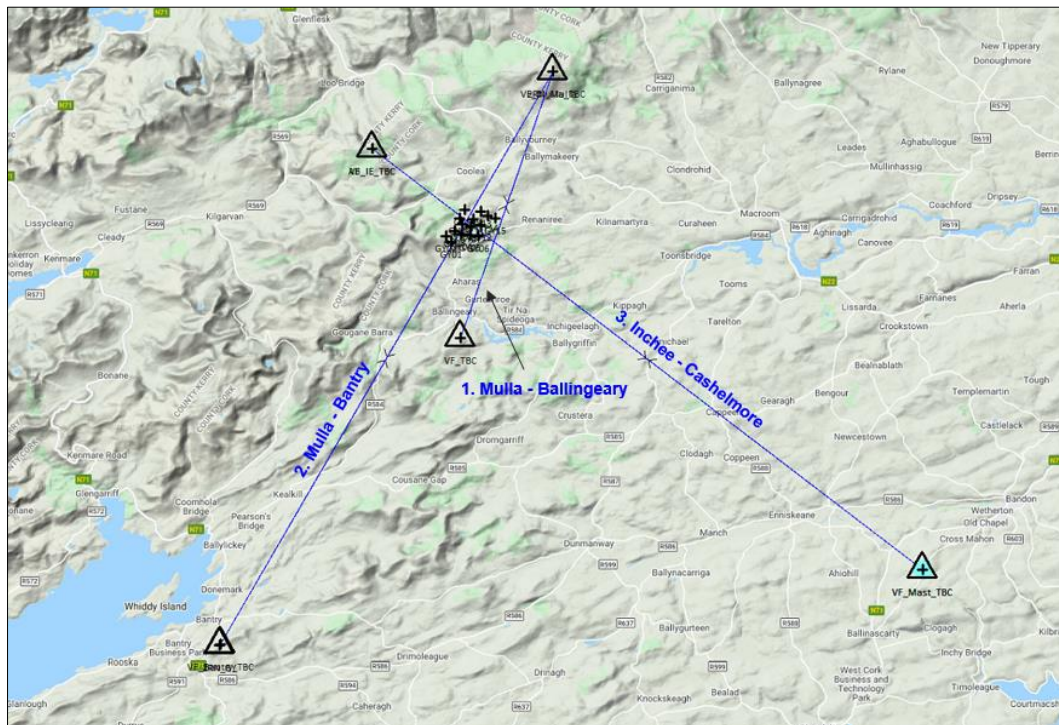


Figure 4. Plan View of Vodafone Telecommunications Links requiring Analysis

* The Desktop Survey Analysis findings are subject to accuracy of the information (GPS co-ordinates, turbine dimensions, etc.) provided to Ai Bridges.

	Procedure: 001	Rev: 6.0
Title: Gortyrhilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

4.1.1 Link 1 Analysis (Mullaghanish to Ballingearry – Vodafone)

Figure 5 below shows a close-up Plan View of the radio link relative to the Gortyrhilly wind turbines. Desktop analysis indicates that there is over 290m clearance between the blade-tip of the nearest turbine (T15) and the radio link. At this distance there will be no impacts to the operation of the radio link.

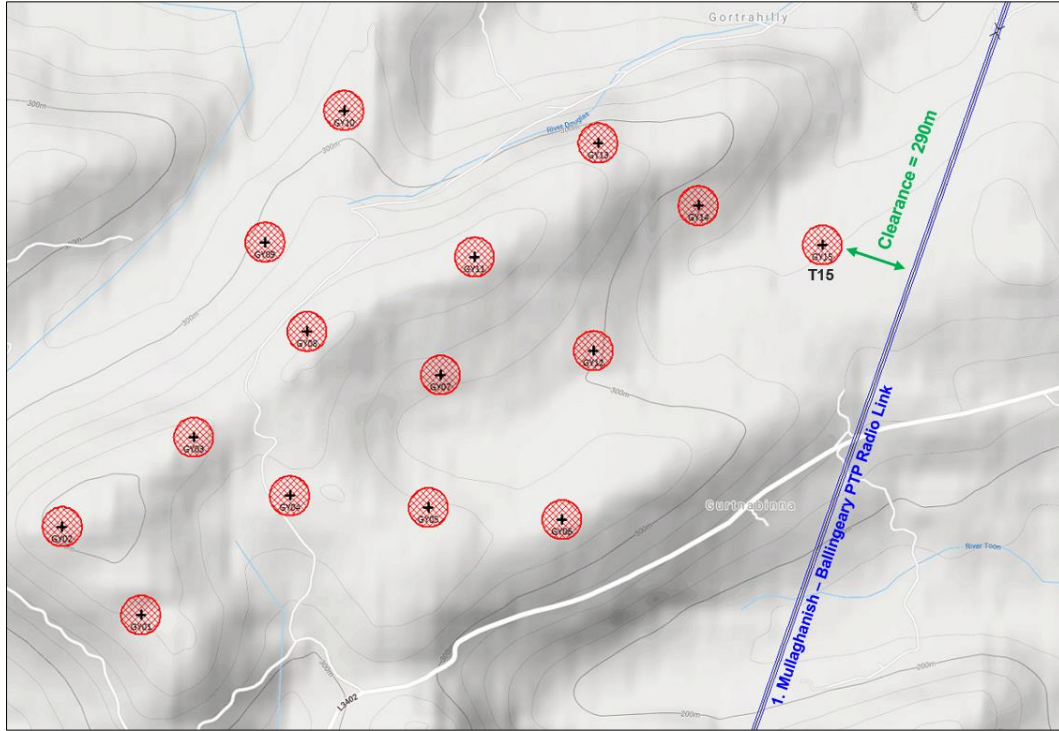


Figure 5. Close-up Plan View of the radio link between Mullaghanish and Ballingearry.

Table 6 below provides a brief summary of the desktop survey analysis of Link 1.

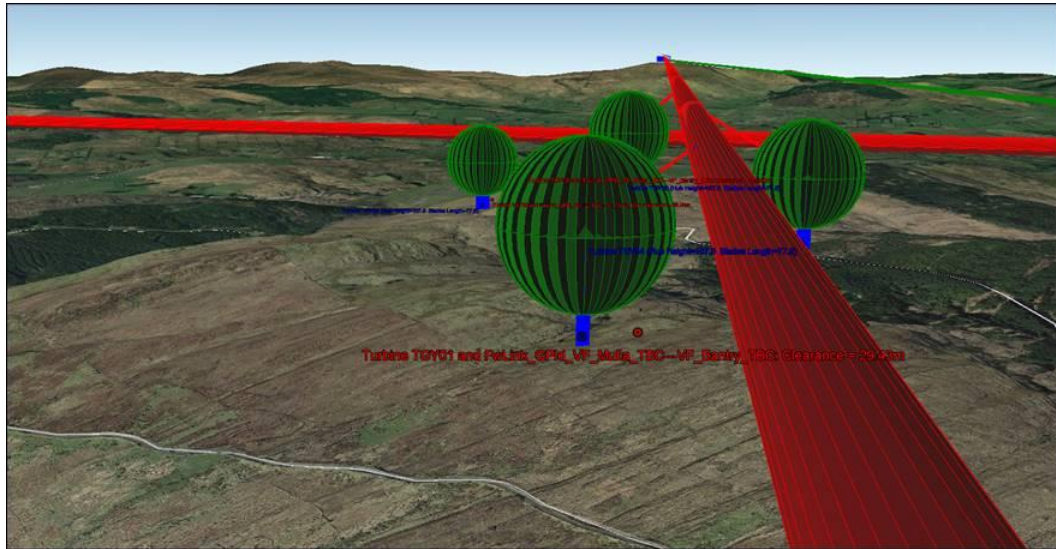
Operator	Vodafone Ireland (TBC)
Link Description	Licensed PTP microwave radio link between Mullaghanish and Ballingearry.
Wind Farm Impacts	No Impacts

Table 6. Link 1 – Analysis Summary

	Procedure: 001	Rev: 6.0
Title: Gortyrallyhilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

4.1.2 Link 2 Analysis (Mullaghanish to Bantry – Vodafone)

Figure 6 below shows a 3D view of the Vodafone link relative to the nearest of the proposed turbines (T08, T04 & T01). Desktop analysis indicates that there is a clearance distance of 29m between the 1st Fresnel Zone of the microwave radio link and the blade-tip of the nearest turbine (T01). At this distance the operation of the radio link will not be impacted.




Turbine Ident	Turbine Lat	Turbine Long	Turbine Blade Length (m)	Turbine Hub Height AGL (m)	Link Ident	Fresnel Number (nth)	Fresnel Freq. (MHz)	Clearance(m)
TGY08	51.89897	-9.22554	77.5	107.5	FwLink_GPId_VF_Mulla_TBC--VF_Bantry_TBC	1	11000	32.54
TGY04	51.89312	-9.22654	77.5	107.5	FwLink_GPId_VF_Mulla_TBC--VF_Bantry_TBC	1	11000	108.13
TGY01	51.88888	-9.23511	77.5	107.5	FwLink_GPId_VF_Mulla_TBC--VF_Bantry_TBC	1	11000	29.43

Figure 6. 3D view of Vodafone's radio link between Mullaghanish and Bantry.

Table 7 below provides a brief summary of the desktop survey analysis of Link 2.

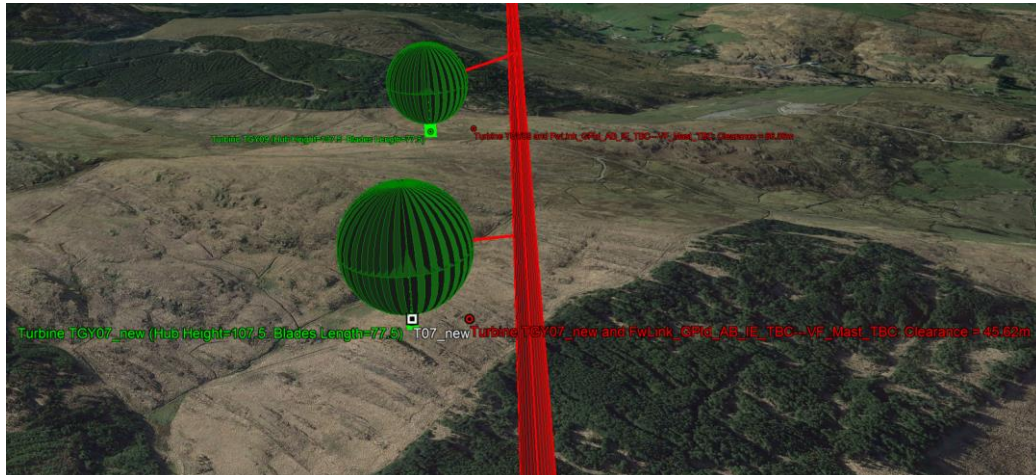
Operator	Vodafone Ireland
Link Description	Licensed PTP microwave radio link between Mullaghanish and Bantry.
Wind Farm Impacts	No impacts.

Table 7. Link 2 – Analysis Summary

	Procedure: 001	Rev: 6.0
Title: Gortyrahilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

4.1.3 Link 3 Analysis (Inchee to Cashelmore – Vodafone)

Figure 7 below shows a 3D view of the Vodafone link relative to the nearest of the proposed turbines (T07 & T09). Desktop analysis indicates that there is a clearance distance of 45.62m between the 1st Fresnel Zone of the microwave radio link and the blade-tip of the nearest turbine (T07). At this distance the operation of the radio link will not be impacted.



Turbine Ident	Turbine Lat	Turbine Long	Turbine Blade Length (m)	Turbine Hub Height AGL (m)	Link Ident	Fresnel Number (nth)	Fresnel Freq. (MHz)	Clearance(m)
TGY09	51.9022	-9.227947	77.5	107.5	FwLink_GPIId_AB_IE_TBC---VF_Mast_TBC	1	11000	86.56
TGY07_new	51.8979	-9.218117	77.5	107.5	FwLink_GPIId_AB_IE_TBC---VF_Mast_TBC	1	11000	45.62

Figure 7. 3D View of Vodafone’s radio link between Inchee and Cashelmore.

Table 8 below provides a brief summary of the desktop survey analysis of Link 3.

Operator	Vodafone Ireland
Link Description	Licensed PTP microwave radio link between Inchee and Cashelmore
Wind Farm Impacts	No impacts.

Table 8. Link 3 – Analysis Summary

	Procedure: 001	Rev: 6.0
Title: Gortyrabhilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

4.2 2RN UHF / FM Networks

Table 9 below lists 2RN telecommunications links that required a desktop analysis. The links are also shown relative to the proposed wind farm in Figure 4 below. The results of the desktop analysis* for these links are provided in Sections 4.2.1 to 4.2.3.

Link ID	Operator	Link Description
4	2RN	UHF link from Mullaghanish to Bantry
5	2RN	UHF link from Mullaghanish to Mt Gabriel
6	2RN	FM link from Mullaghanish to Bantry

Table 9. 2RN Telecommunications Links requiring Analysis

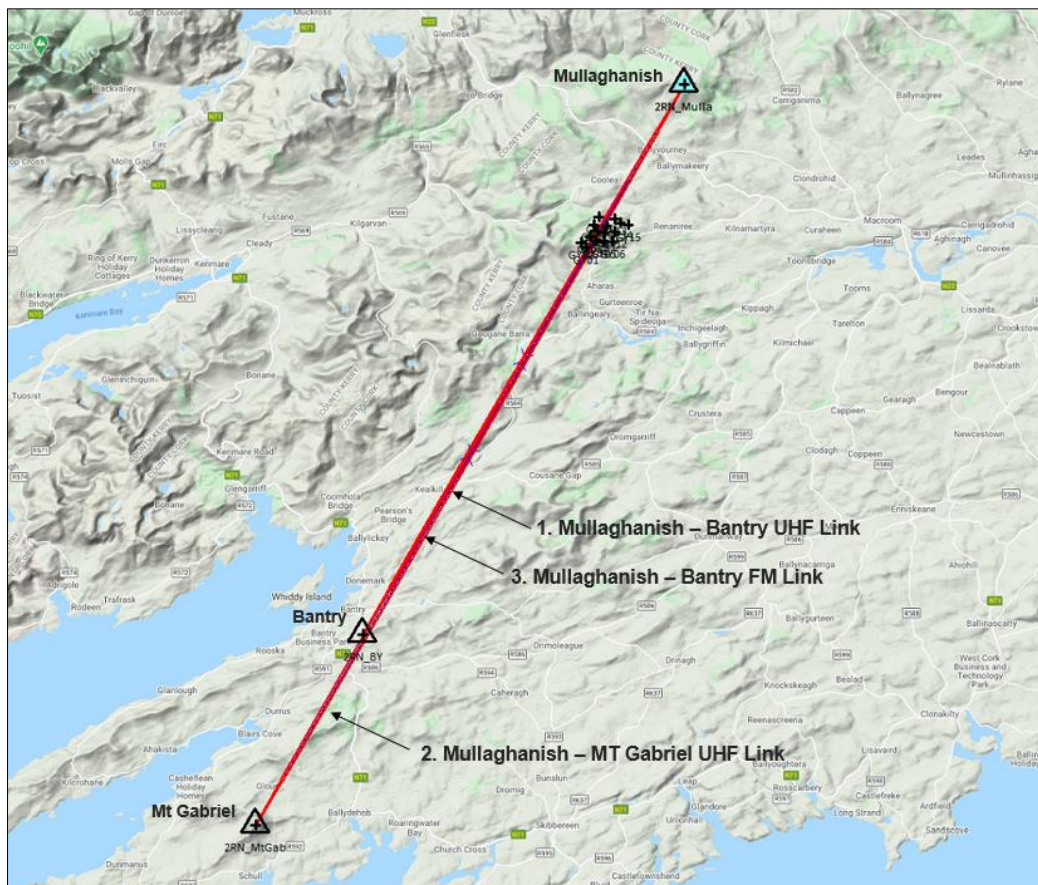



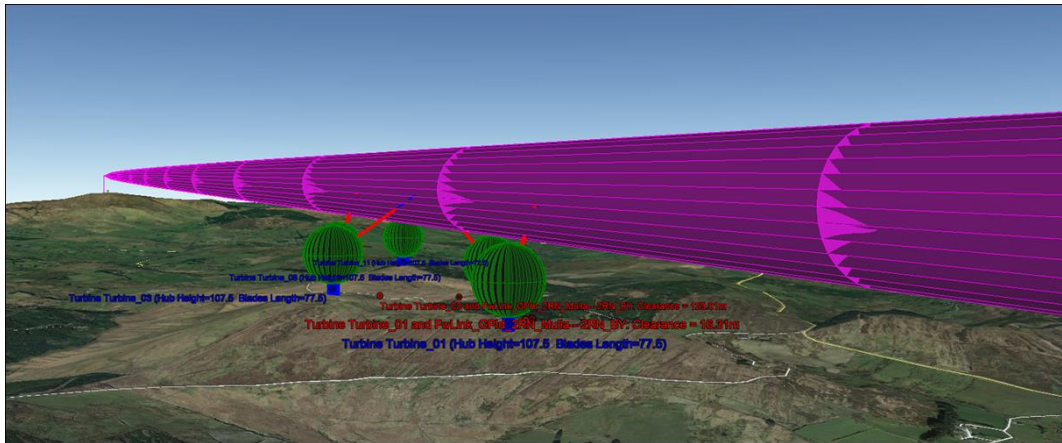
Figure 8. Plan View of 2RN Telecommunications Links requiring Analysis

* The Desktop Survey Analysis findings are subject to accuracy of the information (GPS co-ordinates, turbine dimensions, etc.) provided to Ai Bridges.

	Procedure: 001	Rev: 6.0
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4.2.1 Link 4 Analysis (UHF Link from Mullaghanish to Bantry - 2RN)

Figure 9 below shows a 3D view of the 2RN link relative to the nearest of the proposed turbines (T01, T04, T08, T03 & T11). Desktop analysis indicates that there is a clearance distance of 16m between the 2nd Fresnel Zone of the microwave radio link and the blade-tip of the nearest turbine (T01). At this distance the operation of the UHF link will not be impacted.



Turbine Ident	Turbine Lat	Turbine Long	Turbine Blade Length (m)	Turbine Hub Height AGL (m)	Turbine Ground Altitude ASL (m)	Link Ident	Fresnel Number (nth)	Fresnel Freq. (MHz)	Clearance(m)
Turbine_01	51.888881	-9.235111	77.5	107.5	377.29	FwLink_GPIId_2RN_Mulla---2RN_BY	2	474	16.31
Turbine_04	51.893122	-9.226539	77.5	107.5	359.9	FwLink_GPIId_2RN_Mulla---2RN_BY	2	474	102.46
Turbine_08	51.898967	-9.225536	77.5	107.5	384.29	FwLink_GPIId_2RN_Mulla---2RN_BY	2	474	30.84
Turbine_03	51.895203	-9.232075	77.5	107.5	395.57	FwLink_GPIId_2RN_Mulla---2RN_BY	2	474	129.01
Turbine_11	51.901628	-9.215886	77.5	107.5	381.87	FwLink_GPIId_2RN_Mulla---2RN_BY	2	474	225.6

Figure 9. 3D View of the 2RN UHF link between Mullaghanish and Bantry.

Table 10 below provides a brief summary of the desktop survey analysis of Link 4.

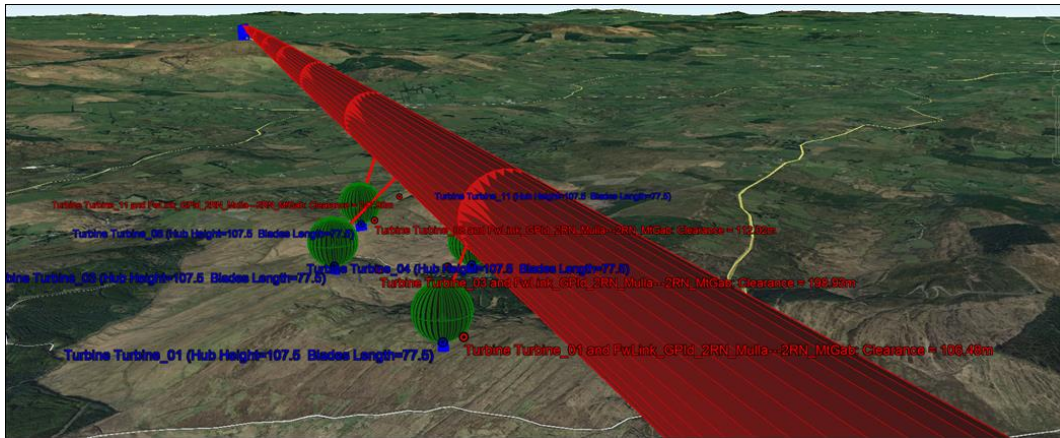
Operator	2RN
Link Description	474MHz Telecommunications Link from Mullaghanish to Bantry
Wind Farm Impacts	No impacts.

Table 10. Link 4 – Analysis Summary

	Procedure: 001	Rev: 6.0
Title: Gortyrally Telecommunications Impact Study	Approved: KH	Date: 21/07/22

4.2.2 Link 5 Analysis (UHF Link from Mullaghanish to Mt Gabriel - 2RN)

Figure 10 below shows a 3D view of the 2RN link relative to the nearest of the proposed turbines (T01, T04, T08, T03 & T11). Desktop analysis indicates that there is a clearance distance of 106m between the 2nd Fresnel Zone of the microwave radio link and the blade-tip of the nearest turbine (T01). At this distance the operation of the UHF link will not be impacted.



Turbine Ident	Turbine Lat	Turbine Long	Turbine Blade Length (m)	Turbine Hub Height AGL (m)	Turbine Ground Altitude ASL (m)	Link Ident	Fresnel Number (nth)	Fresnel Freq. (MHz)	Clearance(m)
Turbine_01	51.888881	-9.235111	77.5	107.5	377.29	FwLink_GPID_2RN_Mulla---2RN_MtGab	2	474	106.48
Turbine_04	51.893122	-9.226539	77.5	107.5	359.9	FwLink_GPID_2RN_Mulla---2RN_MtGab	2	474	152.85
Turbine_08	51.898967	-9.225536	77.5	107.5	384.29	FwLink_GPID_2RN_Mulla---2RN_MtGab	2	474	112.02
Turbine_03	51.895203	-9.232075	77.5	107.5	395.57	FwLink_GPID_2RN_Mulla---2RN_MtGab	2	474	198.93
Turbine_11	51.901628	-9.215886	77.5	107.5	381.87	FwLink_GPID_2RN_Mulla---2RN_MtGab	2	474	247.98

Figure 10. 3D View of the 2RN UHF link between Mullaghanish and Mt Gabriel.

Table 11 below provides a brief summary of the desktop survey analysis of Link 5.

Operator	2RN
Link Description	474MHz Telecommunications Link from Mullaghanish to Mt Gabriel
Wind Farm Impacts	No impacts.

Table 11. Link 5 – Analysis Summary

	Procedure: 001	Rev: 6.0
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4.2.3 Link 6 Analysis (FM link from Mullaghanish to Bantry - 2RN)

Figure 11 below shows a Plan View of the 2RN link between Mullaghanish and Bantry. The nearest of the proposed turbines to the 2RN link are (T01& T08).

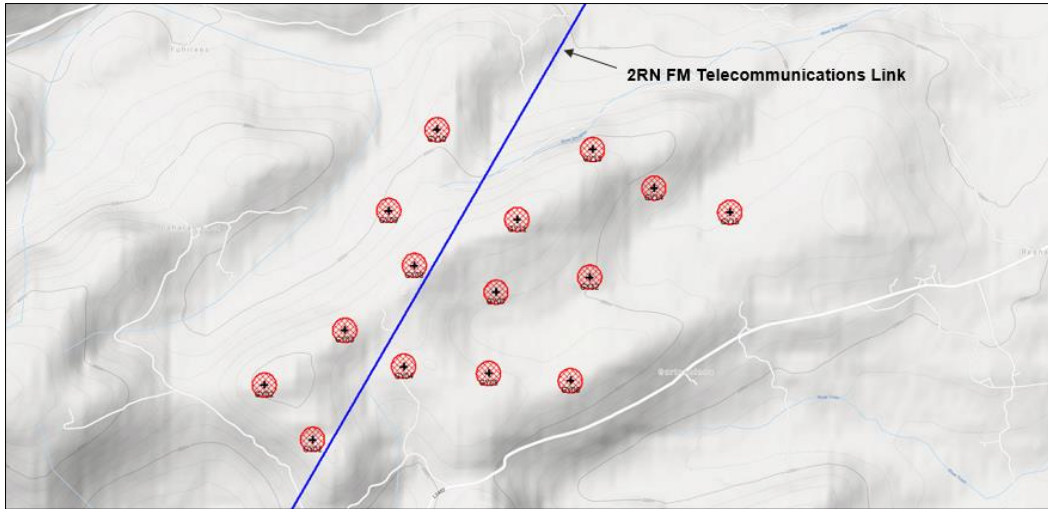


Figure 11. Plan View of the 2RN FM link between Mullaghanish and Bantry.

Figure 12 shows a 3D view of the FM link relative to Turbine T01. Network analysis indicates that there would be a Clearance of 8.47 m between the Fresnel Zone (0.6 Fresnel) of the FM link and this turbine.

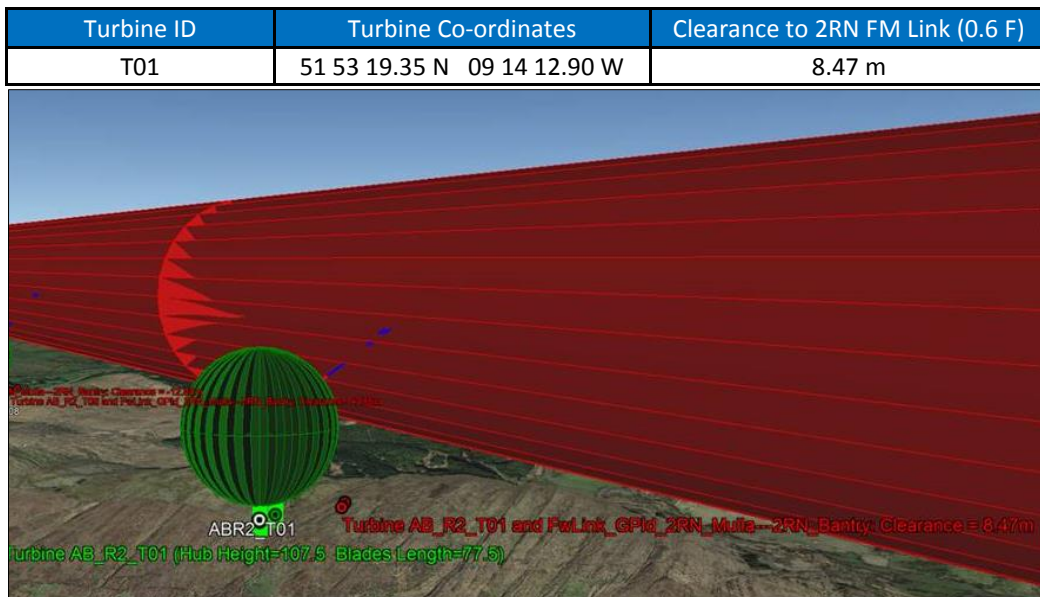


Figure 12. 3D View of the 2RN FM link relative to T01.


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Figure 13 shows a 3D view of the FM link relative to Turbine T08. Network analysis indicates that there would be a small infringement of 4.78 m into the Fresnel Zone (0.6 Fresnel) of the FM link by this turbine.

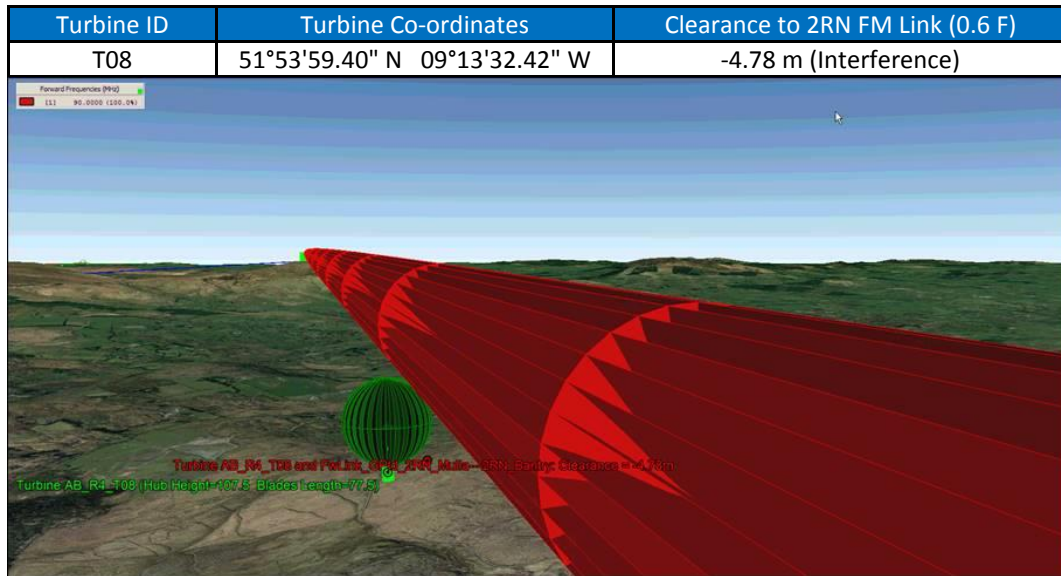


Figure 13. 3D View of the 2RN FM link relative to T08.

Table 12 below provides a brief summary of the desktop survey analysis of Link 6.

Operator	2RN
Link Description	FM Telecommunications Link from Mullaghanish to Bantry
Wind Farm Impacts	Infringement of 4.78 m into the Fresnel Zone (0.6 Fresnel)

Table 12. Link 6 – Analysis Summary

	Procedure: 001	Rev: 6.0
Title: Gortyrahilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

4.3 Enet Transmission Networks

Table 13 below lists the licensed transmission radio links that required a desktop analysis. The links are also shown relative to the proposed wind farm in Figure 4 below. The results of the desktop analysis* for this link are provided in Section 4.3.1.

Link ID	Operator	Link Description
7	Enet	PTP microwave radio link from Mullaghanish - Bantry

Table 13. Enet Telecommunications Links requiring Analysis

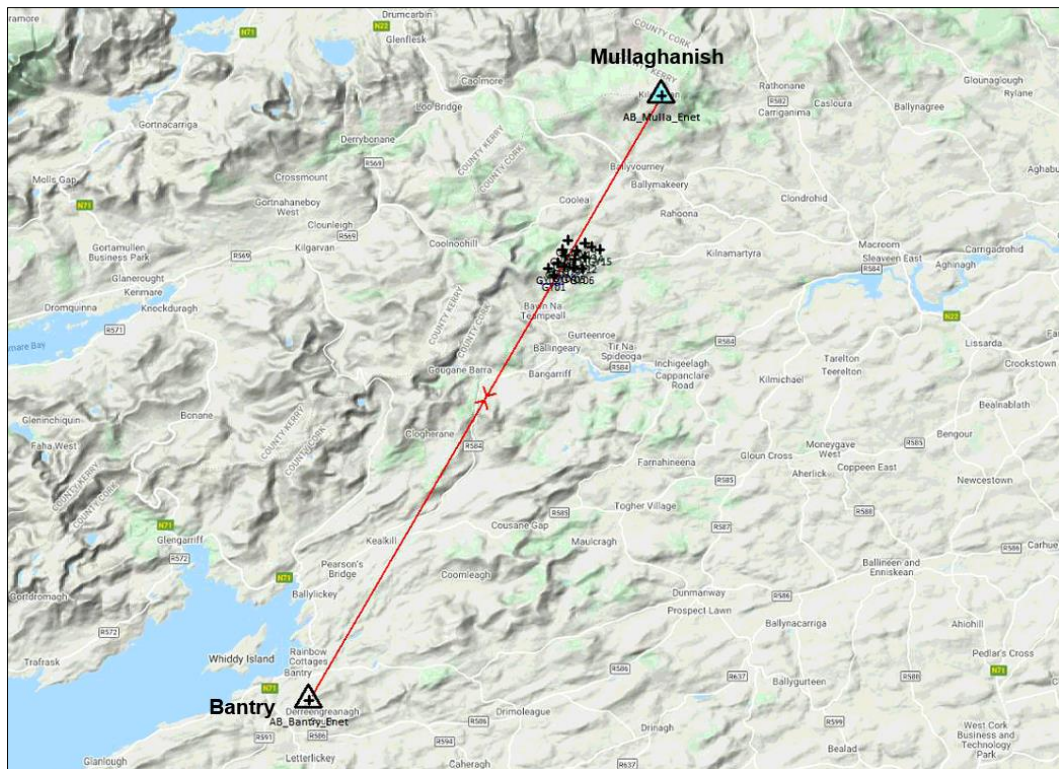



Figure 14. Plan View of Enet Telecommunications Links requiring Analysis

4.3.1 Link 7 Analysis (Mullaghanish to Bantry – Enet)

Figure 15 below shows a 3D view of the Enet link relative to the nearest of the proposed turbines (T04). Desktop analysis indicates that there is a clearance distance of 59m between the 2nd Fresnel Zone of the microwave radio link and the blade-tip of the nearest turbine (T04). At this distance the operation of the radio link will not be impacted.

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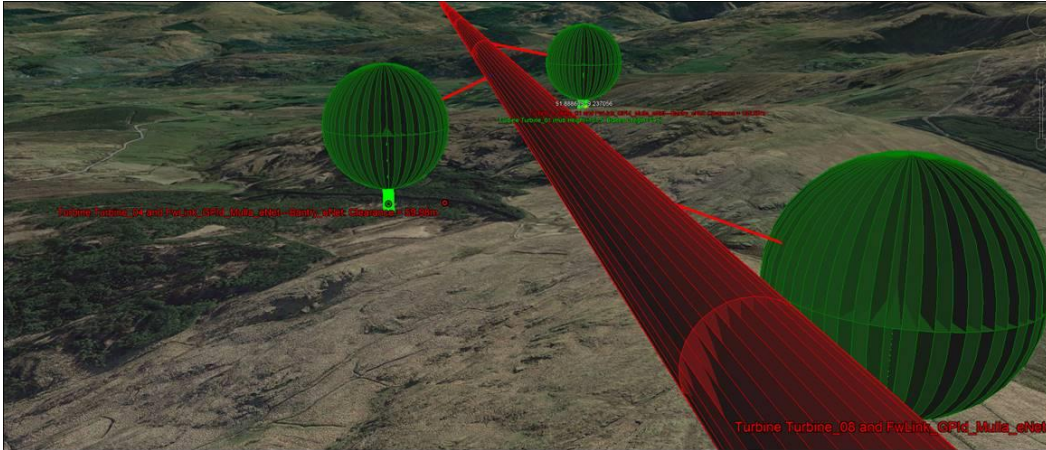



Figure 15. 3D view of Enet’s radio link between Mullaghanish and Bantry.


Table 14 below provides a brief summary of the desktop survey analysis of Link 7.

Operator	Enet
Link Description	Licensed PTP microwave radio link between Mullaghanish and Bantry.
Wind Farm Impacts	No Impacts

Table 14. Link 7 – Analysis Summary

 <i>Total Broadband Solutions</i>	Procedure: 001	Rev: 6.0
Title: Gortyrahilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

Section 5 - Conclusions

	Procedure: 001	Rev: 6.0
Title: Gortyrahilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

5. Conclusions

From the findings made in this report the following conclusions have been made:

- Results from telecom operator consultations and desktop survey analysis indicate that there are seven telecommunications links crossing through/near the proposed wind farm. In the event that a wind turbine is erected in a location that would block a radio link path, the operation of the link could be impacted.
- The telecommunications links which could potentially be impacted by the Gortyrahilly wind farm development are listed below in Table 15.

Operator	Licensed PTP Link Description	Impact of Wind Farm
Vodafone Ireland	PTP radio link from Mullaghanish to Ballingeary	No impacts. Network analysis indicates that this link is sufficiently far from the nearest turbine that the operation of the link will not be impacted.
Vodafone Ireland	PTP radio link from Mullaghanish to Bantry	No impacts. Network analysis indicates that this link is sufficiently far from the nearest turbine that the operation of the link will not be impacted.
Vodafone Ireland	PTP radio link from Inchee to Cashelmore	No impacts. Network analysis indicates that this link is sufficiently far from the nearest turbine that the operation of the link will not be impacted.
2RN	UHF radio link from Mullaghanish to Bantry	Unlikely to be impacted; however, Mitigation Measures have been agreed to eliminate potential impacts.
2RN	UHF link from Mullaghanish to Mt Gabriel	Unlikely to be impacted; however, Mitigation Measures have been agreed to eliminate potential impacts.
2RN	FM link from Mullaghanish to Bantry	Infringement of 4.78 m into the Fresnel Zone (0.6 Fresnel) Mitigation Measures have been agreed to eliminate potential impacts.
Enet	PTP radio link from Mullaghanish to Bantry	No impacts. Network analysis indicates that this link is sufficiently far from the nearest turbine that the operation of the link will not be impacted.

Table 15. Telecommunications Links potentially impacted by Gortyrahilly Wind Farm.

- To offset the potential impact on the 2RN FM link from Mullaghanish to Bantry, 2RN have confirmed that the following mitigation measure options are acceptable.


	Procedure: 001	Rev: 6.0
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Option 1 – Microwave radio link


- Installation of a microwave radio link \ FM Radio Multiplexor equipment upgrade to be installed and maintained on behalf of 2RN by a third party for duration of operation of the wind farm
- Annual Mast Rental costs at 2RN Mullaghanish and Bantry Mast sites to be covered by the wind farm owner for the duration of the operation of the wind farm.
- Estimate Costs
 - Once-off Hardware & Installation Costs : circa €20,000
 - Ongoing Mast Rental Costs : TBC pending response from 2RN
 - Ongoing Maintenance Costs : TBC pending response from 2RN

Option 2 – Fibre Broadband Connection

- Provision of a point to point 10MB dedicated internet access connection from 2RN Head-end site to Bantry Mast Transmitter site for an FM link noting that should there be a 50MB DIA connection for both FM and UHF links.
Note : standard fibre broadband services operate at minimum 100Mb , 1GB and 10GB connections
- Annual internet service charge to be covered by the wind farm owner for the duration of the operation of the wind farm.
- Estimate Costs
 - Once-off Hardware & Installation Costs : circa €20,000
 - Ongoing Internet Service Rental Costs : TBC pending response from 2RN
 - Ongoing Maintenance Costs : TBC pending response from 2RN

 <i>Total Broadband Solutions</i>	Procedure: 001	Rev: 6.0
Title: Gortyrahilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

APPENDIX A – Gortyrahilly Wind Farm Turbine Co-ordinates

	Procedure: 001	Rev: 6.0
Title: Gortyrhilly Telecommunications Impact Study	Approved: KH	Date: 21/07/22

Appendix A – Gortyrhilly Wind Farm Turbine Co-ordinates

The co-ordinates of the proposed wind turbines at Gortyrhilly are shown below in Table A.1

Turbine No.	ITM Easting (m)	ITM Northing (m)
T1	514907.000	571448.000
T2	514680.000	571824.000
T3	515202.687	572167.405
T4	515579.543	571928.530
T5	516128.564	571873.408
T6	516657.641	571816.859
T7	516168.645	572451.468
T8	515652.241	572674.507
T9	515483.825	572993.920
T10	515769.474	573426.672
T11	516329.340	572862.857
T12	516794.049	572483.804
T13	516818.699	573308.485
T14	517195.080	573067.183
T15	517591.630	572861.806

Table A.1 Gortyrhilly Wind Farm Turbine Co-ordinates