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Report


Lissinagroagh Wind Farm Telecommunications Impact Assessment Report

Document Number:

Author: DM/PT

Approved for Release: Rev 7.0 KH **Date:** 20/04/26

Document Filename: *Lissinagroagh Wind Farm Telecommunications Impact Assessment*

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Executive Summary


Ai Bridges was commissioned to evaluate the possible impacts that the proposed wind farm at Lissinagroagh, Co Leitrim could have on existing telecommunications operator networks. The scope of work included field and desktop surveys to determine telecommunications network infrastructure that could be impacted by the proposed development. Consultations with telecom operators were also undertaken to assist in identifying network infrastructure that could be impacted by the proposed wind farm.

Telecommunications mast-sites with network infrastructure that could potentially be impacted by the development were identified and a field survey of each of these sites was carried out. During the field surveys, radio antennas with bearings in the direction of the wind farm were recorded. The findings of the field surveys are provided in Appendix B of this report.

During the consultation process, twenty telecom operators were contacted. At the time of writing this report, fifteen of these operators have responded to the consultation request. The responses received from each of the telecom operators can be found in Section 3 of this report. Using the information obtained during the field survey assessments and consultation process a desktop impact analysis (2D and 3D) was carried out and all of the telecommunication operator networks were analysed using radio planning \ modelling software.

Results from the impact analysis indicate that although that there are five telecom operators (Ref. Table 1) with networks in the vicinity of the proposed development, only one operator network (2RN) would be impacted by the proposed turbine layout.

Operator	Link Description	Nearest Turbine(s)	Impacts / Observations	Possible Mitigation Measures
2RN	VHF off-air radio link from Truskmore to Monaghan.	T05 & T06	Interference Impact (Radio Link Fresnel Zone obstructed by T05 and T06)	<p>Option 1: Re-route the 2RN radio link via an alternative 2RN mast-site (e.g. Claremont Carn or Cairn Hill).</p> <p>Option 2: Re-route the FM (VHF) service into Monaghan via a new fibre broadband connection.</p> <p>Option 3: Link replacement with alternative PTP radio link.</p>
Enet	PTP radio link between Truskmore Mt and St. Michael's Primary School.	T12	No impacts. (Clearance > 900 m)	N.A.
ESB	Satellite Broadband Connection #1 (SAT#1) at Faughery MV Substation.	T06 & T09	No impacts. (Satellite path to/from SAT #1 would not be obstructed by proposed turbines)	N.A.
	Satellite Broadband Connection #2 (SAT #2) at Faughery MV Substation.	T06 & T09	No impacts. (Satellite path to/from SAT #2 would not be obstructed by proposed turbines)	N.A.
Adelphi (Net1)	PTP radio link between Dough Mt and Bee Park.	T13	No impacts. (Clearance > 500 m)	N.A.

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	PTP radio link between Dough Mt and O'Donnell's Rock.	T13	No impacts. (Clearance = 5.6 m)	<u>(Optional Mitigation Measures)</u> Option 1: Increase radio antenna installation height at Dough Mt. Option 2: Relay mast located within the proposed wind farm site.
Vodafone	PTP radio link between Truskmore and Lissinagroagh.	T13	No impacts. (Clearance = 33.3 m)	N.A.
	PTP radio link between Truskmore and Cornagee.	T14	No impacts. (Clearance > 250 m)	N.A.

Table 1. Telecom Operator Networks in the vicinity of the proposed wind farm.


Network analysis indicates that the 2RN VHF radio link between Truskmore and Monaghan would be impacted by turbines T05 and T06. Mitigation measures to offset the potential impacts of the proposed turbine layout on the 2RN radio link include: re-routing the impacted radio link via an alternative 2RN mast, re-routing the FM service into Monaghan via a new fibre broadband connection, or replacing the existing VHF link with an alternative radio link. These mitigation measures are outlined in Section 6.1 of this report. 2RN have been contacted in relation to the potential impact of T05 and T06 on their VHF radio link from Truskmore to Monaghan and have indicated they do not have any objection to the proposed development proceeding on the basis that any mitigation measures, if required, would be covered by the wind farm developer. It would be a requirement that all mitigation measure solutions would be discussed and agreed in the event of a consent of planning, and that the agreed mitigation measure solution would be implemented to the satisfaction of 2RN, and before the impacting turbines become operational. 2RN have stated that their preferred mitigation solutions in order of preference are:

1. Re-routing of the link via an alternative transmitter site
2. Use of Fibre circuits at the existing POP sites
3. Link replacement with alternative PTP radio link

It should be noted that 3D analysis indicates that the clearance distance between Turbine T13 and the Adelphi Net1 radio link between Dough Mt and O'Donnell's Rock would be relatively small (i.e. clearance distance from blade-tip of T13 to radio link Fresnel Zone = 5.6m). To account for any potential impacts that may be reported during the operational phase of the proposed development, optional mitigation measure solutions should be considered for this radio link. The optional mitigation measures available to the developer for the Adelphi radio link between Dough Mt and O'Donnell's Rock have been provided in Section 6.2 of this report. Adelphi Net1 have indicated that they are not opposed to the proposed development and have stated that they are agreeable to the proposed mitigation measure strategy (i.e. if mitigation measures are required for this radio link, the cost would be covered by the wind farm developer). Possible mitigation solutions for the Adelphi link are

1. Increasing the radio antenna height at Dough Mt
2. Relaying the link via a relay-mast located within the proposed wind farm site.

These mitigation measures are outlined in Section 6.2 of this report.


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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 approximately 3km northeast of Manorhamilton in County Leitrim. The development is in the pre-planning stage and exact details regarding the quantity, location and turbine dimension have yet to be finalized.

For the purpose of this study, a 14-turbine layout has been considered (Revised June 2025 Turbine Layout). The coordinates of the turbines assessed in this report are provided in Appendix A. The dimensions of the turbines assessed in this report are provided in Table 2 below.

Wind Farm	Number of Turbines	Turbine Tip Height	Turbine Rotor Diameter
Lissinagroagh	14	185 m	163 m

Table 2. Wind Farm Turbine Details

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

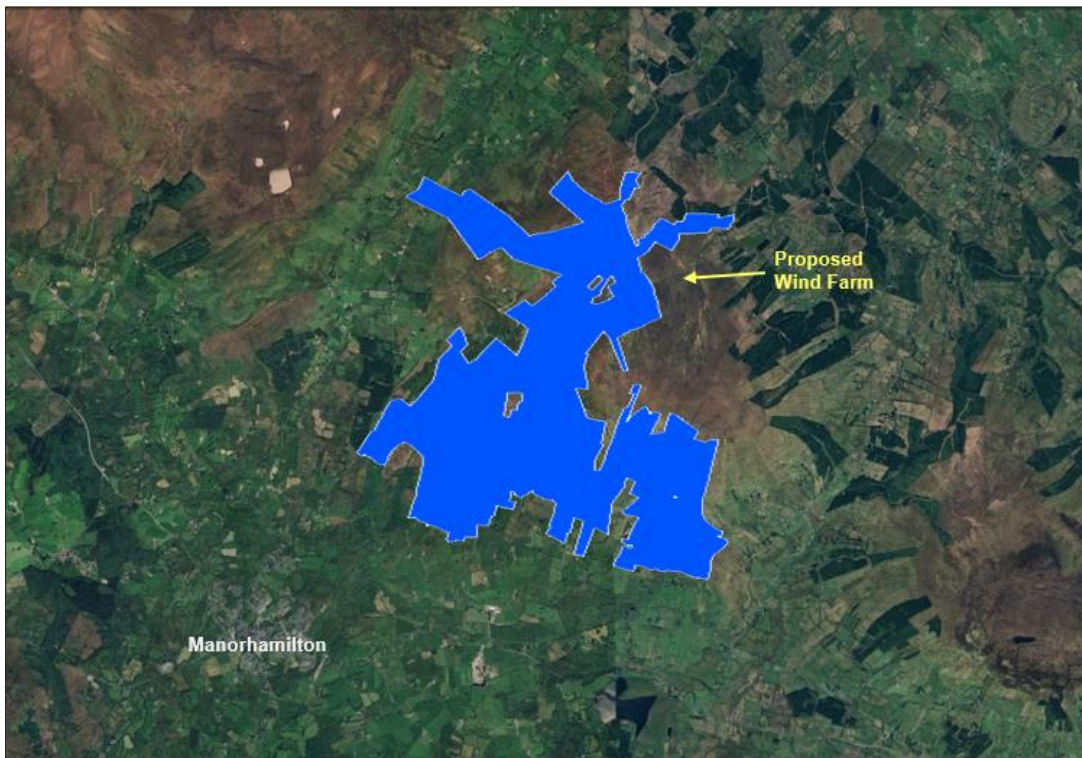




Figure 1. Location of proposed wind farm.*

** The outline included in the figure reflects the study area for the proposed development for purposes of this Telecommunications Assessment report and it does not represent the final Planning Boundary. The final Planning Boundary will not be significantly different to the boundary shown in the above figure and any differences will have negligible impacts on the findings of this report.*

 <i>Total Broadband Solutions</i>	Procedure: 001	Rev: 7.0
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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 Modelling and Analysis
- Report Generation

A summary of each of these stages is provided below:

Telecom Operator Consultations


Consultations are commenced with 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 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. A selection of mast-site coordinates is then obtained and inputs from various operators \ service providers are converted from Irish National Grid (Easting and Northing in meters) to degrees minutes seconds format and then 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 Lissinagroagh. Figure 2 below shows the proposed wind farm site boundary plotted in the radio planning tool.

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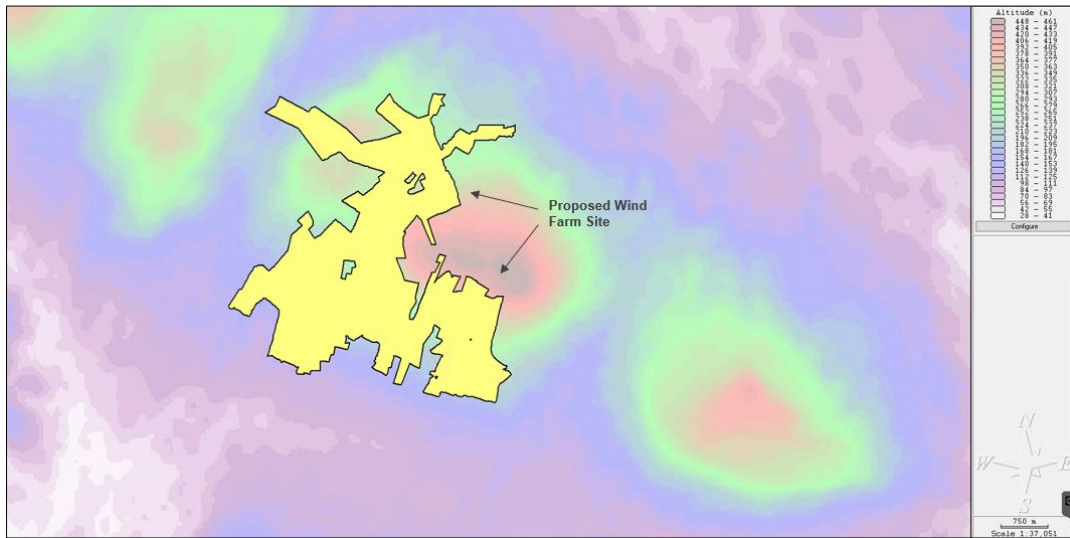


Figure 2. Wind Farm Boundary plotted in Radio Planning Software.*

The findings from the consultations and field surveys are collated and the communications networks requiring further analysis are identified. 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 crosses over/near the wind farm boundary modelled in radio planning software.

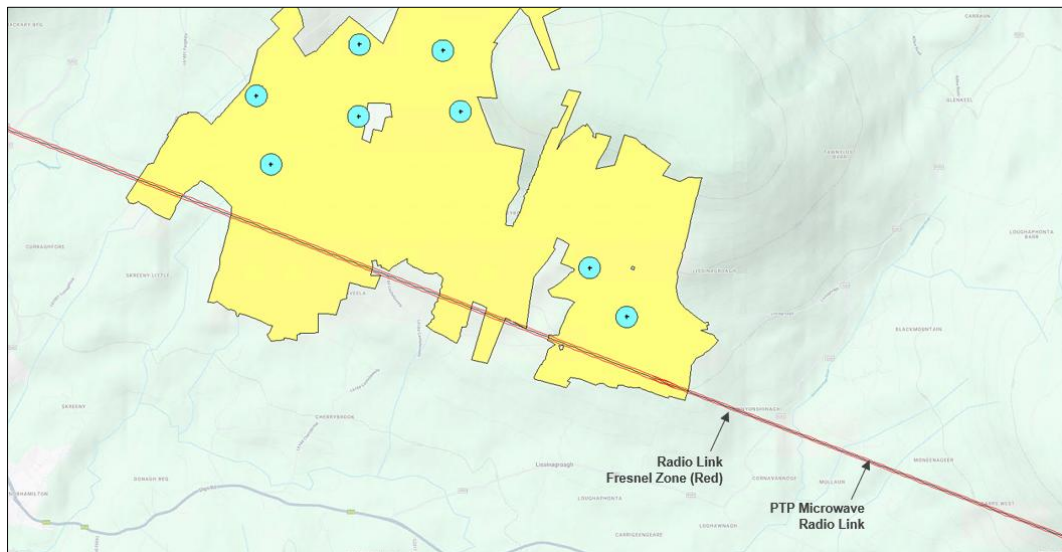



Figure 3. Example of microwave radio link crossing over/near the proposed wind farm boundary modelled in radio planning software.*


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.

** The outline included in the figure reflects the study area for the proposed development for purposes of this Telecommunications Assessment report and it does not represent the final Planning Boundary. The final Planning Boundary will not be significantly different to the boundary shown in the above figure and any differences will have negligible impacts on the findings of this report.*

 <i>Total Broadband Solutions</i>	Procedure: 001	Rev: 7.0
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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 March 2024 were undertaken with telecom network operators to assist in identifying 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 3.1.20.

ID	Operator	Response Received (Yes/No)	Issues raised by Operator \ Observations.
1	2RN	Yes	2RN have raised a concern regarding one VHF off-air radio link. 2RN have also requested that a protocol document be signed should the wind farm go ahead (regarding the TV broadcast service in the area).
2	Airwave	No	No response. (No response expected.)
3	An Garda Síochána	No	No response. (No response expected.)
4	Broadcast Authority of Ireland (BAI)	Yes	No issues.
5	BT Ireland	Yes	No issues.
6	CIE/Irish Rail	N.A.	The nearest rail line to the proposed development is more than 20 km away. At this distance there will no impact to CIE's communications network that operates along the rail line route.
7	Dept. of Defence	Yes	The DoD have acknowledged receipt of the consultation request and have stated that would revert in due course. To date, no issues have been raised.
8	Eir	Yes	No issues.
9	Enet	No	Enet have raised a concern regarding one Licensed PTP microwave radio link.
10	ESB Networks	No	No response. However, field survey data indicates that ESB have two Satellite Broadband connection at Faughery MV Substation
11	Imagine Broadband	Yes	No issues.
12	Irish Aviation Authority (IAA)	Yes	No issues.
13	Irish Water	Yes	No issues.
14	Leitrim County Council	Yes	No issues.
15	Adelphi (Net1)	Yes	Adelphi have raised a concern regarding two Licensed PTP microwave radio links.
16	Tetra Ireland (TI)	Yes	No issues.
17	Three Ireland	Yes	No issues.
18	Viatel	Yes	No issues.
19	Virgin Media	Yes	No issues.
20	Vodafone Ireland	Yes	Vodafone have raised a concern regarding two Licensed PTP microwave radio links.

Table 3. Telecom Operators Consulted

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3.1.1 2RN Response to Consultations

The email correspondence between 2RN and Ai Bridges Ltd are provided below:

11.03.24 2RN email to Ai Bridges Ltd

“We have an off-air link passing over the proposed windfarm between or Truskmore and Monaghan sites.

Link Name / ID	Band MHz/GHz	Link Length	Site A			Site B		
			Lat	Long	Ant Height	Lat	Long	Ant Height
TSK-MMN	90.4 MHz	89.8km	54.373904	-8.370805	64m AGL	54.185381	-7.030881	13m AGL

There is also a serious risk of interference to viewers to the southeast of the proposed site receiving from Truskmore.

We would therefore ask that a protocol be signed between the developer and 2rn should the site go ahead and that we be informed when the turbine locations and dimensions are defined.”

20.06.24 Ai Bridges Ltd email to 2RN

Hello Johnny,

Thank you for taking my call just now. As discussed, I am following up in relation to a new wind farm development , Lissinagroagh Wind Farm , where we have been assessing the impacts on Telecoms Networks.

We have sent out a previous consultation to your team on this site.

As discussed on our call we are seeing that there will be a potential impact to the 2RN off-air link from Truskmore to Monaghan. Our engineers have used the precedent of the Gortarahilly Wind Farm (correspondence included below) to model the impacts on the Lissinagroagh development.

Also attached please find the analysis and proposed mitigation measure solutions as well as mitigation measure cost estimates.

Would be grateful if you could review our assessment and proposed mitigation measure solutions and if you could assess the estimated costs

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

Best Regards,
Kevin Hayes,
Ai Bridges Ltd.,

20.06.24 2RN email to Ai Bridges Ltd

“Hi Kevin,


Thanks for sending this on. I'll take a look at your analysis and get back to you. Perhaps you could send me on again the latest turbine locations and details please – in case they have changed since we last looked at it.

In the meantime I've had a quick look back through my files on this one now.

First of all, it seems we signed a protocol with FuturEnergy Lissinagroagh for this one – with a note that some additional considerations for our off-air link needed to go into the EIA.

Couple of details on that:

- 1- There is just 1 FM radio off-air link at risk here (2FM from Truskmore). All other FM services are currently fed from Clermont Carr. 2FM cannot be received from Clermont due to a local adjacent channel radio interferer at the Monaghan site.*

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- 2- One of the proposed solutions was to deploy additional filtering at Monaghan so that 2FM could possibly be received from Clermont (this is untested)
- 3- Make use of local fibre, which is apparently available at the Monaghan site.
- 4- Since dealing with this previously in 2021/2022 we have brought 2FM on-air in Cairn Hill, and it is a potential alternative source to Truskmore. If feasible this is likely to be the least costly solution.

We also noted potential problems with an area of vulnerable reception from Truskmore around the village of Blacklion on the Cavan/Leitrim boarder. This area suffers from fringing diffracted reception from Truskmore, and co-channel interference from Clermont Cam, so is particularly at risk to windfarm disruption – I would call it high risk.

Regards, Johnny”

24.06.24 2RN email to Ai Bridges Ltd

“p.s. – I see the revised turbine locations in your document now – sorry missed that at first glance. We’ll take a look with these and get back to you. Regards, Johnny”

24.06.24 Ai Bridges Ltd email to 2RN

Hello Johnny,

Thank you for the prompt response on this.

We will look to re-write our proposed mitigations proposals based on the options below and we will also include reference to the potential TVI Impacts from service from Truskmore around the village of Blacklion on the Cavan/Leitrim boarder.

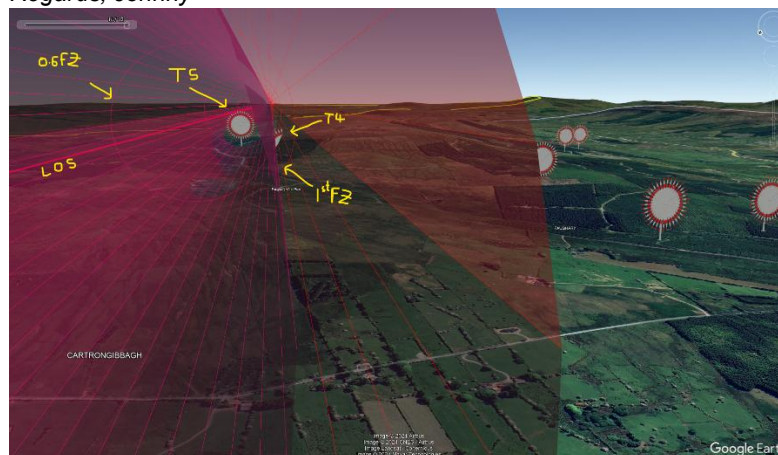
Best Regards,
Kevin Hayes,
Ai Bridges Ltd.,


26.06.24 2RN email to Ai Bridges Ltd

“Hi Kevin,

Having a look at the new turbine locations here, they do indeed seem a good bit worse from our perspective – compared to where they were previously when we last looked at this one. We can see turbine 5 just clips the line of sight and completely encroaches into the Fresnel zone. Turbine 4 sits between the 0.6 and 1st zone (at 88MHz) – as does the ground on this hill.

Regards, Johnny”



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27.06.24 Ai Bridges Ltd email to 2RN

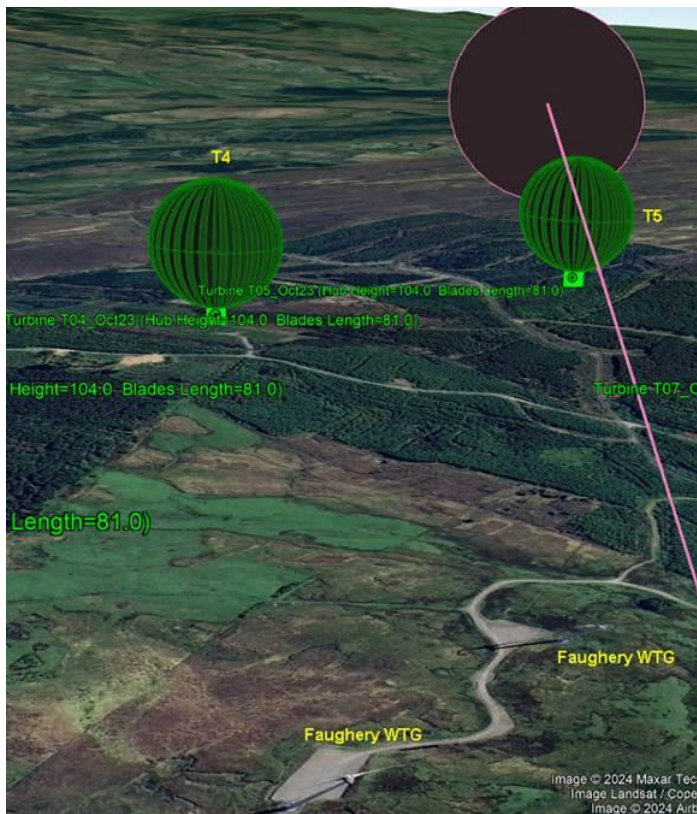
Hello Johnny,

Thank you for your prompt response on this. We have investigated this again our end and while we are seeing interference from the T05 turbine we are not seeing any interference from the T04 turbine and this is represented below

Also our engineers have observed that the operational Faughery Wind Farm turbines would also have an impact. They will look to get these turbine dimensions and assess the impact of these turbines.

Would you be available for a brief call to discuss.

Best Regards,
Kevin Hayes,
Ai Bridges Ltd.,




27.06.24 2RN email to Ai Bridges Ltd

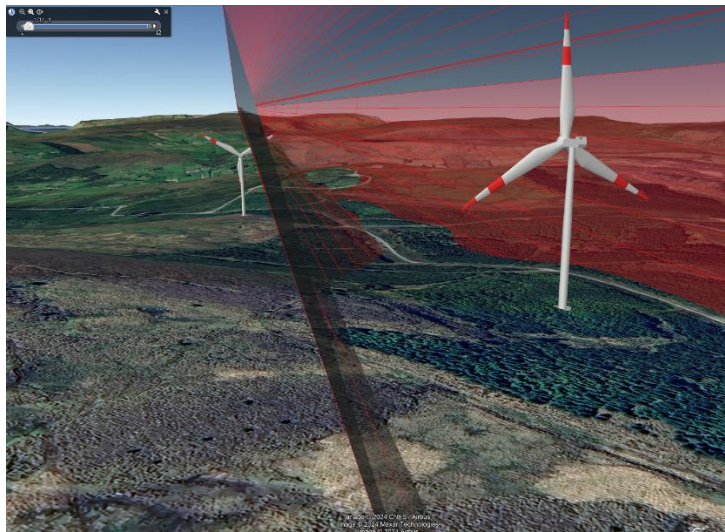
“Hi Kevin, apologies – my mistake, T6, not T4. It is T6 that I think breaks the 1st Fresnel zone (but is clear of the 0.6 zone). Shown on the left below.

We will also look at Faughery – I have a file on this, but it was possibly assessed (2011) before Truskmore more was used to feed Monaghan. Our file says that the Faughery turbines have 121m tip height, and it looks like T2 (Faughery) is right on the line of sight.

I'd be happy to take a call anytime tomorrow (9:30 to 11:30, or anytime after lunch)?

Regards, Johnny”

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27.06.24 Ai Bridges Ltd email to 2RN


Hi Johnny,

Thanks for that, our engineers can look at that Faughery turbine as well

Just another 3D view of the T04, T05 and the T06 turbines. We can see that T06 is outside the 0.6F1. I will try and give you a call tomorrow to discuss.

Best Regards,
 Kevin Hayes,
 Ai Bridges Ltd.,



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22.09.25 Ai Bridges Ltd email to 2RN

Hello Johnny,

I hope that you have been keeping well ?

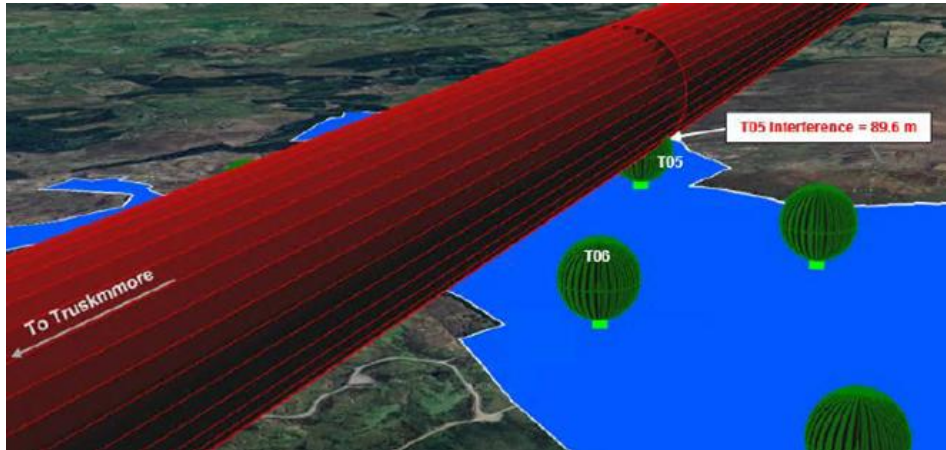
We have been asked to re-visit the link analysis below based on consideration of all other constraints.

In 2024 we identified an impact from T05 based on the Turbine Layout at that time 2RN broadcast network, as show below. Based on the revised 2025 Turbine Layout – the impact form T05 has reduced by 0.5m. Due to other constraints T06 has been moved and now interferes with the 2RN network and encroaches the broadcast radio link by 50.7m.

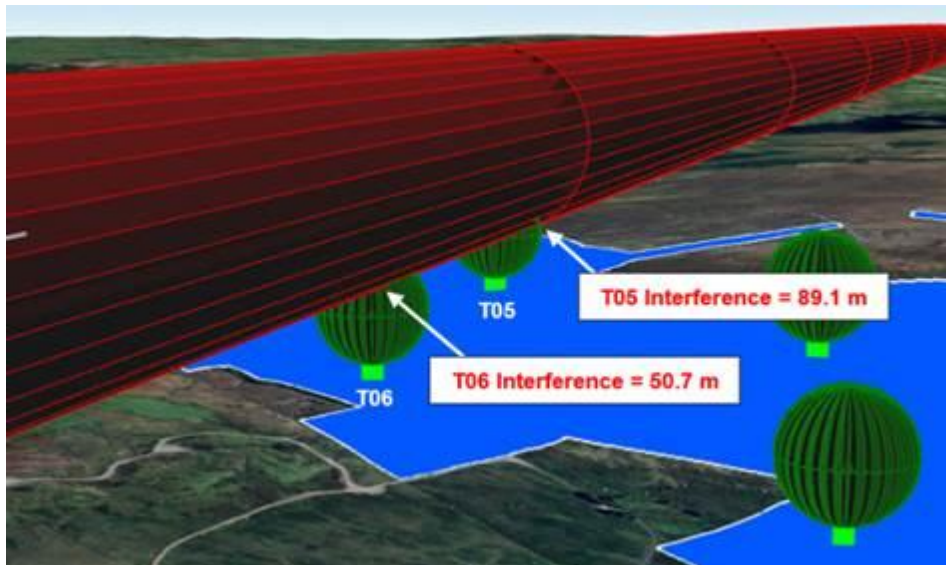
We have not considered the existing operational wind farm.


Would you be available tomorrow for a brief call to discuss possible mitigation measure solutions i.e. based on what was agreed on the wind farm impacts caused to the Mullaghanish – Bandon link where we put a mitigation measure protocol agreement account fibre \ radio solutions ?

2024



2025



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08.10.25 Ai Bridges Ltd email to 2RN

Hello Johnny,

I am following up from our last call. As discussed, please find the attached turbine co-ordinates in two formats:

1. The Green Table is the Lissinagroagh turbine layout in ITM Format
2. The Blue Table below are the coordinates – which we converted to WGS-84 format.
3. We modelled the turbines based on the following dimensions
 - Hub Height: 104 m
 - Rotor Radius: 81m

We will look to submit our Assessment Report in the same format as previously completed for the Gortarahilly project and we will note that in the event of a planning consent that the site developer would be conditioned to engage with 2RN to mitigate any impacts and that the developer would cover costs of mitigation.

The options that would be presented would be:

1. Link replacement with alternative PTP radio link
2. Re-routing of the link via an alternative transmitter site
3. Use of Fibre circuits at the existing POP sites

Would you be able to confirm that the above mitigation measure solution options are what we discuss on our last call.

RefName	ITM_X	ITM_Y	Name	Latitude	Longitude
T01	592596.207	844330.3931	T01	54° 20' 51.376"N	8° 6' 49.952"W
T02	591893.2422	844059.5263	T02	54° 20' 42.575"N	8° 7' 28.849"W
T03	591464.8867	844376.3995	T03	54° 20' 52.800"N	8° 7' 52.598"W
T04	592751.6129	843851.3224	T04	54° 20' 35.887"N	8° 6' 41.305"W
T05	592751.1814	843331.5233	T05	54° 20' 19.073"N	8° 6' 41.284"W
T06	592099.1026	843475.5097	T06	54° 20' 23.696"N	8° 7' 17.395"W
T07	592178.9712	842837.0337	T07	54° 20' 3.047"N	8° 7' 12.913"W
T08	592310.3589	842380.3584	T08	54° 19' 48.282"N	8° 7' 5.598"W
T09	591552.8611	842883.3822	T09	54° 20' 4.510"N	8° 7' 47.575"W
T10	591544.4751	842345.3228	T10	54° 19' 47.105"N	8° 7' 47.984"W
T11	590776.2101	842500.7544	T11	54° 19' 52.085"N	8° 8' 30.522"W
T12	590885.3721	841985.604	T12	54° 19' 35.428"N	8° 8' 24.424"W
T13	593280.1238	841205.2439	T13	54° 19' 10.319"N	8° 6' 11.830"W
T14	593558.369	840837.0472	T14	54° 18' 58.422"N	8° 5' 56.405"W

10.10.25 2RN email to Ai Bridges Ltd


“Hi Kevin, thanks for sending this info on.

T5 and T6 are directly in line with our off-air link for the national FM Radio broadcasting services at Monaghan. At these current planned locations we consider these turbines to create a risk to the existing FM radio distribution to Monaghan, and it would be our preference that these turbines be located to minimise this risk.

Failing that, please highlight our concerns with T5 and T6, and include the three mitigation options you have outlined in your email as discussed. Our order of preference for the mitigation solutions (which is probably also the order of least expensive to most expensive) is:

1. *Re-routing of the link via an alternative transmitter site*
2. *Use of Fibre circuits at the existing POP sites*
3. *Link replacement with alternative PTP radio link*

Happy to discuss further.”

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10.10.25 Ai Bridges Ltd email to 2RN

Hello Johnny,

Thank you for your email.

We will include and note the concerns raised below in relation to T5 and T6. We will also include the agreed mitigation measure solutions below in the order of preference below.

We will also propose that all mitigation measure solutions be discuss and agreed in the event of a consent of planning and that the agreed mitigation measure solution would be implemented to the satisfaction of 2RN and before the impacting turbines become operational.

3.1.2 Airwave Response to Consultations

To date no response has been received.

3.1.3 An Garda Síochána Response to Consultations

To date no response has been received.

3.1.4 Broadcast Authority of Ireland (BAI) Response to Consultations

The BAI provided the following email response to consultations:

“The BAI does not perform an in-depth analysis of the effect of wind turbines on FM networks. However, we are not aware of any issues from existing windfarms into existing FM networks. Also, the proposed windfarms are not located close to any existing or planned FM transmission sites.”

3.1.5 BT Ireland Response to Consultations

BT provided the following email response to consultations:

“BT no longer have microwave network.”

3.1.6 CIE/Irish Rail Response to Consultations

N.A. The nearest rail line to the proposed development is more than 20 km away. At this distance there will no impact to CIE’s communications network that operates along the rail line route.

3.1.7 Department of Defence Response to Consultations


The Department of Defence provided the following email response to consultations:

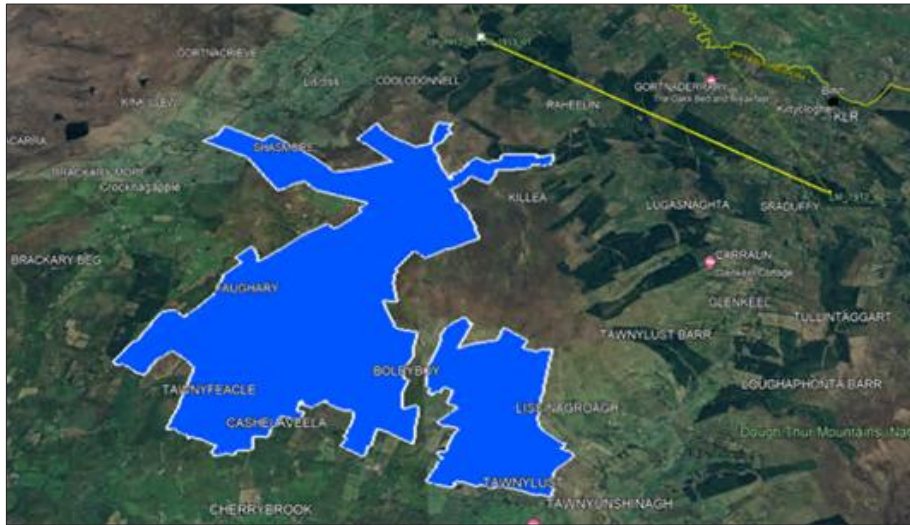
“The Department of Defence wishes to acknowledge receipt of you e-mails below re: the proposed Leitrim Wind Farm Development. We will consult with our Defence Forces colleagues and we will revert in due course.”

3.1.8 Eir Response to Consultations

Eir provided the following email response to consultations:

“We have no transmission links within the proposed area and it has no risk to the network for Eir Mobile or the Eir fixed network.”

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3.1.9 Enet Response to Consultations

Enet provided the following email response to consultations:

“We have one link passing through this area:”

Link Name / ID	Band MHz/GHz	Link Length	Site A			Site B		
			Lat	Long	Ant Height	Lat	Long	Ant Height
RTE Truskmore / SCP1053 - St. Michael's Primary School	11GHz	21.4km	54°22'26.14"N	8°22'15.09"W	20m	54°17'53.39"N	8° 4'5.99"W	12m

3.1.10 ESB Networks Response to Consultations

To date no response has been received.

Note: Although there has been no response received from ESB in relation to the Lissinagroagh wind farm, field survey data indicates that ESB operate two Satellite Broadband connections at Faughery MV substation, adjacent to the proposed wind farm at Lissinagroagh.

3.1.11 Imagine Broadband Response to Consultations

Imagine Broadband provided the following email response to consultations:

“At present Imagine have no microwave links affected by this development. Your mail has been forwarded to our radio planning department. They will respond directly if they have any concerns.”

3.1.12 IAA Response to Consultations


The IAA provided the following email response to consultations:

“There are no issues for ANI Navigational-Aids.”

3.1.13 Irish Water (Uisce Éireann) Response to Consultations

Irish Water provided the following email response to consultations:

“I can confirm that there are no Uisce Éireann telemetry communications links traversing the proposed wind farm study area.”

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3.1.14 Leitrim County Council Response to Consultations

Leitrim County Council provided the following email response to consultations:

"We dont have any telecommunications equipment in the location you are referring to as we are not a Telecoms provider."

3.1.15 Adelphi (Net1) Response to Consultations

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

From: Kevin Hayes
Date: Fri, 15 Mar 2024 at 09:06
Subject: RE: Leitrim Wind Farm Development
To: John Gartlan
Cc: Info - AiBridges

Dear John,


I am following up from our email correspondence below and our telephone call earlier this week. We have conducted a due diligence telecommunications mast survey at Dough Mountain and O'Donnell's Rock. We would be grateful if you could confirm if the telecoms masts that we have identified below are the locations of your telecoms network infrastructure points of presence. Also we would be grateful which of the masts in the photo below at O'Donnell's Rock does Net1 operative off.

We would be grateful if you could complete the table below with the links that traverse the proposed development site.

Link Name / ID	Band MHz/GHz	Link Length	Site A					Site B						
			Lat	Long	Easting	Northing	Ant Height	Lat	Long	Easting	Northing	Ant Height		

Dough Mountain



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O'Donnell's Rock



From: John Gartlan
Sent: 15 March 2024 09:18
To: Raymond Ferguson; Declan Holland; Kevin Hayes
Subject: Fwd: Leitrim Wind Farm Development

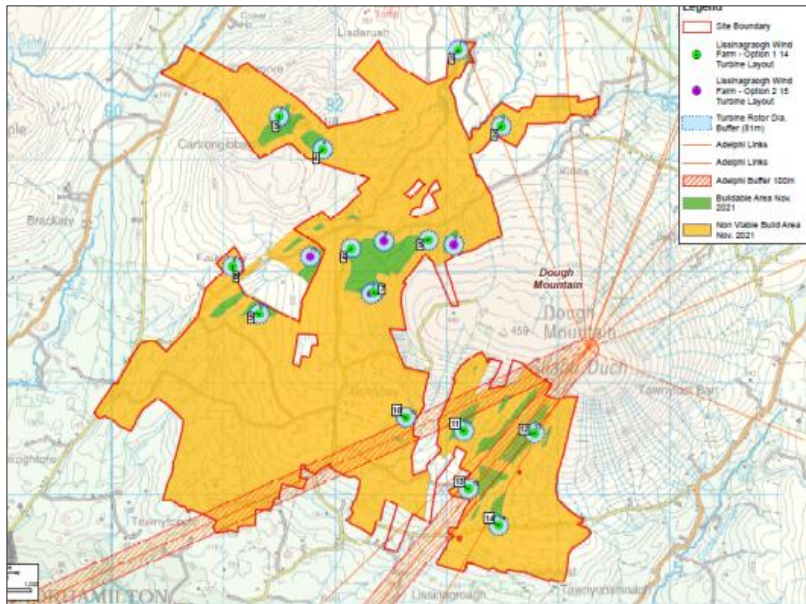
“Kevin


*We are tired filling in things for all the various proposed windfarm developments near Dough.
...”*

----- Forwarded message -----

From: Raymond Ferguson
Date: Fri, 15 Mar 2024 at 11:52
Subject: Fwd: FW: Adelphi links passing through the wind farm at Lissinagroagh
To: John Gartlan

“Some of the correspondence with the last guy”

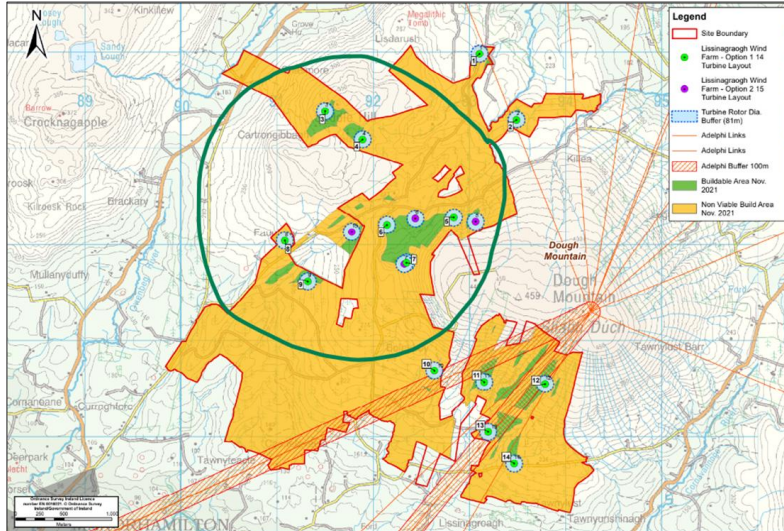


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----- Forwarded message -----

From: Raymond Ferguson
Date: Fri, 15 Mar 2024 at 11:50
Subject: windfarm dough
To: John Gartlan

“You can let Kevin know that this area doesn’t affect us at all.”



08.10.24 Ai Bridges Ltd Email to Adelphi (Net1)

Hello John,

Thank you for taking my call and for noting that you do not expect there to be an impact from the proposed development based on the previous correspondence below dating back to 2024.

As discussed, the developers of the Lissinagroagh wind farm have requested that we follow up with you to advise that they will be submitting a planning application for the proposed development.

The developer acknowledges that if there were to be a potential impact on the Adelphi Net1 telecoms network that they would

- 1. cover the cost of any mitigation measure solution, should there be an impact to the Adelphi including replacing mast and increasing the height, a link re-route etc*
- 2. be conditioned to implement a mitigation measure solution, to the agreement and satisfaction of Adelphi Net1, in the event of a potential wind turbine impact on the Adelphi Net1 radio link.*

I would be grateful if you could confirm that you would accept the proposed mitigation measure strategy above.


*Best Regards,
Kevin Hayes.*

09.10.24 Ai Bridges Ltd Email to Adelphi (Net1)

“Hi Kevin,

We are happy with this proposal.

*Kind Regards
John”*

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3.1.16 Tetra Ireland (TI) Response to Consultations

Tetra Ireland provided the following email response to consultations:

"We anticipate no impact from the development as proposed."

3.1.17 Three Ireland Response to Consultations

Three Ireland provided the following email response to consultations:

"This development won't have an impact on our transmission network."

3.1.18 Viatel Response to Consultations

Viatel provided the following email response to consultations:

"No impact on Viatel wireless network."

3.1.19 Virgin Media Response to Consultations

Virgin Media provided the following email response to consultations:

"Virgin Media Ireland DO NOT have any radio links in this area"


3.1.20 Vodafone Response to Consultations

Vodafone provided the following email response to consultations:


"Please see details below. A clearance of 30m from the first Fresnel zone is desired."

Link Name / ID	Band MHz/GHz	Link Length	Site A			Site B		
			Lat	Long	Ant Height	Lat	Long	Ant Height
S0013LM014_S0	15 GHz	18.68km	54.31954389	-8.098181918	21m	54.37391739	-8.370813549	17m
S0013CNGFR_S0	18 GHz	31.32km	54.27238703	-7.920266668	15m	54.37391739	-8.370813549	15m



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Section 4 - Field Surveys

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4. Introduction

To assess the accuracy of the network information (radio link co-ordinates, antenna heights etc.) provided by the telecom operators, field surveys of the telecom-mast sites in the vicinity of the proposed wind farm were carried out. During the field surveys, radio antennas with bearings in the direction of the wind farm were recorded.

The telecom mast-sites surveyed for this study (labelled Mast-Site A to Mast-Site I) are shown relative to the proposed wind farm site in Figure 4 below. The findings from the field surveys of the mast-sites are presented in Appendix B of this report.

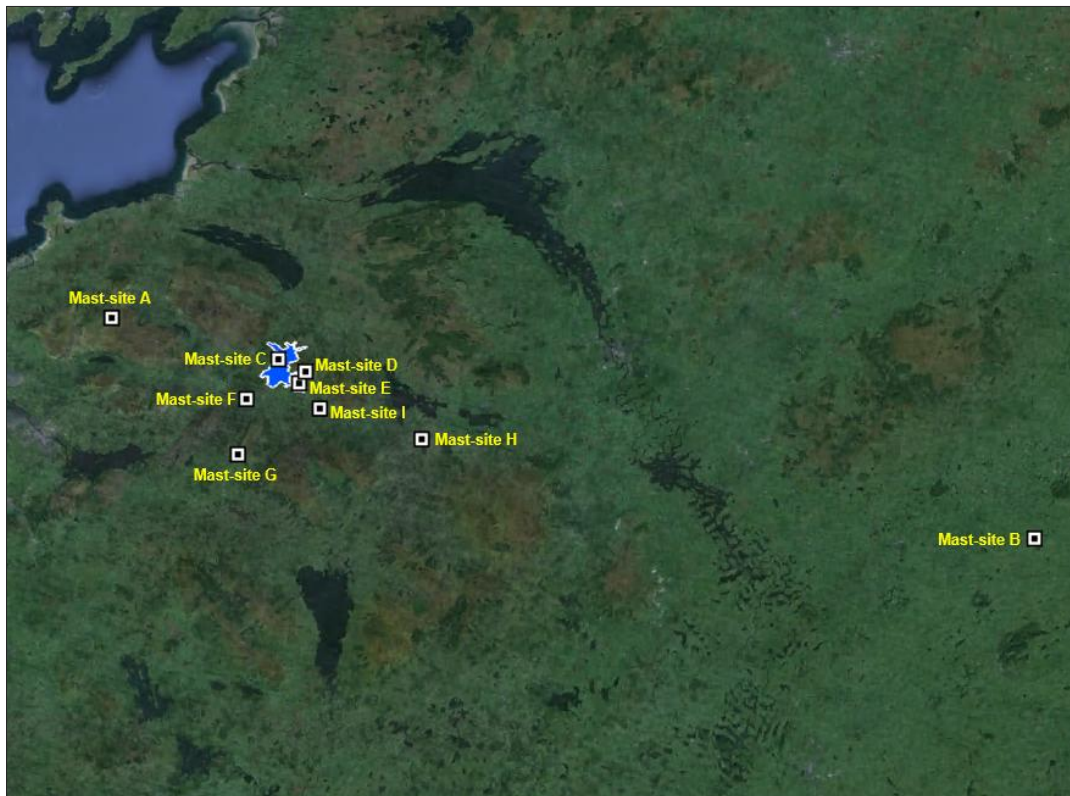




Figure 4. Telecom Mast-Sites Surveyed.

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Section 5 - Desktop Survey Analysis

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5. Introduction

Based on the findings of the consultation process and field surveys, there are four Telecom Operators with networks in the vicinity of the proposed development that require a detailed technical analysis:

- 2RN Network
- Enet Network
- ESB Network
- Adelphi (Net1) Network
- Vodafone Network

Sections 5.1 to 5.5 below outlines the desktop survey analysis findings* for the Telecom Operator Networks listed above. In Section 5.6 an assessment of Cumulative Impacts is provided.

5.1 2RN Network Analysis

The 2RN network in the vicinity of the proposed wind farm consists of one VHF off-air radio link. The radio link is listed below in Table 4 and a Plan View of the 2RN network is shown in Figure 5. The plan view indicates that radio link is potentially impacted by the proposed wind farm development.

Link ID	Operator	Link Description
1	2RN	VHF off-air radio link from Truskmore to Monaghan.

Table 4. 2RN Radio Links requiring Analysis

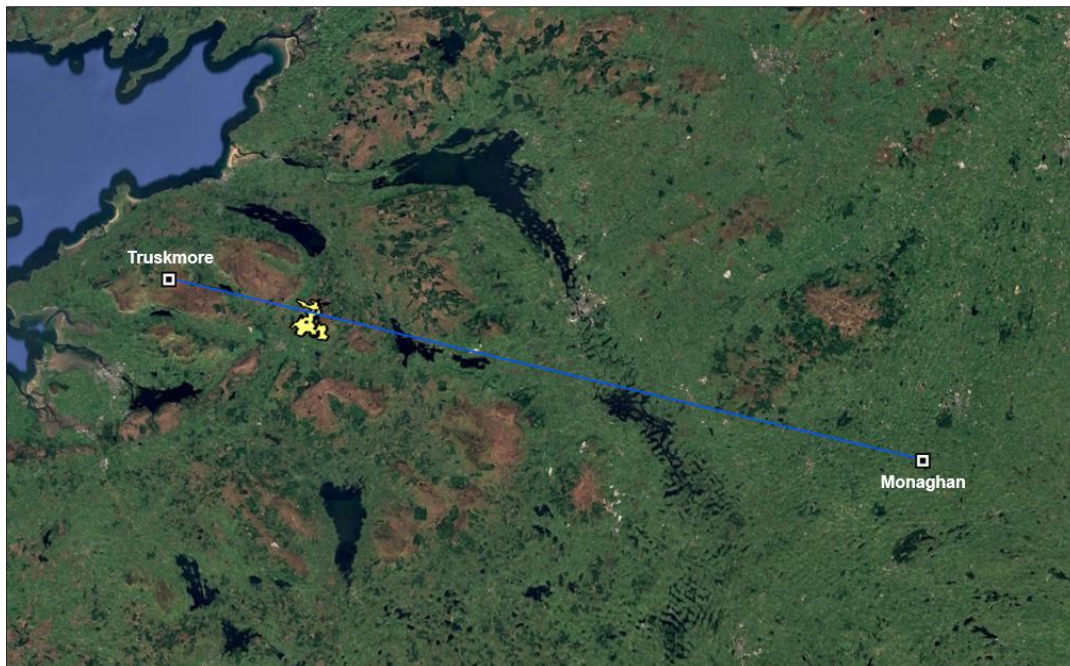



Figure 5. 2RN Radio Network – Plan View

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

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To further assess the potential impact, the radio link has been modelled in 3D and the Clearance Distances between the Fresnel Zone of the link and the blade-tip of the nearest turbine(s) have been calculated. A 3D view of the microwave radio link relative to the proposed turbines is shown below in Figure 6.

The results of the 3D analysis indicate that turbines T05 and T06 would obstruct the Fresnel Zone of the radio link (i.e. the operation of the 2RN radio link would be impacted by T05 and T06).

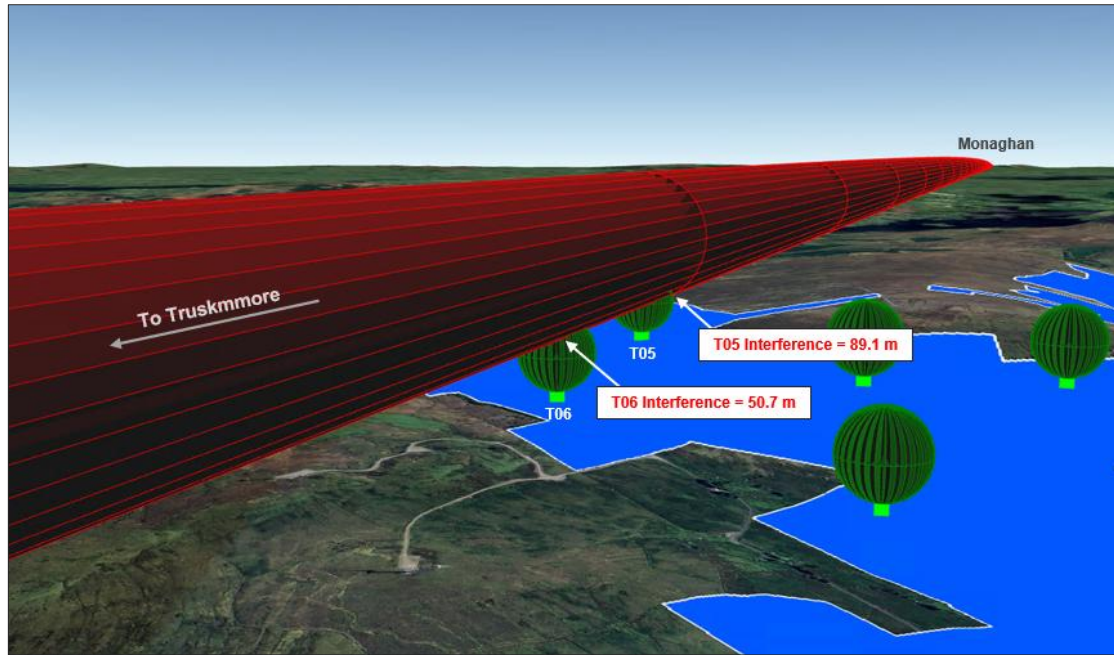



Figure 6. 2RN Network – 3D View.

Table 5 below provides a brief summary of the radio link interference analysis for the closest turbines (T05 and T06) to the 2RN radio link.

Radio Link ID	Link Description	Nearest Turbine(s)	Fresnel Zone (0.6F) Clearance / Interference	Wind Farm Impacts
2RN Link 1	Truskmore to Monaghan.	T05	-89.1 m (Infringement into Fresnel Zone)	Potentially Impacted (Mitigation measures required)
		T06	-50.7 m (Infringement into Fresnel Zone)	

Table 5. 2RN Network – Analysis Summary

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5.2 Enet Network Analysis

The Enet network in the vicinity of the proposed wind farm consists of one Point-to-Point (PTP) microwave radio link. The radio link is listed below in Table 6 and a Plan View of the Enet network is shown in in Figure 7. The plan view indicates that radio link is potentially impacted by the proposed wind farm development.

Link ID	Operator	Link Description
1	Enet	PTP microwave radio link from Truskmore to St. Michael's Primary School.

Table 6. Enet Radio Links requiring Analysis



Figure 7. Enet Radio Network – Plan View*

To further assess the potential impact, the radio link has been modelled in 3D and the Clearance Distances between the Fresnel Zone of the link and the blade-tip of the nearest turbine(s) have been calculated. A 3D view of the microwave radio link relative to the proposed turbines is shown below in Figure 8.

The results of the 3D analysis indicate that the Enet radio link is over 900m from the nearest of the proposed turbines (T12). At this distance there will be no impact on the Enet radio link due to the proposed wind farm development

** The outline included in the figure reflects the study area for the proposed development for purposes of this Telecommunications Assessment report and it does not represent the final Planning Boundary. The final Planning Boundary will not be significantly different to the boundary shown in the above figure and any differences will have negligible impacts on the findings of this report.*


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Figure 8. Enet Network – 3D View.*

Table 7 below provides a brief summary of the radio link interference analysis for the Enet network.

Radio Link ID	Link Description	Nearest Turbine(s)	Fresnel Zone (F1) Clearance / Interference	Wind Farm Impacts
Enet Link 1	Truskmore to St. Michael's Primary School.	T12	> 900 m	No impacts.

Table 7. Enet Network – Analysis Summary

* The outline included in the figure reflects the study area for the proposed development for purposes of this Telecommunications Assessment report and it does not represent the final Planning Boundary. The final Planning Boundary will not be significantly different to the boundary shown in the above figure and any differences will have negligible impacts on the findings of this report.

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5.3 ESB Network Analysis

The ESB network in the vicinity of the proposed wind farm consists of two Satellite Broadband connections at Faughery MV Substation. The communications links are listed below in Table 8 and a Plan View of the ESB MV Substation at Faughery wind farm is shown in Figure 9.

ID	Operator	Link Description
SAT #1	ESB	Satellite Broadband connection on recorded bearing of 160°
SAT #2	ESB	Satellite Broadband connection on recorded bearing of 205°

Table 8. ESB Communications Links requiring Analysis



Figure 9. ESB Communications Network – Plan View

Obstacles do not impact Satellite Broadband Connections unless they obstruct the LOS (Line-of-Sight) path to the serving satellite. This only occurs when the obstacle is in close proximity to the satellite dish and has a height above the base of the satellite dish that would obstruct the LOS.

Figure 10 below shows that the nearest of the proposed turbines to SAT #1 are T06 and T09. As the figure shows, neither of the turbines would obstruct the LOS from SAT #1 to the serving satellite. As none of the proposed turbines would obstruct the satellite path to/from SAT #1, there would be no impact to the satellite service.


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Figure 10. ESB – SAT #1

Figure 11 below shows that the nearest of the proposed turbines to SAT #2 would be T06 and T09. As the figure shows, neither of the turbines would obstruct the LOS from SAT #2 to the serving satellite. As none of the proposed turbines would obstruct the satellite path to/from SAT #2, there would be no impact to the satellite service.

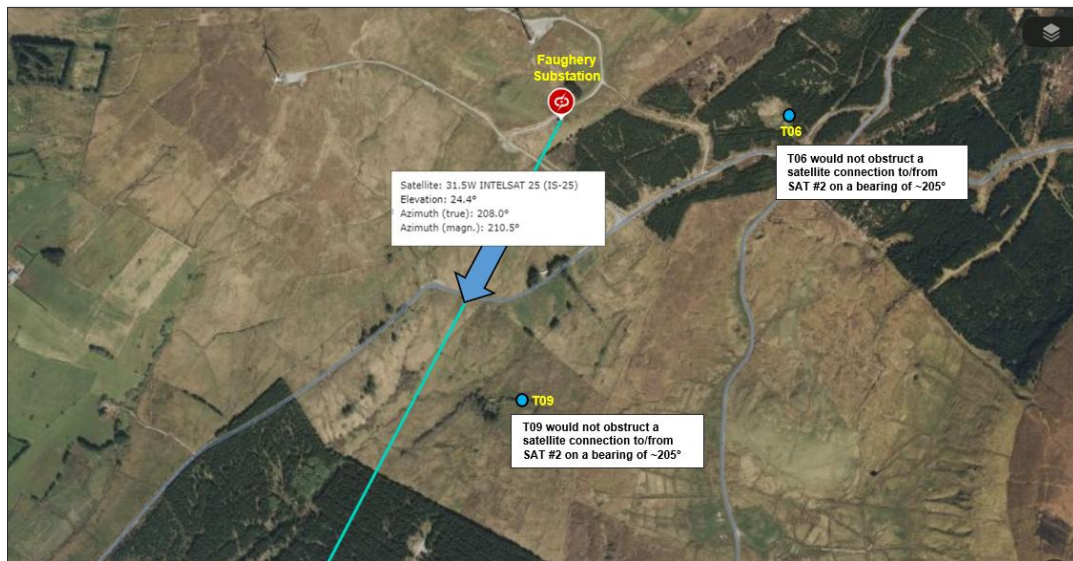



Figure 11. ESB – SAT #2

ID	Description	Nearest Turbines to LOS	Wind Farm Impacts
SAT #1	Satellite Broadband Connection (Dish on recorded bearing of 160°)	T06 and T09	No impacts.
SAT #2	Satellite Broadband Connection (Dish on recorded bearing of 205°)	T06 and T09	No impacts.

Table 9. ESB Network – Analysis Summary

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5.4 Adelphi (Net1) Network Analysis

The Adelphi network in the vicinity of the proposed wind farm consists of two Point-to-Point (PTP) microwave radio links. The radio links are listed below in Table 10 and a Plan View of the Adelphi network is shown in Figure 12. The plan view indicates that radio links are potentially impacted by the proposed wind farm development.

Link ID	Operator	Link Description
1	Adelphi	PTP microwave radio link from Dough to Bee Park.
2	Adelphi	PTP microwave radio link from Dough to O'Donnell's Rock.

Table 10. Adelphi Radio Links requiring Analysis

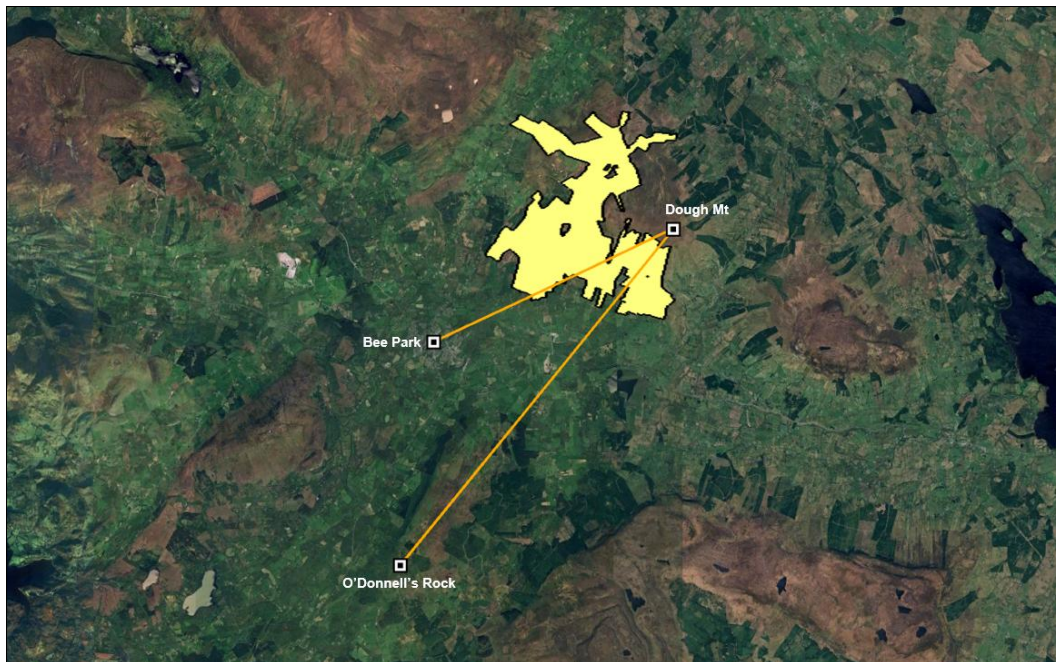



Figure 12. Adelphi Radio Network – Plan View*

A close-up plan view of the proposed turbines shown relative to the Adelphi radio links is provided below in Figure 13. The plan view indicates that the radio link between Dough and O'Donnell's Rock could potentially be impacted by the proposed turbine layout. To further assess the potential impacts, the radio links have been modelled in 3D and the Clearance Distances between the Fresnel Zones and the blade-tip of the nearest turbine(s) have been calculated. A 3D view of the microwave radio links relative to the proposed turbines is shown below in Figure 14.

The results of the 3D analysis indicate the proposed turbines would not obstruct the Fresnel Zone of either of the two Adelphi radio links from Dough. However, the clearance distance between the blade-tip of T13 and the radio link to O'Donnell's Rock is relatively small at 5.3 m. Should Adelphi have any concerns regarding the proximity of T13 to the Fresnel Zone of this link, optional mitigation measures are available to the developer. These mitigation measures are outlined in Section 6 of this report.

** The outline included in the figure reflects the study area for the proposed development for purposes of this Telecommunications Assessment report and it does not represent the final Planning Boundary. The final Planning Boundary will not be significantly different to the boundary shown in the above figure and any differences will have negligible impacts on the findings of this report.*

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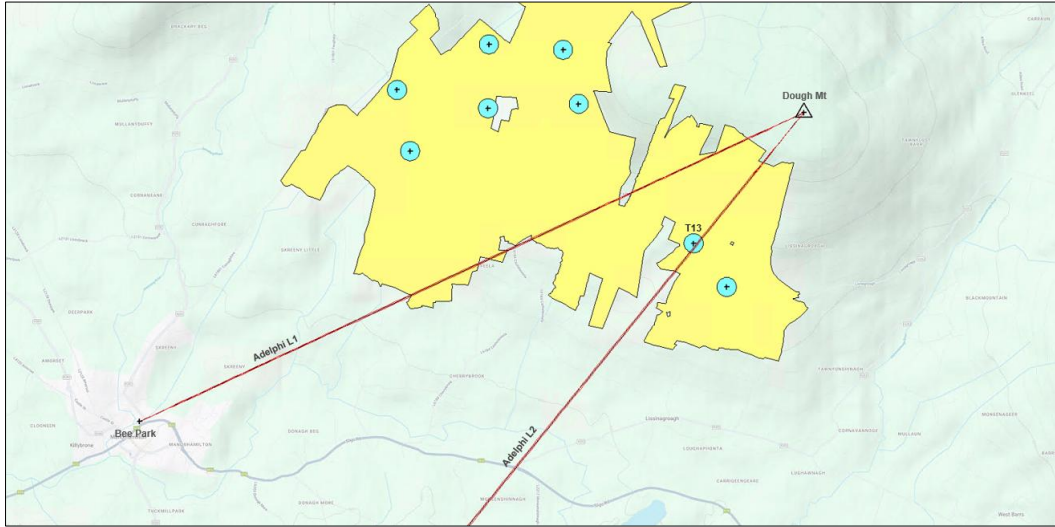


Figure 13. Adelphi Network – Close-up Plan View.*

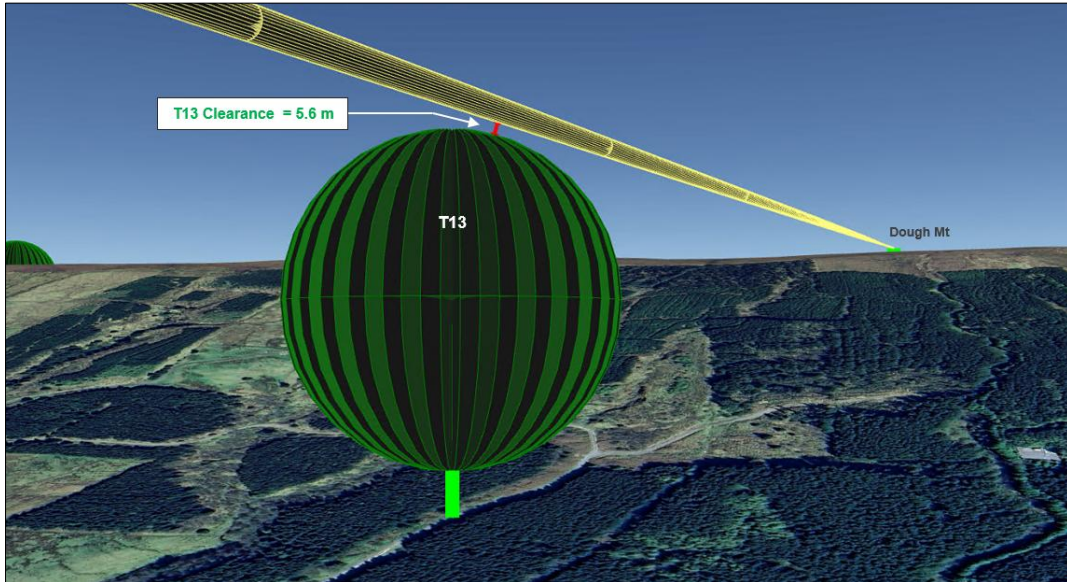



Figure 14. Adelphi Network – 3D View.

Table 11 below provides a brief summary of the radio link interference analysis for the closest turbines to Adelphi radio links.

Radio Link ID	Link Description	Nearest Turbine(s)	Fresnel Zone (F1) Clearance/Interference	Wind Farm Impacts
Adelphi Link 1	Dough to Bee Park	T13	> 500 m	No Impacts.
Adelphi Link 2	Dough to O'Donnell's Rock	T13	5.6 m	No impacts. Should Adelphi have any concerns regarding the proximity of T13, optional mitigation measures are available. (Ref. Section 6).

Table 11. Adelphi Network – Analysis Summary

* The outline included in the figure reflects the study area for the proposed development for purposes of this Telecommunications Assessment report and it does not represent the final Planning Boundary. The final Planning Boundary will not be significantly different to the boundary shown in the above figure and any differences will have negligible impacts on the findings of this report.

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5.5 Vodafone Ireland Network Analysis

The Vodafone network in the vicinity of the proposed wind farm consists of two Point-to-Point (PTP) microwave radio links. The radio links are listed below in Table 12 and a Plan View of the Vodafone network is shown in Figure 15. The plan view indicates that radio links are potentially impacted by the proposed wind farm development.

Link ID	Operator	Link Description
1	Vodafone	PTP microwave radio link from Truskmore to Lissinagroagh.
2	Vodafone	PTP microwave radio link from Truskmore to Cornagee

Table 12. Vodafone Radio Links requiring Analysis

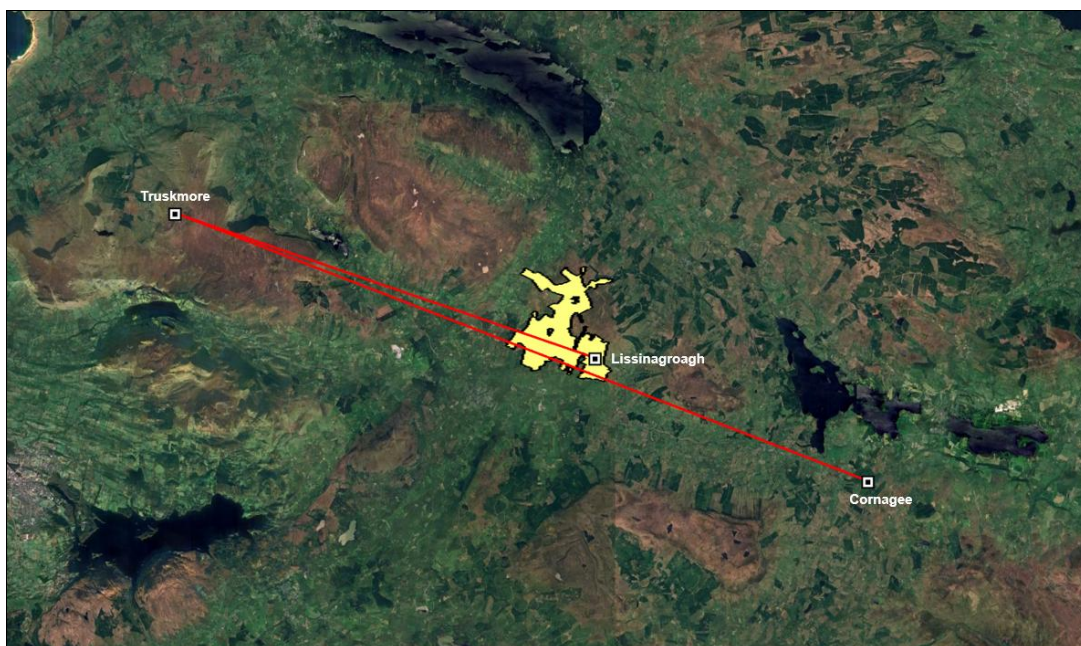



Figure 15. Vodafone Radio Network – Plan View*

To further assess the potential impacts, the radio links have been modelled in 3D and the Clearance Distances between the Fresnel Zones and the blade-tip of the nearest turbine(s) have been calculated. A 3D view of the microwave radio links relative to the proposed turbines is shown below in Figure 16.

The results of the 3D analysis indicate that none of the proposed wind turbines would obstruct either of the Vodafone radio links.

** The outline included in the figure reflects the study area for the proposed development for purposes of this Telecommunications Assessment report and it does not represent the final Planning Boundary. The final Planning Boundary will not be significantly different to the boundary shown in the above figure and any differences will have negligible impacts on the findings of this report.*

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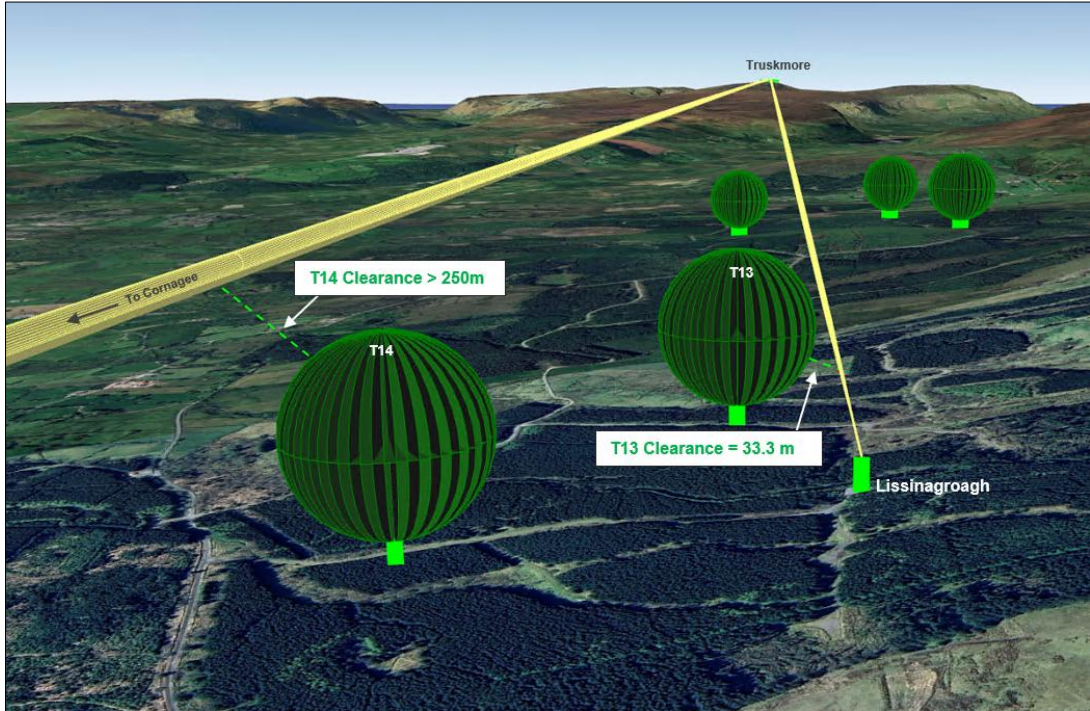



Figure 16. Vodafone Network – 3D View.

Table 13 below provides a brief summary of the radio link interference analysis for the closest turbines to both of the Vodafone radio links.

Radio Link ID	Link Description	Nearest Turbine(s)	Fresnel Zone (F1) Clearance/Interference	Wind Farm Impacts
Vodafone Link 1	Truskmore to Lissinagroagh	T13	33.3 m	No Impacts.
Vodafone Link 2	Truskmore to Cornagee	T14	> 250 m	No Impacts.

Table 13. Vodafone Network – Analysis Summary

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5.6 Cumulative Impacts

As the proposed development is relatively close to the border with Northern Ireland (i.e. approximately 3 km), the potential for cumulative impacts on cross-border radio links have been assessed.

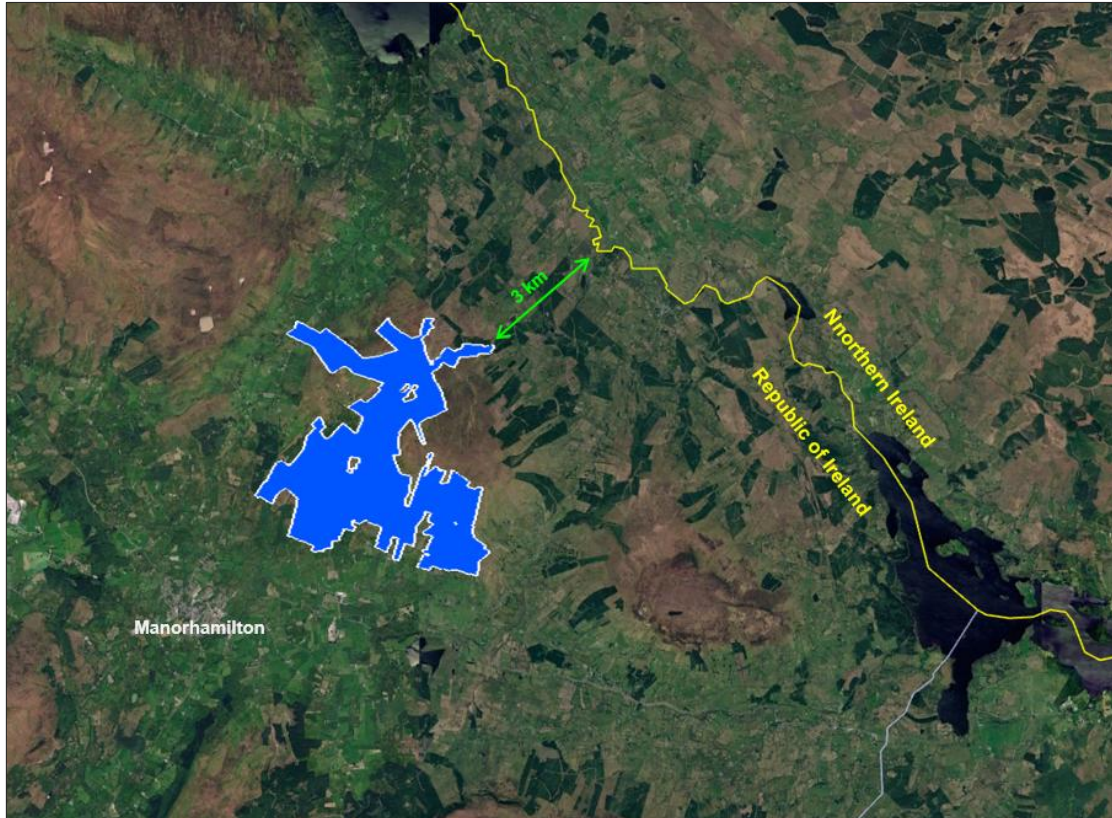




Figure 17. Proximity of proposed development to Northern Irish Border

During the field surveys no radio links were observed in the direction of Northern Ireland. In addition, none of the telecom operators contacted during the consultation process raised any concerns regarding cross-border radio networks.

For these reasons, it is anticipated that there are no transboundary networks that would be impacted by the proposed development.

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Section 6 - Mitigation Measures

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6. Mitigation Measures

Sections 6.1 and 6.2 that follow, describe the mitigation measures available to the wind farm developer to offset the potential impact of the proposed turbine layout on the 2RN and Adelphi telecommunications networks.

6.1 Mitigation Measure Solutions – 2RN Network

To offset the potential impact of T05 and T06 on the 2RN radio link from Truskmore to Monaghan the following mitigation solutions are available:

- Option 1 – Re-route the 2RN radio link to Monaghan via an alternative 2RN Mast
- Option 2 – Re-route the FM service into Monaghan via a new fibre broadband connection
- Option 3 – Link replacement with alternative PTP radio link

These measures are described in Sections 6.1.1 to Section 6.1.3 that follow.

6.1.1 Option 1 – Re-route the 2RN radio link via an alternative 2RN Mast.

An option to mitigate for the impact on the radio link to between Truskmore and Monaghan would be to use an alternative 2RN mast to re-route the VHF off-air link to Monaghan.

Figure 18 below illustrates how the existing 2RNs mast at either Clermont Carn or Cairn Hill could potentially be used to re-route the VHF off-air link to the Monaghan 2RN mast-site.

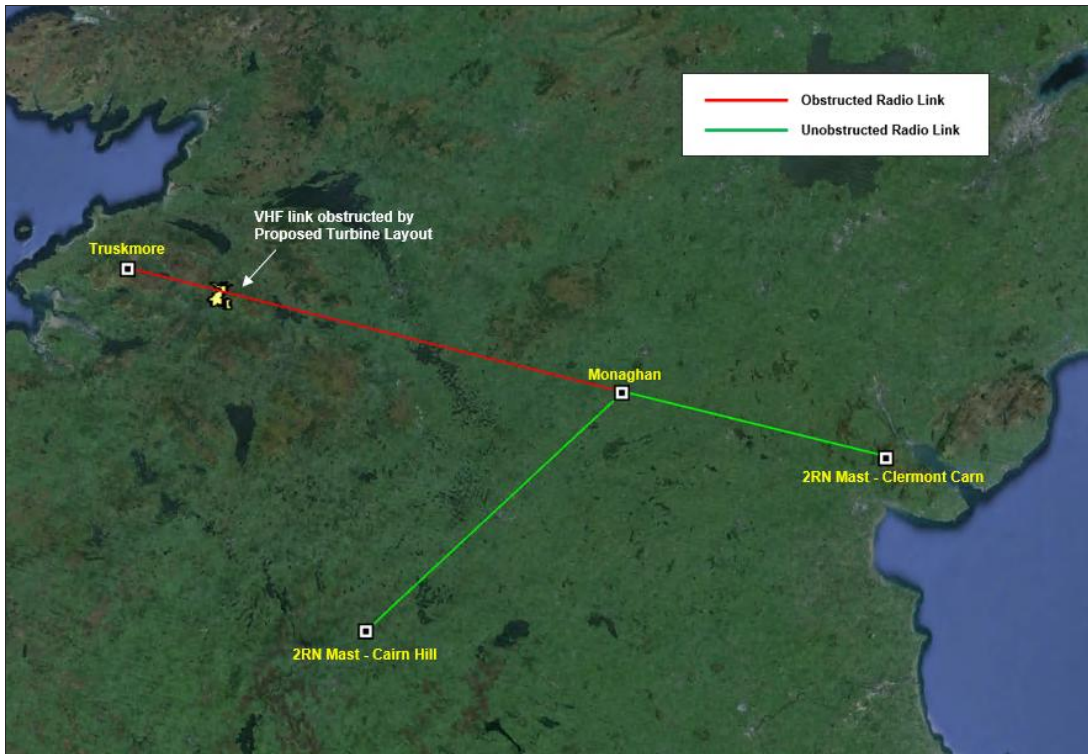



Figure 18. Example of how an alternative 2RN mast could be used to re-route the impacted VHF radio link to the Monaghan 2RN mast-site.

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6.1.2 Option 2 – Re-route the FM service into Monaghan via a new fibre broadband connection.

An alternative option to mitigate for the impact on the radio link between Truskmore and Monaghan would be to re-route the FM service into the 2RN Monaghan site via a new fibre broadband connection with high-availability service including redundancy based on Tier 1 service level agreement. In addition to a fibre connection at the 2RN Monaghan site, FM interface equipment would also be required.


6.1.3 Option 3 – Link replacement with alternative PTP radio link.

Another option to mitigate for the potential impact to the radio link between Truskmore and Monaghan would be to replace the existing VHF radio link with an alternative PTP radio link. A higher frequency radio link would have a smaller Fresnel Zone which may not be obstructed by the proposed turbines. Additional detailed radio link analysis would be required to fully assess this mitigation proposal.

Note 1: A fibre broadband mitigation solution has previously been proposed to 2RN regarding another wind farm in a different part of the country, which was submitted through the planning process in 2021. 2RN estimated the approximated cost of a new fibre broadband connection to be €25,000 (excluding installation costs). The service commissioning costs would be estimated at €5,000 - €8,000 and would be subject to further consultation with 2RN.

Note 2: Any additional ongoing operational costs associated with the operation of a re-routed radio link, such as mast rental and maintenance would have to be agreed with 2RN. In the event of a fibre broadband mitigation measure the costs of the fibre broadband services would also have to be determined and agreed with 2RN.

Note 3: On previous other wind farm developments where 2RN have links that are potentially impacted, 2RN have been open to allowing the turbine(s) to be erected for a period (e.g. 3 months) to permit testing to determine if the radio link is significantly impacted, or not. If the results of the tests show that the link is significantly impacted, then pre-agreed mitigation solutions are implemented, prior to the operational phase of the wind farm. Additional consultations with 2RN would be required for any such arrangement for the proposed Lissinagroagh development.

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6.2 Mitigation Measure Solutions – Adelphi Network

To offset the potential impact of T13 on the Adelphi radio link between Dough and O’Donnell’s Rock the following mitigation solutions are available:

Option 1 – Increase radio antenna installation height at Dough Mountain

Option 2 – Relay Mast located within the Proposed Wind Farm Site

These measures are described in Sections 6.2.1 and Section 6.2.2 that follow. These mitigation measures have been discussed with Adelphi (Net1), who have stated that they are happy with the proposed mitigation strategy, as set out during consultations (Ref Section 3.1.15).

6.2.1 Option 1 – Increase radio antenna installation height at Dough Mt

Network analysis indicates that raising the radio antenna at the Dough end of the radio link, to a height of 18m AGL (Above Ground Level), would increase the clearance distance between the blade-tip of T13 and the Fresnel Zone (F1) of the radio link to 10.6 m. At this distance it is very unlikely that there would be any impacts to the operation of the radio link.

Figure 19 below shows a 3D view of the clearance that could potentially be achieved by raising the antenna height at Dough Mt to 18m AGL.

Note: The existing mast-structure at Dough Mt may need to be replaced with a taller telecoms mast to achieve an acceptable clearance.

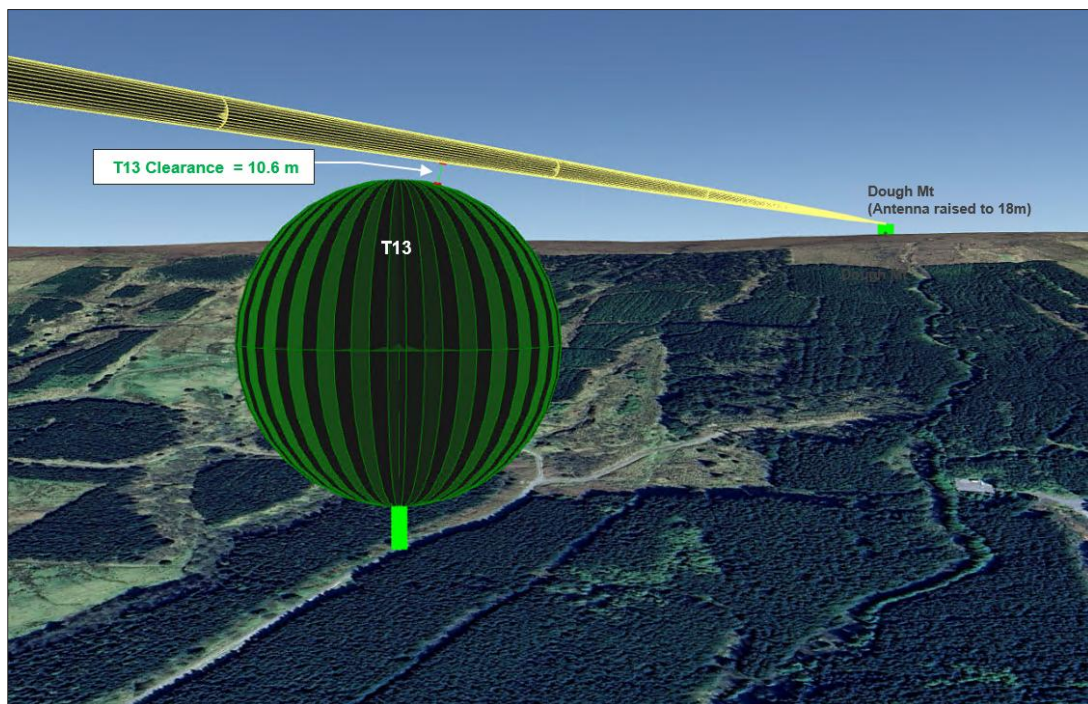



Figure 19. 3D View illustrating how raising the antenna install height at Dough Mt could increase the clearance distance between T13 and the radio link.

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6.2.2. Option 2 – Relay Mast located within the proposed Wind Farm Site

A relay mast at the location shown in the figure below could be used to offset any possible impact of turbine T13 on Adelphi Link 2 (Dough to O'Donnell's Rock).

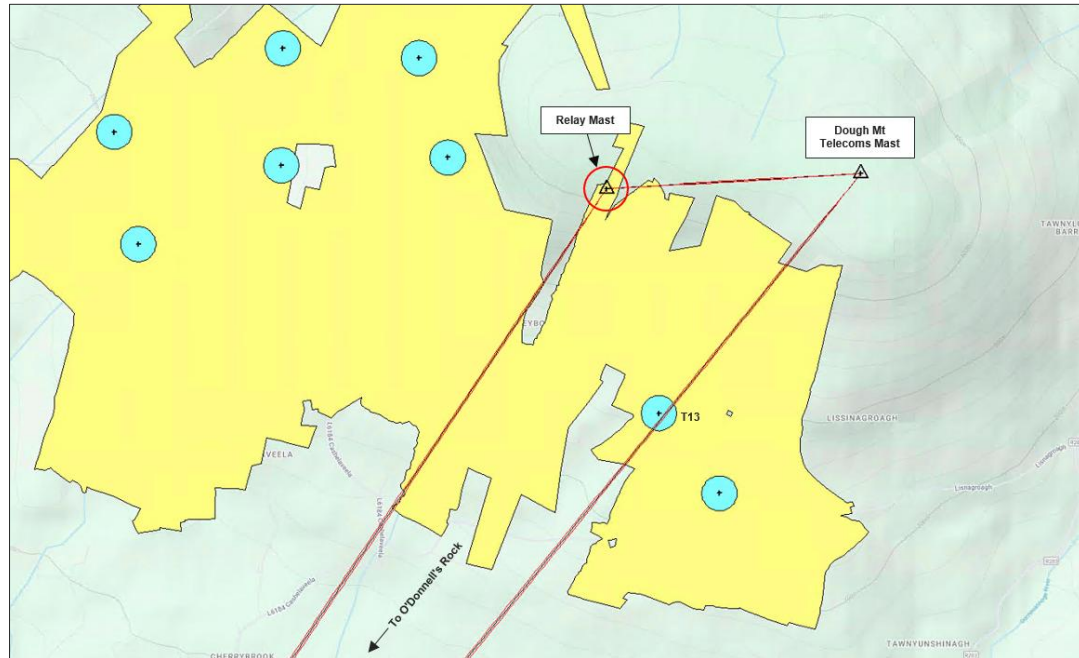


Figure 20. Proposed Relay Mast Location*

To determine if a relay mast at the proposed location could be used to facilitate a viable connection between Dough and O'Donnell's Rock, radio link path profiles were generated. Radio Link Budgets were also carried out to determine if the proposed radio links would meet the Radio Link Availability Criteria required by ComReg for radio licensing. The Radio Link Path Profiles and Radio Link Budgets are based on the following ITU-R Recommendations:

- ITU-R P.525-2
- ITU-R P.526-11
- ITU-R P.676-8

The radio Path Profiles are shown below in Section 6.2.2.1 and Section 6.2.2.2. The Radio Link Budgets can be found in Appendix C (Sections C.1 and C.2).

** The outline included in the figure reflects the study area for the proposed development for purposes of this Telecommunications Assessment report and it does not represent the final Planning Boundary. The final Planning Boundary will not be significantly different to the boundary shown in the above figure and any differences will have negligible impacts on the findings of this report.*

6.2.2.1 Path Profile – Dough to Proposed Relay Mast

The radio link path profile shows clear Line-of-Sight (LOS) and the link budget results would pass the radio availability criteria. The radio link budget for this link is provided in Appendix C.1.

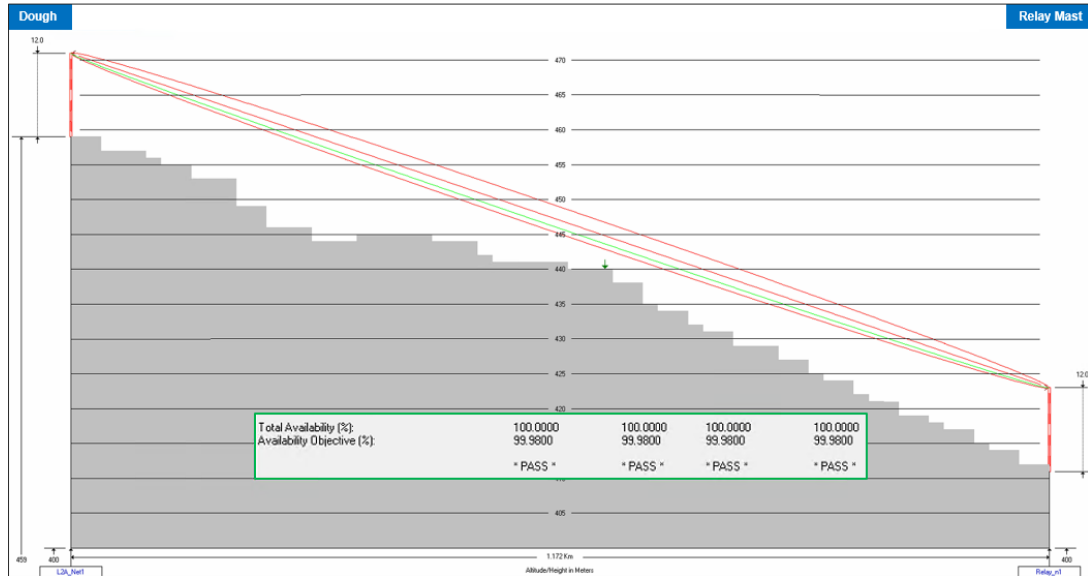


Figure 21. Path Profile - Dough to Relay Mast

6.2.2.2 Path Profile – Proposed Relay Mast to O’Donnell’s Rock

The radio link path profile shows clear Line-of-Sight (LOS) and the link budget results would pass the radio availability criteria. The radio link budget for this link is provided in Appendix C.2.

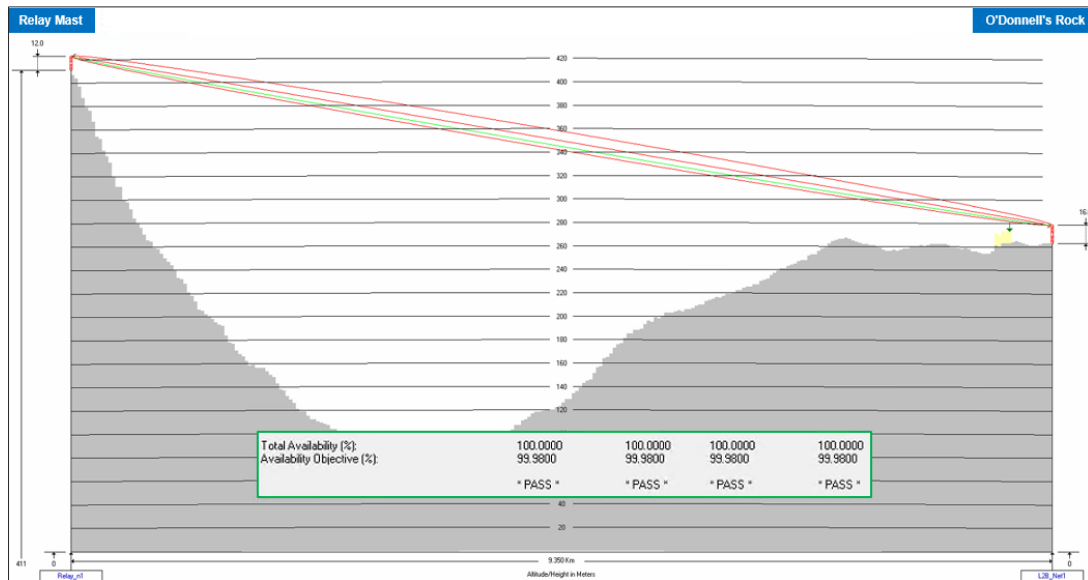




Figure 22. Path Profile - Relay Mast to O’Donnell’s Rock

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Section 7 - Conclusions

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7 Conclusions

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


- Results from the telecom operator consultations, field and desktop surveys indicate that there are five telecom operators with networks in the vicinity of the proposed the wind farm development.
- Table 14 below lists the telecom operator networks and the impact of the proposed turbine layout along with the recommended mitigation measures.

Operator	Network Description	Observations	Possible Mitigation Measures
2RN	VHF off-air radio link from Truskmore to Monaghan.	Interference Impact (Radio Link Fresnel Zone obstructed by T05 and T06)	<p>Option 1: Re-route the 2RN radio link via an alternative 2RN mast-site (e.g. Claremont Carn or Cairn Hill).</p> <p>Option 2: Re-route the FM service into Monaghan via a new fibre broadband connection.</p> <p>Option 3: Link replacement with alternative PTP radio link</p>
Enet	PTP radio link between Truskmore and St. Michael's Primary School.	No impacts.	N.A.
ESB	Satellite Broadband Connection #1 at Faughery MV Substation.	No impacts.	N.A.
	Satellite Broadband Connection #2 at Faughery MV Substation.	No impacts.	N.A.
Adelphi (Net1)	PTP radio link between Dough Mt and Bee Park.	No impacts.	N.A.
	PTP radio link between Dough Mt and O'Donnell's Rock.	No impacts. (Clearance to T13 = 5.6 m) Should Adelphi have any concerns regarding the proximity of T13, optional mitigation measures are available.	<p>(Optional Mitigation Measures)</p> <p>Option 1: Increase radio antenna installation height at Dough Mt.</p> <p>Option 2: Relay mast located within the wind farm site.</p>
Vodafone	PTP radio link between Truskmore and Lissinagroagh.	No impacts.	N.A.
	PTP radio link between Truskmore and Cornagee.	No impacts.	N.A.


Table 14. Radio Links potentially impacted by proposed wind farm

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- 2RN have been contacted in relation to the potential impact of T05 and T06 on their VHF radio link from Truskmore to Monaghan (Ref. Section 3.1.1). 2RN have indicated they do not have any objection to the proposed development proceeding on the basis that any mitigation measures (should they be required) would be covered by the wind farm developer. 2RN have also stated that their preferred mitigation solution is to re-route the link via an alternative transmitter site (e.g. Claremont Carn or Cairn Hill).
- Adelphi Net1 have also indicated that that are not opposed to the proposed development and have stated that they are agreeable to the proposed mitigation measure strategy, if required.

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APPENDIX A – Wind Farm Turbine Coordinates


	Procedure: 001	Rev: 7.0
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Appendix A – Wind Farm Turbine Co-ordinates


The development is in the pre-planning stage and the Final Turbine Layout is yet to be finalized. The turbine layout considered in this Telecommunications Impact Study is provided below.

Turbine ID	Co-ordinates (WGS 84)	
	Latitude	Longitude
T01	54 20 51.376 N	8 6 49.952 W
T02	54 20 42.575 N	8 7 28.849 W
T03	54 20 52.800 N	8 7 52.598 W
T04	54 20 35.887 N	8 6 41.305 W
T05	54 20 19.073 N	8 6 41.284 W
T06	54 20 23.696 N	8 7 17.395 W
T07	54 20 03.047 N	8 7 12.913 W
T08	54 19 48.282 N	8 7 05.598 W
T09	54 20 04.510 N	8 7 47.575 W
T10	54 19 47.105 N	8 7 47.984 W
T11	54 19 52.085 N	8 8 30.522 W
T12	54 19 35.428 N	8 8 24.424 W
T13	54 19 10.319 N	8 6 11.830 W
T14	54 18 58.422 N	8 5 56.405 W

Table 15. Wind Farm Layout - Turbine Co-ordinates (Revised June 2025 Layout)

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APPENDIX B – Field Survey Findings

	Procedure: 001	Rev: 7.0
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Appendix B – Field Survey Findings

The telecom mast-sites surveyed for this Telecoms Impact Study are shown relative to the proposed wind farm site in Figure 23 below.

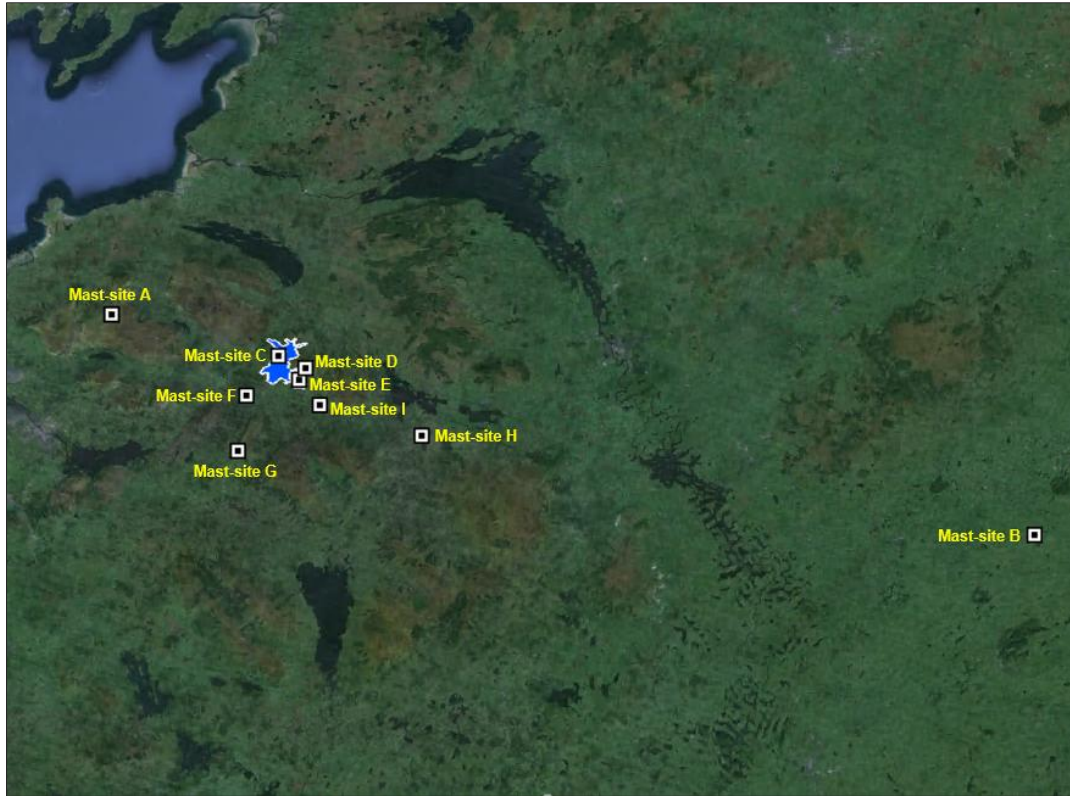



Figure 23. Telecom Mast-Sites shown relative to proposed wind farm.

The findings from the field surveys of each of the mast-sites are presented below.

	Procedure: 001	Rev: 7.0
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Mast-Site A (Truskmore)

Telecommunications Mast-Site A is located on Truskmore Mountain and is approximately 15 km northwest of the proposed wind farm. Photos of the mast-structures at this location are shown below.


The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 16.



Figure 24. Mast-Site A

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast A1	2RN, Enet
Mast A2	Vodafone

Table 16. Field Survey Summary – Mast-Site A

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Mast-Site B (Monaghan)


Telecommunications Mast-Site B is located in the townland of Calliagh, Co Monaghan and is approximately 71 km southeast of the proposed wind farm. A photo of the mast-structure at this location is shown below. The Telecom Operators who have radio links operating from this mast in the direction of the wind farm are listed in Table 17.



Figure 25. Mast-Site B

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast B	2RN

Table 17. Field Survey Summary – Mast-Site B

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Mast-Site C (Faughery MV Substation)


Telecommunications Mast-Site C is located at Faughery MV Substation located adjacent to the proposed wind farm at Lissinagroagh. A photo of the substation building at this location is shown below. The Telecom Operators who have radio links operating from this mast-structure in the direction of the wind farm are listed in Table 18.



Figure 26. Mast-Site C

Mast ID	Telecom operators with communications links in direction of proposed wind farm
Mast C	ESB

Table 18. Field Survey Summary – Mast-Site C

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Mast-Site D (Dough Mountain)

Telecommunications Mast-Site D is located on Dough Mountain and is less than 1 km from the proposed wind farm site boundary. A photo of the mast-structure at this location is shown below.


The Telecom Operators who have radio links operating from this mast in the direction of the wind farm are listed in Table 19.



Figure 27. Mast-Site D

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast D	Adelphi (Net1)

Table 19. Field Survey Summary – Mast-Site D

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Mast-Site E (Lissnagroagh)

Telecommunications Mast-Site E is located within the proposed wind farm site boundary. A photo of the mast-structure at this location is shown below.

The Telecom Operators who have radio links operating from this mast in the direction of the wind farm are listed in Table 20.




Figure 28. Mast-Site E

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast E	Vodafone

Table 20. Field Survey Summary – Mast-site E

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Mast-Site F (Bee Park)

Telecommunications Mast-Site F is located at Bee Park, Manorhamilton and is approximately 2 km southwest of the proposed wind farm. A photo of the mast-structure at this location is shown below.


The Telecom Operators who have radio links operating from this mast in the direction of the wind farm are listed in Table 21.



Figure 29. Mast-Site F

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast F	Adelphi (Net1)

Table 21. Field Survey Summary – Mast-Site F

	Procedure: 001	Rev: 7.0
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Mast-Site G (O'Donnell's Rock)

Telecommunications Mast-Site G is located in the townland of O'Donnell's Rock and is approximately 7 km southwest of the proposed wind farm. A photo of the mast-structure at this location is shown below.


The Telecom Operators who have radio links operating from this mast in the direction of the wind farm are listed in Table 22.



Figure 30. Mast-Site G

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast G	Adelphi (Net1)

Table 22. Field Survey Summary – Mast-Site G

	Procedure: 001	Rev: 7.0
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Mast-Site H (Cornagee)

Telecommunications Mast-Site H is located in the townland of Cornagee, Co Cavan and is approximately 14 km southeast of the proposed wind farm. A photo of the mast-structure at this location is shown below.


The Telecom Operators who have radio links operating from this mast in the direction of the wind farm are listed in Table 23.



Figure 31. Mast-Site H

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast H	Vodafone

Table 23. Field Survey Summary – Mast-Site H

	Procedure: 001	Rev: 7.0
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Mast-Site I (St. Michael's Primary School)

Telecommunications Mast-Site I is located at St. Michael's Primary School, Barrs West, Co and is approximately 2 km southeast of the proposed wind farm. A photo of the mast-structure at this location is shown below. The Telecom Operators who have radio links operating from this mast in the direction of the wind farm are listed in Table 24.




Figure 32. Mast-Site I


Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast I	Enet

Table 24. Field Survey Summary – Mast-Site I

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APPENDIX C – Radio Link Budgets

	Procedure: 001	Rev: 7.0
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APPENDIX C – Radio Link Budgets


C.1. Dough – Relay Mast

Site: L2A_Net1 (Dough) Relay_n1
Name:
Type: Cell Cell
Latitude: 54°19'45.9"N 54°19'43.6"N
Longitude: 8°05'20.4"W 8°06'25.2"W
Altitude (m): 459.0 411.0

UserData1: User Data

Datum: World Geodetic System 1984 (WGS 84)

	Forward Link	Reverse Link		
Transmission Site:	L2A_Net1	Relay_n1		
Reception Site:	Relay_n1	L2A_Net1		
Radio Type:	NetRadio0001	NetRadio0001		
Modulation Scheme:	4-QAM	4-QAM		
Bandwidth (MHz):	2	2		
Roll-Off Factor:	0.2	0.2		
Coding Gain (dB):	0	0		
System Gains (dB):	0	0		
Channel Overhead (%):	20	20		
FEC Overhead (%):	0	0		
Reference Temperature (°K):	290	290		
Receiver Noise Figure (dB):	5	5		
Maximum Data Rate (Mbps):	2.667	2.667		
Maximum Bit Rate (Mbps):	3.333	3.333		
Required Bit Error Rate:	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Service Threshold (dBm):	-91	-90	-91	-90
Carrier to Noise Ratio (dB):	14.965	15.965	14.965	15.965
Cross Polarization Improvement Factor (dB):	20	20	20	20
Rx Equalization Sig Norm Parameter (Kn,M):	0.1	0.1	0.1	0.1
Rx Equalization Sig Norm Parameter (Kn,NM):	0.1	0.1	0.1	0.1
UserData1:	User Data	User Data		
Center Frequency (MHz):	26000	26000		
Channel Bandwidth (MHz):	28	28		
Transmission Power (dBm):	30	30		
Transmission Gains (dB):	0	0		
Transmission System Loss (dB):	0	0	0	0
Transmission Line Loss (dB/100 m):	4	4	4	4
Transmission Line Length (m):	10	10	10	10
Transmission Connection Loss (dB):	0.3	0.3	0.3	0.3
Transmission Number of Connections:	2	2	2	2
Transmission Additional Loss (dB):	0	0	0	0
Transmission Losses (dB):	1	1	1	1
Transmission Antenna:	HP2-26	HP2-26		
Transmission Antenna Size (m):	0.6	0.6	0.6	0.6
Transmission Antenna Height (m):	12	12	12	12
Transmission Antenna Gain (dBd):	38.96	38.96	38.96	38.96
Transmission Antenna Gain (dBi):	41.1	41.1	41.1	41.1
Transmission Power EIRP (dBm):	70.1	70.1	70.1	70.1
Reception Gains (dB):	0	0		
Reception System Loss (dB):	0	0		
Reception Line Loss (dB/100 m):	4	4	4	4
Reception Line Length (m):	10	10	10	10
Reception Connection Loss (dB):	0.3	0.3	0.3	0.3
Reception Number of Connections:	2	2	2	2
Reception Additional Loss (dB):	0	0	0	0
Reception Losses (dB):	1	1	1	1
Reception Antenna:	HP2-26	HP2-26		
Reception Antenna Size (m):	0.6	0.6	0.6	0.6

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Reception Antenna Height (m): 12 12
Reception Antenna Gain (dBd): 38.96 38.96
Reception Antenna Gain (dBi): 41.1 41.1

Link Polarization: Vertical Vertical
Cross Polarization Factor (dB): 30 30

Link Distance (m): 1172.145 1172.145
Azimuth - True (°): 266.586 86.571
Azimuth - Magnetic (°): 268.726 88.719
Transmission Inclination (°): 2.345 -2.345
Reception Inclination (°): 2.345 -2.345

ITU Recommendation: ITU-R P.525-2
Free Space Distance (m): 1173.128 1173.128
Center Frequency (MHz): 26000 26000
Free Space Loss (dB): 122.126 122.126

Max Fresnel Radius (m): 1.839 1.839
Max 2nd Fresnel Radius (m): 2.6 2.6

Earth Radius Factor (K): 4/3
Effective Radius (m): 8502056.000

ITU Recommendation: ITU-R P.526-11
Diffraction Model: Cascade Knife Edge
Diffraction: No LOS Diffraction No LOS Diffraction
Diffraction Loss (dB): 0 0

Clearance Target (%): 60
Minimum Clearance (m): 3.666 3.666
Minimum Clearance Point (m): 640.172 640.172

Terrain Reflection Dispersion (°): 0.5
Reflection Area 1 (m): 279.5 - 297.5 279.5 - 297.5
Reflection Area 2 (m): 910.667 910.667

ITU Recommendation: ITU-R P.676-8
Atmospheric Pressure (hPa): 1013 1013
Standard Temperature (°C): 15 15
Water Vapor Density (g/m³): 7.5 7.5
Atmospheric Gases Loss (dB): 0.155 0.155

Total Path Loss (dB): 122.282 122.282

Reception Signal Level (dBm): -12.082 -12.082


BER 10-3 BER 10-6 BER 10-3 BER 10-6
Service Threshold (dBm): -91 -90 -91 -90
Link Gross Margin (dB): 78.918 77.918 78.918 77.918

ITU Recommendation: ITU-R F.1703-0 / ITU-T G.827
Objective ITU Quality Grade: Short Haul SDH Networks
Unavailability Objective (%): 2.00E-02
Availability Objective (%): 99.9800

ITU Recommendation: ITU-R F.1668-1 / ITU-T G.826
Error Performance Objective BBER (%): 1.60E-05 1.60E-05
Error Performance Objective BBER (s/Month): 0.42 0.42
SESr ESR SESr ESR
Error Performance Objective (%): 1.60E-04 3.20E-03 1.60E-04 3.20E-03
Error Performance Objective (s/Month): 4.205 84.096 4.205 84.096

ITU Recommendation: ITU-R F.1668-1 / ITU-T G.828
Error Performance Objective BBER (%): 4.00E-06 4.00E-06
Error Performance Objective BBER (s/Month): 0.105 0.105
SESr ESR SESr ESR
Error Performance Objective (%): 1.60E-04 8.00E-04 1.60E-04 8.00E-04
Error Performance Objective (s/Month): 4.205 21.024 4.205 21.024

Multipath Model: ITU-R P.530-15
Multipath Planning Type: Quick Planning

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Multipath Time Frame: Average annual distribution
ITU Recommendation: ITU-R P.453-9
Point Refractivity Gradient (dN1): -76.7
Geoclimatic Factor: 4.05E-05 4.05E-05
Multipath Occurrence Factor (%): 3.05E-06 3.05E-06

Precipitation Model: ITU-R P.530-15
ITU Recommendation: ITU-R P.837-5 / ITU-R P.841-4
Precipitation Time Frame: Average annual distribution
Precipitation Rate @ 0.01% (mm/h): 22
ITU Recommendation: ITU-R P.838-3
Specific Attenuation (dB/km): 3.069944 3.069944
Rainfall Attenuation (dB): 5.29 5.29

BER 10-3 BER 10-6 BER 10-3 BER 10-6
Fading Outage (%): 1.52E-15 1.91E-15 1.52E-15 1.91E-15
Selective Fading Outage (%): 1.57E-15 1.57E-15 1.57E-15 1.57E-15
Composite Fading Outage (%): 3.08E-15 3.48E-15 3.08E-15 3.48E-15

Fading Outage (s/Month): 0 0 0 0
Selective Fading Outage (s/Month): 0 0 0 0
Composite Fading Outage (s/Month): 0 0 0 0


BER 10-3 BER 10-6 BER 10-3 BER 10-6
Unavailability due to Rain (%): 0.00E+00 0.00E+00 0.00E+00 0.00E+00
Unavailability due to Rain (s/Year): 0 0 0 0

BER 10-3 BER 10-6 BER 10-3 BER 10-6
Unavailability due to Fading (%): 3.08E-15 3.48E-15 3.08E-15 3.48E-15
Unavailability due to Rain (%): 0.00E+00 0.00E+00 0.00E+00 0.00E+00
Total Unavailability (%): 3.08E-15 3.48E-15 3.08E-15 3.48E-15
Unavailability Objective (%): 2.00E-02 2.00E-02 2.00E-02 2.00E-02

Unavailability due to Fading (s/Year): 0 0 0 0
Unavailability due to Rain (s/Year): 0 0 0 0
Total Unavailability (s/Year): 0 0 0 0
Unavailability Objective (s/Year): 6307.2 6307.2 6307.2 6307.2

Total Availability (%): 100.0000 100.0000 100.0000 100.0000
Availability Objective (%): 99.9800 99.9800 99.9800 99.9800

* PASS * * PASS * * PASS * * PASS *

 <i>Total Broadband Solutions</i>	Procedure: 001	Rev: 7.0
	Title: Lissinagroagh Wind Farm Telecommunications Impact Assessment	Approved: KH


C.2. Relay Mast – O'Donnell's Rock

Site: Relay_n1 L2B_Net1 (O'Donnell's Rock)
Name:
Type: Cell Cell
Latitude: 54°19'43.6"N 54°15'32.5"N
Longitude: 8°06'25.2"W 8°11'12.8"W
Altitude (m): 411.0 263.0

UserData1: User Data

Datum: World Geodetic System 1984 (WGS 84)

	Forward Link	Reverse Link		
Transmission Site:	Relay_n1	L2B_Net1		
Reception Site:	L2B_Net1	Relay_n1		
Radio Type:	NetRadio0001	NetRadio0001		
Modulation Scheme:	4-QAM	4-QAM		
Bandwidth (MHz):	2	2		
Roll-Off Factor:	0.2	0.2		
Coding Gain (dB):	0	0		
System Gains (dB):	0	0		
Channel Overhead (%):	20	20		
FEC Overhead (%):	0	0		
Reference Temperature (°K):	290	290		
Receiver Noise Figure (dB):	5	5		
Maximum Data Rate (Mbps):	2.667	2.667		
Maximum Bit Rate (Mbps):	3.333	3.333		
Required Bit Error Rate:	BER 10-3 BER 10-6	BER 10-3 BER 10-6		
Service Threshold (dBm):	-91 -90	-91 -90		
Carrier to Noise Ratio (dB):	14.965 15.965	14.965 15.965		
Cross Polarization Improvement Factor (dB):	20	20	20	20
Rx Equalization Sig Norm Parameter (Kn,M):	0.1	0.1	0.1	0.1
Rx Equalization Sig Norm Parameter (Kn,NM):	0.1	0.1	0.1	0.1
UserData1:	User Data	User Data		
Center Frequency (MHz):	11000	11000		
Channel Bandwidth (MHz):	28	28		
Transmission Power (dBm):	30	30		
Transmission Gains (dB):	0	0		
Transmission System Loss (dB):	0	0	0	
Transmission Line Loss (dB/100 m):	4	4	4	
Transmission Line Length (m):	10	10	10	
Transmission Connection Loss (dB):	0.3	0.3	0.3	
Transmission Number of Connections:	2	2	2	
Transmission Additional Loss (dB):	0	0	0	
Transmission Losses (dB):	1	1	1	
Transmission Antenna:	HP2-11-NSMA	HP2-11-NSMA		
Transmission Antenna Size (m):	0.6	0.6		
Transmission Antenna Height (m):	12	16		
Transmission Antenna Gain (dBd):	32.36	32.36		
Transmission Antenna Gain (dBi):	34.5	34.5		
Transmission Power EIRP (dBm):	63.5	63.5		
Reception Gains (dB):	0	0		
Reception System Loss (dB):	0	0		
Reception Line Loss (dB/100 m):	4	4	4	
Reception Line Length (m):	10	10	10	
Reception Connection Loss (dB):	0.3	0.3	0.3	
Reception Number of Connections:	2	2	2	
Reception Additional Loss (dB):	0	0	0	
Reception Losses (dB):	1	1	1	
Reception Antenna:	HP2-11-NSMA	HP2-11-NSMA		
Reception Antenna Size (m):	0.6	0.6		
Reception Antenna Height (m):	16	12		
Reception Antenna Gain (dBd):	32.36	32.36		
Reception Antenna Gain (dBi):	34.5	34.5		

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Link Polarization: Vertical Vertical
 Cross Polarization Factor (dB): 26.667 26.667

Link Distance (m): 9350.026 9350.026
 Azimuth - True (°): 213.792 33.727
 Azimuth - Magnetic (°): 215.939 35.894
 Transmission Inclination (°): 0.882 -0.882
 Reception Inclination (°): 0.882 -0.882

ITU Recommendation: ITU-R P.525-2
 Free Space Distance (m): 9351.135 9351.135
 Center Frequency (MHz): 11000 11000
 Free Space Loss (dB): 132.685 132.685

Max Fresnel Radius (m): 7.984 7.984
 Max 2nd Fresnel Radius (m): 11.292 11.292

Earth Radius Factor (K): 4/3
 Effective Radius (m): 8502056.000

ITU Recommendation: ITU-R P.526-11
 Diffraction Model: Cascade Knife Edge
 Diffraction: No LOS Diffraction No LOS Diffraction
 Diffraction Loss (dB): 0 0

Clearance Target (%): 60
 Minimum Clearance (m): 10.084 10.084
 Minimum Clearance Point (m): 8944.209 8944.209

Terrain Reflection Dispersion (°): 0.5

Reflection Area 1 (m): 925.263 925.263
 Reflection Area 2 (m): 1282.382 1282.382
 Reflection Area 3 (m): 1347.3 - 1379.8 1347.3 - 1379.8
 Reflection Area 4 (m): 2613.5 - 2645.9 2613.5 - 2645.9
 Reflection Area 5 (m): 2710.858 2710.858
 Reflection Area 6 (m): 2775.8 - 2808.3 2775.8 - 2808.3
 Reflection Area 7 (m): 7840.4 - 7872.9 7840.4 - 7872.9
 Reflection Area 8 (m): 8035.179 8035.179
 Reflection Area 9 (m): 8100.1 - 8132.6 8100.1 - 8132.6
 Reflection Area 10 (m): 8230.0 - 8294.9 8230.0 - 8294.9
 Reflection Area 11 (m): 8424.764 8424.764
 Reflection Area 12 (m): 8489.7 - 8522.2 8489.7 - 8522.2
 Reflection Area 13 (m): 8911.744 8911.744

ITU Recommendation: ITU-R P.676-8
 Atmospheric Pressure (hPa): 1013 1013
 Standard Temperature (°C): 15 15
 Water Vapor Density (g/m³): 7.5 7.5
 Atmospheric Gases Loss (dB): 0.154 0.154

Total Path Loss (dB): 132.84 132.84


Reception Signal Level (dBm): -35.84 -35.84

BER 10-3 BER 10-6 BER 10-3 BER 10-6
 Service Threshold (dBm): -91 -90 -91 -90
 Link Gross Margin (dB): 55.16 54.16 55.16 54.16

ITU Recommendation: ITU-R F.1703-0 / ITU-T G.827
 Objective ITU Quality Grade: Short Haul SDH Networks
 Unavailability Objective (%): 2.00E-02
 Availability Objective (%): 99.9800

ITU Recommendation: ITU-R F.1668-1 / ITU-T G.826
 Error Performance Objective BBER (%): 1.60E-05 1.60E-05
 Error Performance Objective BBER (s/Month): 0.42 0.42
 SESR ESR SESR ESR
 Error Performance Objective (%): 1.60E-04 3.20E-03 1.60E-04 3.20E-03
 Error Performance Objective (s/Month): 4.205 84.096 4.205 84.096

ITU Recommendation: ITU-R F.1668-1 / ITU-T G.828
 Error Performance Objective BBER (%): 4.00E-06 4.00E-06

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Error Performance Objective BBER (s/Month): 0.105 0.105
SESr SESr SESr SESr
Error Performance Objective (%): 1.60E-04 8.00E-04 1.60E-04 8.00E-04
Error Performance Objective (s/Month): 4.205 21.024 4.205 21.024

Multipath Model: ITU-R P.530-15
Multipath Planning Type: Quick Planning
Multipath Time Frame: Average annual distribution
ITU Recommendation: ITU-R P.453-9
Point Refractivity Gradient (dN1): -76.7
Geoclimatic Factor: 4.05E-05 4.05E-05
Multipath Occurrence Factor (%): 4.31E-03 4.31E-03

Precipitation Model: ITU-R P.530-15
ITU Recommendation: ITU-R P.837-5 / ITU-R P.841-4
Precipitation Time Frame: Average annual distribution
Precipitation Rate @ 0.01% (mm/h): 22
ITU Recommendation: ITU-R P.838-3
Specific Attenuation (dB/km): 0.627683 0.627683
Rainfall Attenuation (dB): 4.511 4.511

BER 10-3 BER 10-6 BER 10-3 BER 10-6
Fading Outage (%): 1.05E-09 1.32E-09 1.05E-09 1.32E-09
Selective Fading Outage (%): 7.96E-11 7.96E-11 7.96E-11 7.96E-11
Composite Fading Outage (%): 1.13E-09 1.40E-09 1.13E-09 1.40E-09

Fading Outage (s/Month): 0 0 0 0
Selective Fading Outage (s/Month): 0 0 0 0
Composite Fading Outage (s/Month): 0 0 0 0

BER 10-3 BER 10-6 BER 10-3 BER 10-6
Unavailability due to Rain (%): 0.00E+00 0.00E+00 0.00E+00 0.00E+00
Unavailability due to Rain (s/Year): 0 0 0 0

BER 10-3 BER 10-6 BER 10-3 BER 10-6
Unavailability due to Fading (%): 1.13E-09 1.40E-09 1.13E-09 1.40E-09
Unavailability due to Rain (%): 0.00E+00 0.00E+00 0.00E+00 0.00E+00
Total Unavailability (%): 1.13E-09 1.40E-09 1.13E-09 1.40E-09
Unavailability Objective (%): 2.00E-02 2.00E-02 2.00E-02 2.00E-02

Unavailability due to Fading (s/Year): 0 0 0 0
Unavailability due to Rain (s/Year): 0 0 0 0
Total Unavailability (s/Year): 0 0 0 0
Unavailability Objective (s/Year): 6307.2 6307.2 6307.2 6307.2

Total Availability (%): 100.0000 100.0000 100.0000 100.0000
Availability Objective (%): 99.9800 99.9800 99.9800 99.9800

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