

APPENDIX A18.1

TV SURVEY

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VIKING WINDFARM

TV IMPACT REPORT

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	Name :	Position :	Signature :
Prepared by :	Colin Brown	Aviation Advisor	
Checked by :	Andy Sloan	Project Manager	
Reviewed by:	Malcolm Grant	Project Services and Estates Manager	
Comment :			

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1. INTRODUCTION

1.1 Scope of Document

- 1.1.1 This report shows the impact Viking Windfarm will have against TV signals. This will give a good estimate as to how many houses may need mitigation and where. This will also give a sound datum to work from when carrying out future surveys. The survey was carried out in January of 2010 at a time before digital switchover when the analogue service was still switched on.

1.2 Location Information

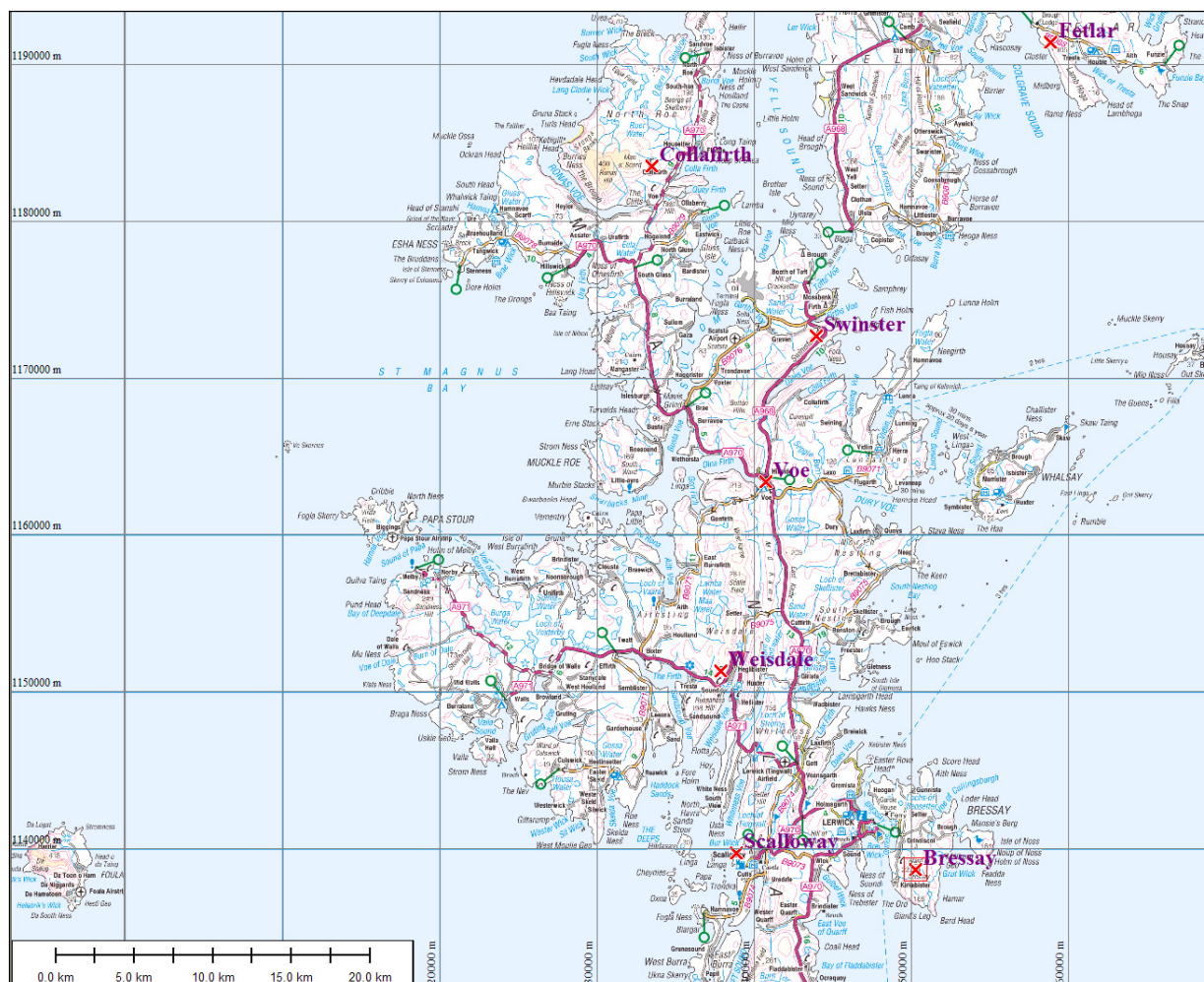
- 1.2.1 The Site is defined as the Viking Windfarm, located on the Shetland islands in an area known as the main land going from Weisdale up to Sullom Voe. The layout of the site is as shown on the Site Layout figure in 3.2.2.

2 TECHNICAL DESCRIPTION

2.1 Analogue Transmitters

- 2.1.1 The main transmitter that provides a service on the Shetland islands is Bressay. Bressay has 8 re-transmission masts and from these masts are 4 self help relay masts. The masts nearest the development are shown on the map below.

- 2.1.2 The figure below shows the location of the Transmitters



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2.1.3 The transmitted signals which the wind farm could affect would come from one of the masts in the table below.

Mast	X	Y	Alt (AMSL)
Bressay	450300	1138700	299
Fetlar	458900	1191400	139
Collafirth	433500	1183500	278
Swinster	444000	1172700	167
Voe	440800	1163400	60
Weisdale	437900	1151300	276
Scalloway	438900	1139700	101
Fitful Head	434700	1113600	299
Baltasound	463500	1210900	40

2.1.4 Below is a table showing terrestrial Transmitter information:

Mast	BBC 1	BBC 2	ITV	CH 4	Aerial Group	Polarity
Bressay	22	28	25	32	A	V
Fetlar	40	46	43	50	B	V
Collafirth	51	44	41	47	B	V
Swinster	55	62	59	65	C/D	V
Voe	57	63	60	53	C/D	V
Weisdale	58	64	61	54	C/D	V
Scalloway	55	62	59	65	C/D	V
Fitful Head	39	45	42	49	B	V
Baltasound	39	45	42	49	B	V

2.1.5 There are 4 self help relays on the island, these are described below. A self help mast is a receiver that takes a good signal and re-transmits it into areas the original signal can't reach, such as a valley. It is owned and operated by the persons who benefit from its purpose.

Name	Parent Tx	Location	Target Population
Sandwick	Bressay	18km SW Lerwick	24
Heylor	Collafirth	43km NNW Lerwick	5
Olna Firth	Collafirth	26km NNW Lerwick	7
Clousta	Weisdale		

2.1.6 The UHF TV spectrum goes from 470-854MHz and is broken down into channels from 21-68 each at 8MHz of bandwidth. These channels are used for analogue and digital TV transmissions:

Channel	Range (MHz)	Vision freq (MHz)	Channel	Range (MHz)	Vision freq (MHz)
21	470-478	471.25	45	662-670	663.25
22	478-486	479.25	46	670-678	671.25
23	486-494	487.25	47	678-686	679.25
24	494-502	495.25	48	686-694	687.25
25	502-510	503.25	49	694-702	695.25
26	510-518	511.25	50	702-710	703.25
27	518-526	519.25	51	710-718	711.25
28	526-534	527.25	52	718-726	719.25
29	534-542	535.25	53	726-734	727.25
30	542-550	543.25	54	734-742	735.25
31	550-558	551.25	55	742-750	743.25

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32	558-566	559.25	56	750-758	751.25
33	566-574	567.25	57	758-766	759.25
34	574-582	575.25	58	766-774	767.25
35	582-590	583.25	59	774-782	775.25
36	590-598	591.25	60	782-790	783.25
37	598-606	599.25	61	790-798	791.25
38	606-614	607.25	62	798-806	799.25
39	614-622	615.25	63	806-814	807.25
40	622-630	623.25	64	814-822	815.25
41	630-638	631.25	65	822-830	823.25
42	638-646	639.25	66	830-838	831.25
43	646-654	647.25	67	838-846	839.25
44	654-662	655.25	68	846-854	847.25

2.1.7 The signal level at the receiver should be between 60 and 80 dBμV and the level should not be allowed to drop below 60 dBμV at any point throughout a TV system.

2.2 Digital Transmitters

2.2.1 There is currently 1 digital service on the island, with digital switch over having occurred between 5th and 19th May 2010 which was after this survey was carried out. Digital signals are less susceptible to interference so that there are only 2 states to a TV picture, either a good picture or no picture. The chance of a wind farm causing negative affects is dramatically reduced with digital signals unless the receiving aerial is in the RF shadow of the wind farm.

2.2.2 The table below shows the current digital transmitter spec for Bressay:

Multiplex 1				Multiplex 2			Multiplex A			Multiplex B			Multiplex C			Multiplex D		
Gp	Ch	O/s	ERP	Ch	O/s	ERP	Ch	O/s	ERP	Ch	O/s	ERP	Ch	O/s	ERP	Ch	O/s	ERP
wv	21	0	1	24	-	1	27	-	1	31	-	1	66	0	1	68	0	1

O/s = Offset is + or – 166.67 kHz

2.2.3 The following channels are transmitted within each multiplex:

Multiplex 1

BBC One	1
BBC Two	2
BBC Three	7
BBC Four (Border region only)	9
CBBC Channel	70
CBeebies (Border region only)	71
BBC News	80
BBC Parliament (Border region only)	81
BBC Red Button (text)	105
BBC Radio Scotland (Scotland and Border region only)	719
BBC Radio Ulster (Northern Ireland only)	719
BBC Radio Wales (Wales only)	719
BBC Radio nan Gàidheal (Scotland and Border region only)	720
BBC Radio Foyle (Northern Ireland only)	720
BBC Radio Cymru (Wales only)	720

Multiplex 2

ITV1	3
Channel 4 (except Wales)	4

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ITV2	6
Channel 4 (Wales only)	8
ITV3	10
Channel 4 +1	13
More 4	14
ITV4	24
E4	28
Teletext	100
Teletext Holidays (Wales only)	101
Rabbit (text)	102
DirectGov (text)	106
U105 (radio, Northern Ireland only)	726
Heart (radio, not Scotland or Northern Ireland)	728
Multiplex A	
S4C (Wales only)	4
Five (not Border region)	5
Tele G (Scotland and Border region only)	8
QVC	16
G.O.L.D.*	17
Bid TV	23
UKTV Style*	26
British Eurosport*	33
Setanta Sports*	34
Five USA	35
Fiver	36
Top Up TV Anytime 1*	38
Top Up TV Anytime 2*	39
Top Up TV Anytime 3*	40
GemsTV1	44
Smile TV (not Wales)	46
Quest	47
Super Casino (not Wales or Northern Ireland)	48
Rocks & Co (not Wales or Northern Ireland)	49
CITV (not Wales)	72
CNN	84
S4C2 (Wales only)	86
Teachers' TV	88
TVX/Red Hot*	97
Teletext Holidays (not Wales)	101
Teletext Casino (not Wales)	103
1-2-1 Dating (text) (not Wales)	104
Smash Hits! (not Wales)	712

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Multiplex B

Five (Border region only)	5
BBC Four (not Border region)	9
CBeebies (not Border region)	71
BBC Parliament (not Border region)	81
Community Channel	87
BBC Red Button (extra video)	301
BBC Red Button (extra video)	302
BBC Red Button (extra video)	303
BBC Red Button (extra video)	305
BBC Radio 1	700
BBC 1Xtra	701
BBC Radio 2	702
BBC Radio 3	703
BBC Radio 4	704
BBC Radio 5 Live	705
BBC 5 Live Sports Extra	706
BBC 6 Music	707
BBC Radio 7	708
BBC Asian Network	709
BBC World Service	710

Multiplex C

Sky Three	11
Dave	19
E4 +1	29
SmileTV	37
Sky News	82
Sky Sports News	83
SkyText	108
TalkSPORT (radio)	723
Premier Christian Radio	725
Absolute Radio	727

Multiplex D

Yesterday	12
Film Four	15
4Music	18
Virgin 1	20
TMF The Music Factory	21
Ideal World	22
Dave ja vu	25
ITV2 +1	27
Top Up TV Anytime 4*	41

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GemsTV	43
National Lottery Xtra	45
Russia Today	85
4TV Interactive Services	300
The Hits Radio	711
Kiss (radio)	713
Heat (radio)	714
Magic (radio)	715
Q (radio)	716
Smooth Radio	718
Kerrang! (radio)	722

2.2.4 Digital changeover means that the digital transmitters are now working and that the analogue signals have been turned off. At the same time as turning off the analogue signals the digital power levels were increased.

2.2.5 After digital changeover the multiplex names changed to:

Current Multiplex Name	Post-switchover Name	Operator
1	BBC A	BBC
2	D3&4	Digital 3 & 4
A	SDN	SDN
B	BBC B	BBC
C	Arqiva A	Arqiva
D	Arqiva B	Arqiva

2.2.6 The table below shows the expected channel arrangements after Digital changeover.

BBC A			D3&4		BBC B		Group
Mast	Ch	ERP	Ch	ERP	Ch	ERP	
Bressay	28	2kW	25	2kW	22	2Kw	AV
Baltasound	46	36W	43	36W	50	36W	BV
Collafirth	45	800W	42	800W	49	800W	BV
Fetlar	47	250W	44	250W	41	250W	BV
Fitful Head	44	19W	41	19W	47	19W	BV
Scalloway	62	6W	59	6W	55	6W	C/DV
Swinster	62	320W	59	320W	55	320W	C/DV
Voe	57	2W	60	2W	53	2W	C/DV
Weisdale	58	12W	61	12W	54	12W	C/DV
SDN			ARQIVA A		ARQIVA B		Group
Mast	Ch	ERP	Ch	ERP	Ch	ERP	
Bressay	27	2KW	24	2kW	21	2kW	AV

2.2.7 It should be highlighted that digital boxes work between 45 and 65dB μ V. If the signal is weaker than this band it will cause errors at the decoder. If a signal is stronger than this band it will cause saturation at the receiver.

2.2.8 The Carrier to noise ratio (C/N) should also be better than 26dB in order for it to be classed as a reliable signal. This will give a good enough ratio, so that if the signal is amplified, the noise won't be amplified along with it, to an unworkable level.

2.2.9 The Bit Error Ratio (BER) is the ratio of bits that the detector in the demodulator is unable to detect against the number of bits transmitted. An acceptable level 2E-4 (2 bits in every 10,000).

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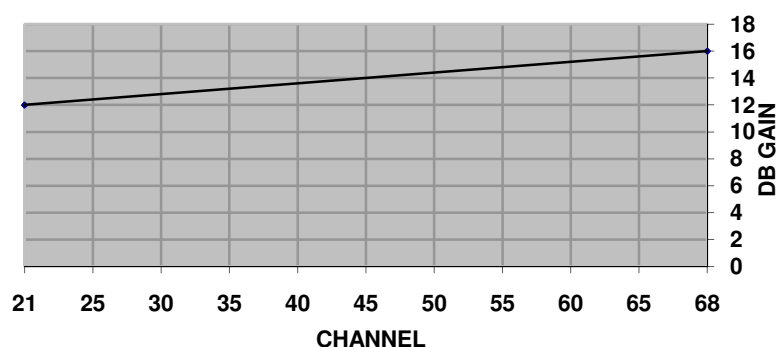
3 SURVEY

3.1 Equipment

3.1.1 The equipment used to carry out this survey was:

- 76 element high gain WB aerial with a gain of 12 – 16 dBs
- 5m of WF100 double screened coax with a total loss of 1.025dB @ 860MHz
- Promax TV Explorer 2+
- X2 F Type connectors
- GPS system

3.1.2 The chart below shows the gain of the 76 element wideband aerial used:



3.1.3 The Antenna was always 3m off the ground which gives a fairly good representation while acting in a safe and controlled manner.

3.2 Surveyed Areas

3.2.1 The area's below were selected by choosing populated areas around the perimeter of the proposed wind farm that may be affected.

AREA	X	Y
LERWICK	445946	1143150
GAZA	435125	1172819
BRAE	435875	1167861
VOE	440704	1163180
GONFIRTH	437367	1161549
VIDLIN	447931	1165423
SWEENING	445937	1166518
LAXFIRTH	448002	1159884
NEAPS	450097	1158335
SKELISTER	446452	1153277
WHITENESS	438734	1144686
TRESTA	436142	1150946
PIXTER	433039	1152320
CLOUSTA	431210	1157226
TWATT	432981	1153365
AITH	434567	1155861
EAST BURRAFIRTH	436264	1158165

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3.2.2 This map shows the above locations around the edge of the proposed development.



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3.3 Method

3.3.1 As stated previously the Shetland islands no longer has an analogue signal and is solely digital. Therefore the analogue signal was tested in order to highlight the antennas that can receive signals and to give indication of how good the signal is under the analogue system.

3.3.2 The test took place using the following method.

- Locate built up areas around the parameter of the wind farm to give a good idea which transmitters are being used and to highlight areas of potential impact.
- Erected the equipment and take a GPS reading.
- An initial 360° horizontal, analogue search for the main transmitters will be carried out and any data recorded.
- When a signal is found the transmitting antenna must be identified, and this will be done using a map and compass.
- A further 360° horizontal search for digital will be carried out.
- The aerial will then be rotated from the horizontal plane through to the vertical plane.
- Again a 360° search will be done in order to find any analogue signals
- It will then be repeated looking for a digital signal.

3.3.3 The table below shows how the analogue quality will be graded and is a recognised method as approved by the CAI:

Quality	Grade	Impairment
Excellent	5	Imperceptible
Good	4	Perceptible but not annoying
Fair	3	Slightly annoying
Poor	2	Annoying
Bad	1	Very annoying

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3.4 Results

3.4.1 TEST SITE 1 – Lerwick



Lerwick is the largest settlement on the Shetlands Island with a population of approx 7,000. The main transmitter for this area is located at Bressay (image above) and provided a good analogue and a good digital signal. Due to the distance from the wind farm and the fact the Transmitter is 18km away from the nearest turbine there will be no impact to the TV service in the area of Lerwick.

3.4.2 TEST SITE 2 – Gaza



Gaza is a small settlement North West of the wind farm. The main signal comes from the Collafirth Transmitter (picture 1 shows the transmitter, picture 2 shows the view of the transmitter from Gaza). Due to the distance from the wind farm and the direction of the transmitter, there will be no adverse affect to the TV signal caused by the wind farm.

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3.4.3 TEST SITE 3 – Brae



Brae has a population of approx 700 and receives its TV signal from the Collafirth Transmitter. The nearest proposed turbine will be 3km away so although the signal will not pass through the wind farm there is the small chance back scatter of the signal from the wind farm may cause some affects. It is thought that the digital change over will make this affect less likely therefore another survey will be carried out after digital change over.

3.4.4 TEST SITE 4 – Voe



Voe is a medium sized settlement with its own Transmitter (see image 1). The signal is transmitting away from the wind farm therefore the turbines should cause no affect to the area of Voe.

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3.4.5 TEST SITE 5 – Gonfirth



At the Gonfirth site it was found there was currently no TV service due to the close proximity to the hills surrounding it. Therefore the houses in the above picture wouldn't currently get a Terrestrial TV service. It was found that the odd home further around the Gon Firth might get a signal from Collafirth Transmitter and these wouldn't be affected by the wind turbines.

3.4.6 TEST SITE 6 – Vidlin



The terrestrial TV signal at Vidlin was found to be coming from the Bressay Transmitter but the analogue signal was found to be poor (see Appendix A). It is assumed that after digital switch over a better digital signal will be present at Vidlin and it shouldn't be affected by the turbines as the line of site (LOS) is over 4km away from the nearest turbine. A post digital survey is required.

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3.4.7 TEST SITE 7 – Sweening



Sweening is a small community that received a slightly degraded signal from the Bressay transmitter mast. The signal would pass very close to the Eastern edge of the wind farm and it is highly likely the signal would be affected. Therefore a second survey is required post digital changeover to observe the quality of the digital signal.

3.4.8 TEST SITE 8 – Laxfirth



Laxfirth was found to have a poor signal from the Bressay transmitter and homes in this area would need a satellite service to get a good TV service. The wind farm might cause some affects to the signal because it will pass close to the Eastern edge of the wind farm but due to the current degraded signal it is deemed that any affect would significantly change the poor signal currently being received.

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3.4.9 TEST SITE 9 – Neaps



Neaps is in Line of Sight to the Bressay Transmitter (see picture) and therefore received a good signal. The signal will not pass through the Windfarm and would be far enough from any of the turbines for them not to have any ill affects.

3.4.10 TEST SITE 10 – Skelister



Skelister's TV service is a good signal from the Weisdale Transmitter (picture 2) although a much degraded signal from Bressay was also found at the test point. The southern edge of the Windfarm runs in parallel to the line of sight from the Weisdale transmitter to skelister and is about 4 km away. Due to this it is believed the wind turbines will have no impact on a digital signal therefore a further post change over survey is required.

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3.4.11 TEST SITE 11 - Whiteness



Whiteness receives a good signal from Bressay with a slightly degraded signal from Weisdale although if the aerial height was increased this would improve the Weisdale reception. Due to the location the turbines will not cause any affects to the TV reception to this area.

3.4.12 TEST SITE 12 – Tresta



Tresta is located 2.5km away from the south Westerly edge of the wind farm and receives a TV signal from weisdale. Due to the closeness of the transmitter and the direction from the transmitter the Windfarm should cause no affect to the area of Tresta.

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3.4.13 TEST SITE 13 – Pixter



Pixter is 4.5 km from the south westerly corner of the wind farm and gets a good signal from Weisdale; it was also found that it received a much degraded signal from Bressay. Due to the location of the transmission and the location of the Weisdale transmitter it is expected that after the digital switch over the wind turbines would have no affect on the transmission but a further post digital survey is required.

3.4.14 TEST SITE 14 – Clousta



Clousta gets a slightly degraded reception from Weisdale at the point the survey was done although as the picture above shows, there are a lot of homes further down into the valley that wouldn't receive a signal of any real quality and therefore are likely to utilise satellite systems for their TV reception. Any homes that are getting a signal from Weisdale transmitter could be affected by the turbines since the signal will pass so close to the turbines. A further post change over survey is required.

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3.4.15 TEST SITE 15 – Twatt



Twatt receives its signal from a self help relay (shown above) which receives the signal from the Weisdale transmitter, boosts it and then redirects it into the valley. The signal from the self help mast was good and is not likely to be affected by the wind turbines. It was also found that there was a very poor signal from the Weisdale mast and a poor signal from Bressay although these were degraded the further down the valley the homes were.

3.4.16 TEST SITE 16 – Aith



Aith receives a very good signal from the Weisdale transmitter but the signal will pass very close to the south westerly corner of the proposed Windfarm and will be very likely to be impacted by the wind turbines.

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3.4.17 TEST SITE 17 – East Burrafirth



East Burrafirth is a small settlement on the West coast of the Shetland main land. Its TV reception is from the Weisdale transmitter and is currently a good signal. The signal from Weisdale will travel through the wind farm to get to this area therefore there is a very high likelihood it will be affected from the wind turbines. A post change over survey is recommended although this area will still be affected.

3.5 *Areas of Likely Impact*

The areas of most impact would be on the west of the island from Aith north to Voe and across to Collafirth. Since the Shetlands is a very rural place there will be homes which are within close proximity to the windfarm which will suffer the affects of the signal being back scattered therefore degrading the quality of the reception.

3.6 *TV Links*

Arqiva operate the TV transmission masts and in order for the signal to be transmitted out to each home it must be sent via microwave links to each sub transmitter. Arqiva have confirmed that the windfarm will not affect any of the microwave links that distribute this data (see Appendix C).

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3.7 Mitigation Methods

- 3.7.1 If it was found that the windfarm was highlighted as causing interference to a TV signal then firstly work should be done in order to validate the claim. This would involve a survey being carried out at the location of the complaint as well as a full system check of the occupants TV system being done. The 2 outcomes of this are:
- TV receiving equipment needs realigned/upgraded.
 - TV signal is affected by the windfarm.
- 3.7.2 If the TV receiving equipment needs upgrading and it is the windfarm that is found to be causing degradation to the signal then the equipment must be upgraded to improve the signal strength. This could also be achieved by realigning the aerial to another transmitter or increasing an aerials height to improve the signal strength.
- 3.7.3 If the signal is being affected by the Windfarm and upgrading the aerial will still not improve the signal level then several mitigation measures are available.
- 3.7.3.1 Digital Satellite system – This should be installed to homes and will be a non-subscription satellite service. Both sky and FreeSat have packages that would suit this.
- 3.7.3.2 Community Self Help Relay – This is a receiving aerial which is located away from the property at a higher level in order to receive a good signal. This signal is then amplified and re-transmitted down to the area affected. This system is suitable for a small community. It will involve renting an area of land/mast as well as electricity to run the amplifier and Mux if required.
- 3.7.3.3 Other possible measures would be to install a community satellite/aerial in order to distribute the signal around the affected area.

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4 CONCLUSION

- 4.1.1 The area around the proposed wind farm was surveyed in order to predict the impact caused by the Wind Turbine Generators on the local Terrestrial TV signal. Seventeen points were checked around the area and it was found that the main transmitter mast was Bressay which is located on the island of Bressay which is to the South West of the wind farm. Since the survey was carried out before the analogue to digital change over between 05/05/10 and 19/05/10 the analogue signal was used to represent the potential signal quality of the impending digital signal.

The survey highlighted that homes on the western edge of the island from Aith up to Voe and across to Collafirth have the greatest potential of being affected by the wind farm.. The area will be digital when the wind farm is planned to be erected, digital signals are less likely to be impacted on by interference and since a digital signal only has two states (good picture or no picture) it is less susceptible to degradation of the quality. A further survey is programmed to take place before any proposed construction in order to fully survey the quality of the digital signal on the island.

It is predicted that somewhere in the region of 300 homes in the area around the wind farm could be affected, most of these would currently have satellite TV because of the poor distribution of Terrestrial signals around the island due to the local terrain.

Mitigation should be in place as described in paragraph 3.7, with the most suitable mitigation likely to be a digital satellite service if realignment/system upgrade doesn't work.

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5 REFERENCE DOCUMENTS

<http://windfarms.kw.bbc.co.uk/rd/projects/windfarms/>

<http://www.ofcom.org.uk/tv/>

<http://www.bbc.co.uk/reception/>

An introduction to Domestic Radio TV and Satellite Reception
by R A Calaz CEng, BSc (Eng), MIEE, MSCTE, ACGI

Ofcom Digital Switchover Transmitter Details – West Country Region

Ofcom/BBC – Digital Television transmitters V3.0 July 2007

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6 APPENDICES

6.1 *Appendix A – Analogue Report Forms*

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6.2 ***APPENDIX B – Digital Report Forms***

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6.3 APPENDIX C – Arqiva Response

Hi Colin,

PROPOSED WINDFARM: Viking (HU 413 608)

Thank you for the opportunity to comment on the above proposal. Arqiva (formerly National Grid Wireless) is responsible for providing the BBC's transmission network and therefore is responsible for ensuring the integrity of Re-Broadcast Links (RBLs). Based on the information that you provided, our analysis shows that the proposed wind farm is unlikely to affect any of our RBLs and hence we would not wish to object.

We note that the turbine locations are well away from our microwave link paths.

Both the BBC Research Department and OFCOM are interested in the effects of windfarm interference on domestic reception for BBC, ITV, Channel 4 and five. The BBC have launched a web-based tool so that wind-farm developers can carry out assessments of interference to domestic reception for themselves. Any wind farm enquires to the BBC or Ofcom now result in the enquirer being directed to this web-based tool. The wind-farm assessment tool can be found at: <http://windfarms.kw.bbc.co.uk>

Regards,

Jack FitzSimons
Principal Engineer, Spectrum Planning
Arqiva
Email: jack.fitzsimons@arqiva.com
Phone: +44 (0) 1926 416 257
Fax: +44 (0) 1926 416 275
