

GRETA VALLEY WIND FARM

Compatibility with Radio Services

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Author	Jason Hills
Contributors	
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1 EXECUTIVE SUMMARY

Meridian Energy Limited (Meridian) is proposing to build a wind farm located in North Canterbury between Omihi and Greta Valley, approximately 65 kilometres north of Christchurch. Kordia has been engaged to provide an analysis of the potential radio communication interference effects associated with the proposed development.

The Wind Farm will be situated around Centre Hill, spread along a 7 kilometre section of ridges. A total of 35 turbine locations have been identified for the proposed Greta Valley Wind Farm.

Assessments Undertaken

The report includes the following:

- A summary of the current relevant research and case study literature on effects to radio communications and an explanation of the mechanisms of interference.
- Results of a search of all radio services licensed to operate in the general vicinity of the Greta Valley Wind Farm.
- Assessment of the Greta Valley Wind Farm with respect to licensed radio services in the general vicinity of the proposed wind farm and an evaluation of the risk of interference occurring. The type of licensed services assessed are:
 - a. Broadcast Analogue & Digital Television and Radio.
 - b. Fixed Radio Linking Services.
 - c. Aeronautical RADAR.
 - d. Other wide area coverage services. (i.e. Land Mobile VHF, Cellular Services and Broadband Wireless Access)

Results of Assessments and Suggested Approach for Effects Identified

It was identified that analogue television coverage is the only radio service at risk of experiencing interference from the proposed Greta Valley Wind Farm.

Our study has identified that up to 13 dwellings could experience analogue television multipath interference caused by the proposed wind farm. Any impairment to reception is likely to be mild and will be sporadic in nature.

It is important to note that these 13 dwellings at risk may be receiving television via digital satellite services. Past experience gained by Kordia, from carrying out similar assessments, suggests that at least 50 percent of the dwellings in rural New Zealand locations receive digital satellite services.

Mitigation strategies such as improving receiver antennas or alternative reception options exist if interference does occur.

2 INTRODUCTION

Kordia has been asked to provide an assessment on the potential effects of this wind farm on licensed radio communications within the area.

The Greta Valley Wind Farm will be located in North Canterbury between Omihi and Greta Valley, approximately 65 kilometres north of Christchurch. The Wind Farm will consist of up to 35 wind turbine generators.

The following represents the maximum envelope for the Greta Valley Wind Farm:

- Up to 35 wind turbines
- Up to 80 metre rotor hub height
- Rotor diameter 101 metre (50.5 metre blades)
- Three blades per turbine
- Total height up to 130.5 metre (tower and blade)

Figure 1 below shows the proposed layout of the Greta Valley Wind Farm.

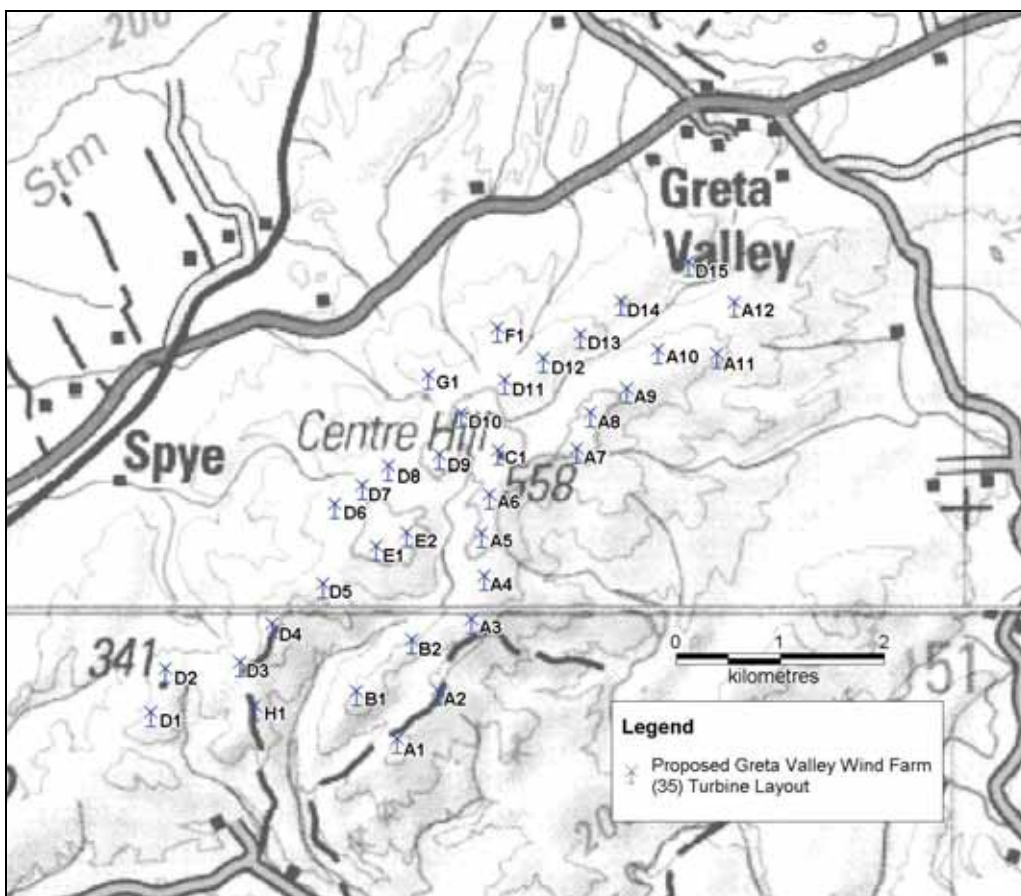


Figure 1: Proposed Greta Valley Wind Farm turbine locations

2.1 OBJECTIVE

The objective of this report is to assess the potential of the proposed wind farm to cause interference to existing licensed radio services in the general vicinity of the proposed wind farm.

2.2 SCOPE

This report provides:

1. A summary of the current relevant research and case study literature on this topic (Section 3) and an explanation of the mechanisms of interference.
2. Results of a search of all radio services licensed to operate in the general vicinity of the proposed wind farm site. (Section 4)
3. Assessment and evaluation of the risk that the Greta Valley Wind Farm will interfere with;
 - a. Broadcast Analogue & Digital Television and Radio.
 - b. Fixed Radio Linking Services.
 - c. Aeronautical RADAR.
 - d. Other wide area coverage services. (i.e. Land Mobile VHF, Cellular Services and Broadband Wireless Access)

In the general vicinity of the proposed wind farm. (Sections 3 to 4.7)

4. Recommended mitigation strategies for likely interference scenarios. (Section 5)

2.3 ASSUMPTIONS

The analysis is based on the proposed 36 turbine zone layout supplied to Kordia on the 14th September 2009.

Building point data^[1] within 20 kilometres from the proposed wind turbine locations was used for the analogue television interference analysis. This data gives the probability that each building point is an occupied dwelling, and from this information we are able to give an estimate of the actual number of dwellings. This is considered to be a conservative approach given that some buildings may not be occupied and those that are occupied may use an alternate means of reception such as satellite. Meridian supplied a set of orthophotographic aerial images which were used to support our assessment of affected dwellings.

For the analogue television assessment, Kordia has assumed which television service and which television transmitter site each building point would most likely to be attempting to receive. The assumptions are based on signal strength and path terrain calculations.

3 WIND FARMS AND RADIO WAVES

Wireless communication systems use radio waves to relay information from a transmitter to a receiver. In some circumstances it is possible for wind turbines to cause interference to wireless receivers.

There are four distinct mechanisms that can potentially cause interference to a radio service:

Electromagnetic Interference (EMI)

- Occurs when a wind turbine generates and radiates radio frequency energy in a frequency band used by a radio service.

Near-Field Effects

- Occurs when a wind turbine is located so close to an existing antenna that it modifies the radiation characteristics of the antenna.

Diffraction

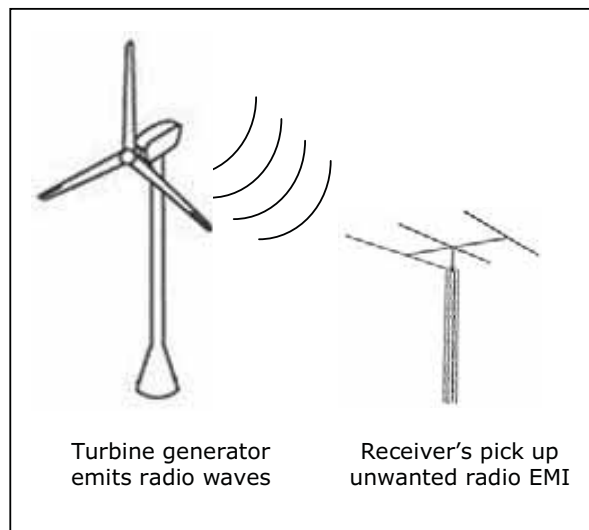
- Occurs when a wind turbine's location causes radio waves to be partially blocked, causing some signal power loss.

Reflection (or Scattering)

- Occurs when radio waves are reflected from a wind turbine's surface.

These mechanisms are explained in more detail in Sections 3.1 to 3.4.

3.1 ELECTROMAGNETIC INTERFERENCE (EMI)

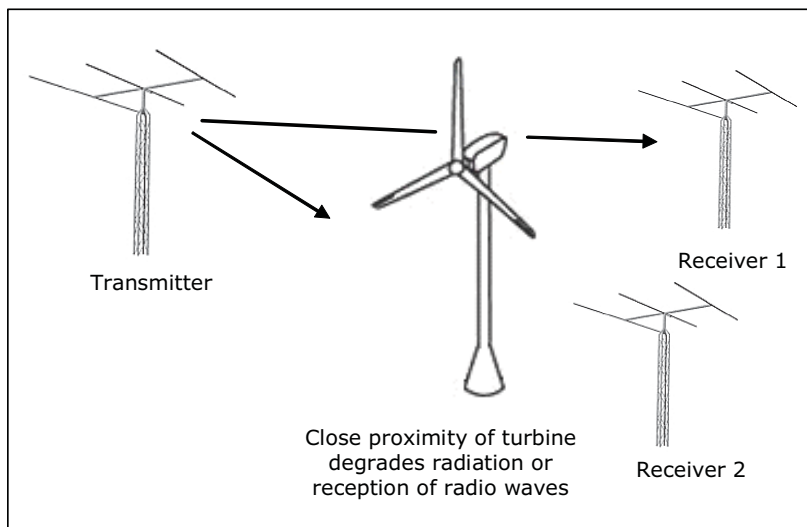


Any device or equipment that uses or generates electricity emits electromagnetic radiation. High powered devices can potentially emit enough radio energy to interfere with radio communication

services if they are not appropriately shielded. However, in general, the level of radio energy emitted from a modern electric motor or generator is very low. Kordia considers that compliance with the New Zealand standard for electromagnetic radiation^[2] is all that is required to reduce the risk of EMI to very low levels.

Kordia believes there have been no instances of New Zealand wind farm installations causing EMI to radio services, therefore it is not expected that this will be an issue for the Greta Valley Wind Farm.

3.2 NEAR-FIELD EFFECTS



A transmitting (or receiving) antenna has a so-called 'near-field' zone. For an antenna to be able to work efficiently, this zone must be free of all objects that could either re-radiate or absorb radio waves.

If this type of effect occurred it would modify the intended performance of the antenna, most commonly reducing the efficiency of the antenna.

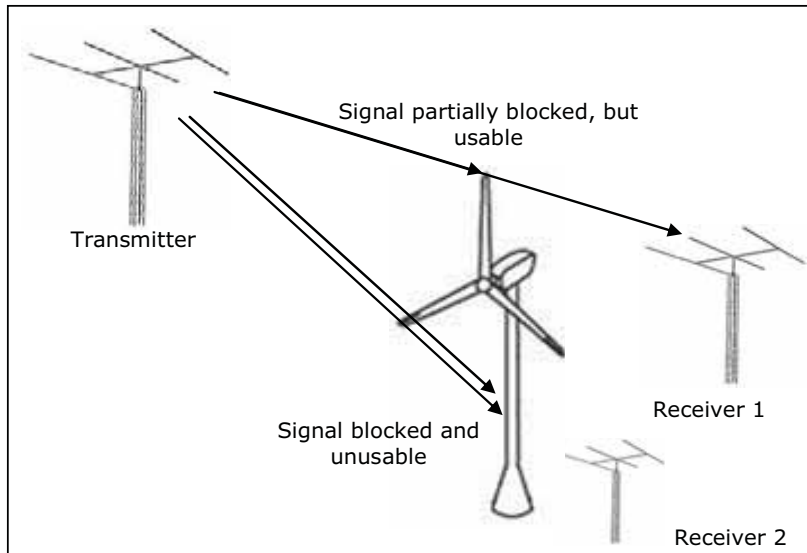
The services most likely to be affected are those with mobile receivers that might be operated a few metres from a turbine tower. The distance of an antenna from a turbine tower that would cause near-field problems is dependent on the operating frequency and directivity. However, in general, VHF (e.g. land repeaters) and UHF (e.g. cellular) services more than 10 - 20 metres from the turbine tower structure are unlikely to experience some degree of near field effects (exact distances will depend on service and frequency).

This issue can be divided into effects to fixed "base station" services and effects to mobile services:

- Turbine towers should not be placed immediately next to any existing fixed antennas in the area (co-ordination with service operator required). In future, it would be prudent for any telecommunications facilities not to be located close enough to turbine towers to cause near field problems.
- Mobile radio services (e.g. mobile phones, walkie-talkies) are by their very nature, roaming. Inevitably, mobile radio users accessing service very close to turbine towers will experience poor radio quality, but the problem can easily be mitigated by moving some metres away from the turbine tower.

The proposed turbine tower layout for the Greta Valley Wind Farm complies with the above recommended separation distances for all existing fixed "base station" and mobile services.

3.3 DIFFRACTION (OR OBSTRUCTION)



Diffraction of a radio wave occurs when an object obstructs part of an advancing wave front. Diffraction effects occur when the obstructing object partially or totally blocks the path of the radio wave. Diffraction effects due to wind turbines can be avoided by requiring obstructions to be outside a specified distance (Fresnel zone - the zone usually considered as containing the useful transmitted power in the direction of the receiver) of a radio link^[3]. In the case of wide area coverage services each turbine will cause a narrow region of diffraction behind it - relocating the turbine will only relocate the problem.

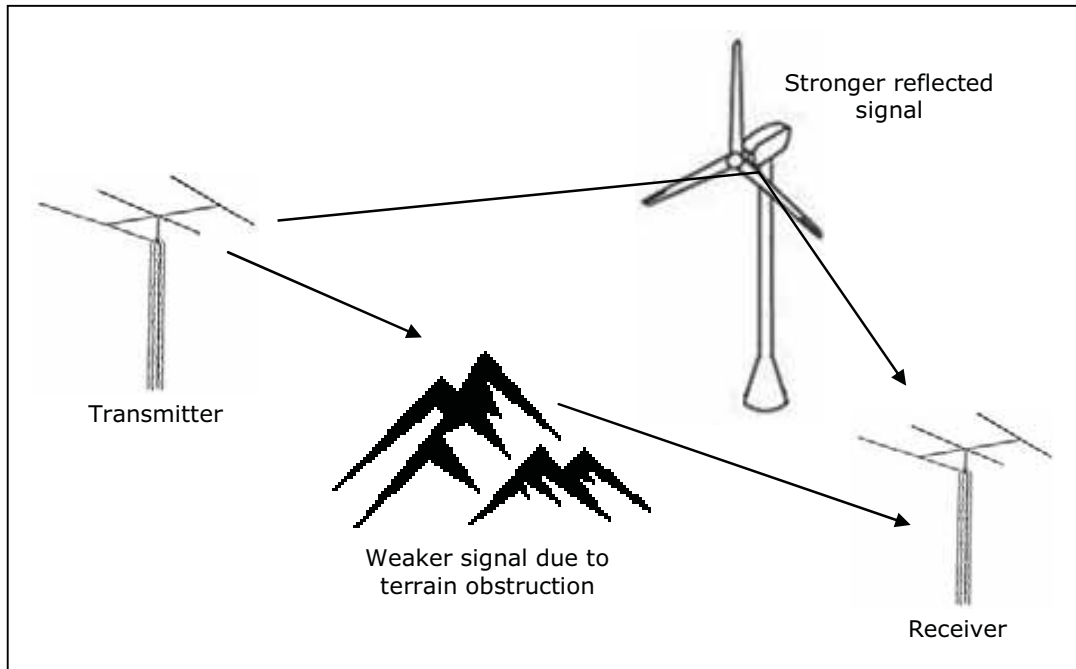
The effect of diffraction is to reduce the amount of energy available at the receiving antenna. If the turbine blades cause diffraction, the radio wave perturbations may cause a periodic disturbance of the signal at the receiver.

While diffraction will affect all radio services, the service it has the most effect on is fixed radio linking. This is discussed further in Section 4.5 of this report.

Fixed radio links of 1 GHz and over are commonly referred to as microwave links. It is the general rule that the first Fresnel zones of microwave links should be kept clear of any obstructions in order to avoid diffraction loss.

Fixed radio links of lower frequencies (under 1 GHz) present less of a problem with regards to obstructions. This is because the first Fresnel zone is much larger, which means that these links are more able to sustain a degree of path obstruction. However, it is still good practice to keep the first Fresnel zone of the low frequency links clear of obstructions, or at the very least to keep the obstructions to a minimum.

3.4 REFLECTION (OR SCATTERING)



Reflection of radio waves from turbine towers and turbine blades is the predominant interference mechanism that can affect radio services.

When a radio wave illuminates an object a portion of the incident energy is re-radiated in various directions. This is termed "scattering". In practice, the re-radiated energy may be somewhat concentrated in a particular direction, but a significant proportion is often re-radiated in other directions^[3].

Wind turbine radio signal scattering occurs when an incident signal is reflected in various directions by the reflective parts of the turbine. Scattering can cause interference to nearby radio services by two mechanisms:

1. Multi-path Propagation: Delayed "echo" signals of the wanted signal arrive at a "victim" receiver via indirect paths relative to the direct path signal. The echoes originate from the wanted transmission incidentally illuminating the wind turbines. These echoes can cause various effects depending on the type of transmission: e.g. ghost images on analogue television pictures; bit errors due to symbol distortion and echo-noise in digital transmissions.
2. Frequency Reuse: Scattered echoes arrive at a receiver having originated from other transmissions using the same channel frequency in the same geographical area. In the above examples, these echoes cause an interference line structure on analogue television pictures, and bit errors due to interference-noise in digital transmissions.

For both mechanisms, the seriousness of the effect depends on the strength and delay of the received echoes relative to the direct path signal, the fade margin of the victim radio service, and the countermeasures employed in the victim receiver. Strong, long delay echoes are particularly troublesome to radio reception.

The strength of a received echo depends on the:

- Radar Cross Section (RCS) of the turbine in the given directions of illumination and scattering;
- Distances between the culprit transmitter, turbine, and victim receiver;
- Radio propagation conditions over these paths;
- Off-axis discrimination of the transmit and receive antennas in their respective directions to the turbine.

The echo delay is the difference in propagation time over the direct path and the echo path.

The worst-case situation is for a large turbine to be located close to either the culprit transmitter or the victim receiver, with unobstructed radio paths to both, and with little discrimination from the transmit and receive antennas to the turbine. In the case of multi-path propagation interference, echo delay in excess of about half the symbol period (or if the receiver is equipped with adaptive equalisation – greater than the transit time through the equaliser) results in the worst-case echo-noise.

In general, the effect of scattering interference on fixed radio links will only become apparent during the relatively short and isolated periods of anomalous propagation, when the wanted signal received over the direct path is strongly faded but the scatter remains un-faded. The effect of the scattering is to increase the vulnerability to signal fading by virtue of a loss in link fade margin. The effect of scatter would thus be to increase the frequency and duration of instances of corrupted transmission as a result of anomalous propagation. This would amount to degradation in link performance.

Analysis of potential scattering effects is undertaken by determining the ratio of unwanted scattered signal to the wanted signal received at the "victim" radio receiver. Knowledge of the maximum unwanted scattered signal to wanted signal ratio ($\frac{P_{Scatter}}{P_{Signal}}$) for each service allows the minimum required distance between radio transmission facilities and a wind turbine to be determined.

The ratio of scatter to signal can be calculated from first principles and depends on:

- Distances between transmitter, receiver and wind turbine
- Obstruction losses along each of the three signal paths
- The RCS of the wind turbine
- The directivity of the transmit and receive antennas

The most uncertain of these parameters is the RCS of the wind turbine, which is not simply its physical area. The RCS value of a wind turbine is a measure of how detectable the turbine is to RADAR. How detectable a turbine is to a RADAR depends on factors such as the conductivity of the wind turbine materials, as well as the physical geometry and reflectivity of the wind turbine surfaces and their angles relative to the radio transmission facilities. The result is that the RCS for a wind turbine over a hypothetical three-dimensional sphere is complex and will vary by several orders of magnitude with both direction and time. Peak RCS values can be much higher than the physical area of the wind turbine, but these will only occur over narrow arcs. These peak values are associated with scattering from specific parts of the turbine structure, e.g. the sharp edges of the rotor blades, the flat plates of the nacelle, or the general shape of the tower. Whilst some peaks might vary slowly in response to wind direction, e.g. those associated with nacelle movement, the peaks associated with the rotation, pitch, and yaw of the blades will vary rapidly.

Scatter interference will be radiated in all directions around wind turbines over a period of time, potentially affecting both wide-area coverage and point-to-point radio services.

Determining the actual RCS of a particular wind turbine is complex and beyond the scope of this assessment.

However, as an example, in a recent British study, *Wind Farms Impact On Radar Aviation Interests*^[4], the RCS of two wind turbines were theoretically modelled, and the dependence of the RCS on various parameters investigated. The results, confirmed by measurements, indicate that the RCS can vary significantly between wind turbine types, and also with operating conditions, directions of illumination and scatter, and time. Consideration of these results indicates that specific RCS values from the study can be used directly in interference co-ordination, and could also be used to estimate an additional RCS margin to cater for various sizes of turbines.

3.4.1 RCS VALUES RECOMMENDED FOR INTERFERENCE ASSESSMENT

For a 100 m tall turbine with 100 m diameter blades the maximum peak RCS value is estimated to be 25,000 m² (+44 dBsm). This value, taken directly from the *Wind Farms Impact On Radar Aviation Interests*^[4], study, is associated with a particular style of nacelle and turbine tower, but is not expected to vary markedly with the overall size of the turbine. Such high values occur in only narrow arcs in isolated directions. The peak RCS associated with the rotating blades is somewhat lower, estimated to be 3,162 m² (+35 dBsm), but RCS values in this range are expected to occur more frequently over the hypothetical sphere.

The RCS is frequency dependent, but it is expected that these values are appropriate over the 44 MHz to 2,000 MHz frequency range considered here (at 44 MHz these values are expected to be conservative). These RCS values are based on calculations of the horizon RCS only (i.e. at the same height as the wind turbine). Whilst they are also expected to be appropriate at locations lower in height than the wind turbines (i.e. the bulk of the area considered for radio service interference assessment), the values may not be sufficient at locations higher than the wind turbines (e.g. at the tops of isolated hills). This is not expected to be a major issue for most services other than perhaps point-to-point fixed radio links (discussed in Section 4.5).

3.4.2 APPLICATION AND USE OF RCS VALUES IN INTERFERENCE ASSESSMENT

The application and use of these RCS values depends on the type of service being assessed and the proximity of wind turbines to the radio facilities.

For a preliminary assessment the concept of the co-ordination zone provides a method to screen out the majority of radio facilities from further consideration. Facilities located beyond the co-ordination distance from wind turbines are most unlikely to be affected by interference. The co-ordination distance is determined using conservative generalised values for the parameters of the turbines, radio equipment, radio service quality expectations, and radio propagation conditions. Different radio services will require, in general, different co-ordination zones. Detailed interference assessment is required only for those radio facilities located within the co-ordination zone, where the actual parameter values would be used to assess the interference. In this report detailed assessment has been deemed necessary only in cases where radio facilities are likely to be located within the co-ordination zone. Although they are conservative, the following co-ordination zones have been used for this report:

Service Type	Co-ordination Zone
Analogue & Digital Television	20 kilometres
Fixed Linking	Anything intruding into the link's 1st Fresnel zone is considered
RADAR	To be determined by Airways New Zealand
Other Wide Area Services	Up to 600 metres

Table 1: Co-ordination zones for difference radio services

The RCS values recommended above can be used directly to determine the required separation distance from a single wind turbine only. Multiple wind turbines will increase the required separation distance, but the increase is not simply a multiplicative effect based on the number of turbines due to the large range of distances between individual turbines and a nearby radio facility. The directional characteristic of the RCS is a further consideration, whereby large RCS values (typically associated with the nacelle) of neighbouring turbines are unlikely to intersect at a single point. On the other hand, there is a high probability that the lower RCS values (associated with the blades) of neighbouring turbines will indeed intersect at various points surrounding a wind farm.

The effect of the interference will be different depending on whether the radio service is wide-area coverage or point-to-point, and this rationale is applied in determining the appropriate RCS values to use:

Wide-Area Coverage Services

The very high but isolated RCS value of 25,000 m² (+44 dBsm) associated with the nacelle will not affect the vast majority of radio facilities within a wide coverage area, and hence this value is not used for either determining the co-ordination distance, or a detailed interference assessment for these types of services. The co-ordination zone is based on a value of 3,162 m² (+35 dBsm) associated with the turbine blades in respect of eight closely spaced hypothetical turbines. In detailed assessments the interference contributions of all of the actual turbines are considered, and is dependant on the turbine type. To put this in some context, for a "large" turbine (nominally 80 metre hub height with 100 metre diameter blades) we would use an RCS value of 1,000 m².

Point-to-Point Services

In detailed assessments 25,000 m² (+44 dBsm) is used in respect of a single hypothetical turbine to calculate the co-ordination distance, and 3,162m² (+35 dBsm) to aggregate the interference from all of the actual turbines.

4 RADIO INTERFERENCE EFFECTS

4.1 ACCURACY OF THE INTERFERENCE EFFECTS ASSESSMENT

The accuracy of the external data sources used for this interference effects assessment are as follows:

- **Terrain data:**

TERRALINK maps are used with a resolution of ± 10 m vertical (contour) and ± 25 m horizontal (coordinates).

- **Ministry of Economic Development database:**

Licence information within the Ministry of Economic Development database regarding site placement of transmitters has been known to sometimes differ by more than 100 metres from the actual location. Generally these differences are not considered critical for this analysis. It is assumed that the database information regarding transmit/receive height and transmit/receive frequency is correct.

- **Turbine RADAR Cross Section (RCS):**

As the exact turbine type will not be confirmed until the detailed design stage, the turbine RCS value cannot be established. Conservative estimates of RCS values have therefore been made and the radio interference analyses are based on these.

The analyses are based on a maximum scenario consisting of 130.5 metre (above ground level) turbine heights (to top of blade), made up of 80 m towers with 50.5 metre blade radius.

4.2 LICENCE SEARCH

To assess the likelihood of any licensed services being affected we searched the New Zealand register of radio frequency licences from within the Ministry of Economic Development (MED) licence database. Licences were sorted into their corresponding categories and analysed with respect to their type i.e. Analogue Television, Fixed Radio Links, etc. These are covered in Sections 4.3 to 4.7.

4.3 INTERFERENCE ASSESSMENT SUMMARY

Transmitter licences and locations in the area were extracted from the MED licence database released on the 14th September 2009. Whether or not these licences are actually in use by the licence holder in no way diminishes the rights of the licence holder in respect of protection from any harmful interference effects. Hence, all radio spectrum licences were analysed.

This section classifies the interference to radio services into categories of effect and risk of occurrence. It discusses for each affected service, the nature and cause of the effect and risk of the interference occurring. These findings are summarised in Table 2. It should be noted that, the

risk assessment presented for inference of analogue television is considered conservative, given some buildings may not be occupied and those that are may be using an alternative means of television reception such as satellite.

Where required, possible solutions have been proposed (Section 5) to mitigate the effects. The 'low' risk categories do not require any specific action as any interference caused is unlikely to be noticeable.

Type of Service	Cause	Effect	General Case Risk	Specific Greta Valley Wind Farm Risk	Mitigation
<p><i>Analogue Terrestrial Television (Wide Area Coverage Service)</i></p>	<p>Reflected or scattered signal</p>	<p>Impairment of TV images by ghosting.</p>	<p>High</p>	<p>Med - Up to 13 dwellings could experience mild impaired analogue reception, although this will be sporadic in nature.</p>	<ul style="list-style-type: none"> Upgrade receiver antenna systems. Receive an alternative service such as or digital satellite, or digital terrestrial if available.
<p><i>Fixed Radio Linking</i></p>	<p>Towers impinge on ray path between transmitter and receiver. Scattering.</p>	<p>Degradation or loss of received signal strength. Degradation in fade margin due to scattering interference.</p>	<p>High</p>	<p>Low - There are fixed radio linking services operating within the general vicinity, with one passing through the proposed wind farm. It is very unlikely that any of these links will be subjected to interference from the proposed turbines.</p>	<p>Not required.</p>
<p><i>Other Wide Area Coverage Services (Broadband Wireless Access – BWA, Mobile communications including cellular and emergency services)</i></p>	<p>Towers, nacelle, or blades cause degradation of signal.</p>	<p>Degradation to the coverage area or loss of signal received from subscriber.</p>	<p>Medium</p>	<p>Low – There are no licensed mobile services operating within the coordination contour of the proposed Greta Valley Wind Farm.</p>	<p>Not required.</p>

Type of Service	Cause	Effect	General Case Risk	Specific Greta Valley Wind Farm Risk	Mitigation
RADAR	Towers, nacelle, or blades cause reflection of RADAR signal.	False traces or impairment on RADAR readings.	Medium	Low – There are no aeronautical RADAR systems in close proximity to the Greta Valley Wind Farm. The closest aeronautical radio service is 40 km away; with the nearest aeronautical RADAR service located at Mt Cass, over 70 km away. These services are not expected to be affected.	Kordia does not believe RADAR services will be affected. However, we recommend that Meridian contact Airways Corporation NZ for further comments.
AM/FM Broadcast Radio	Reflected signal interferes with signal demodulation, or diffracted signal causes signal loss.	Degradation to the coverage area or loss of signal received from subscriber.	Low	Low – Any interference caused is unlikely to be detectable.	Not required.
Digital Terrestrial Television (Wide Area Coverage Service)	Reflected or scattered signal	Impairment of TV picture or sound from uncorrected bit-errors	Low	Low – Interference is unlikely to occur.	Not required.

Table 2: Services likely to be interfered with and the level of risk that interference will occur due to the proposed Greta Valley Wind Farm

4.4 TELEVISION ASSESSMENT

4.4.1 ANALOGUE TERRESTRIAL TELEVISION

This is the most likely transmission service to experience interference, but only within a limited distance from the wind farm. This limited distance has been conservatively estimated as 20 kilometres, shown in Figure 2. The interference will result in the appearance of ghost images in the picture. In some circumstances, loss of colour, buzz on the sound, loss of detail in the picture, and corruption of Teletext may also be noticed^[5].

Diffraction

Diffraction effects will cause no noticeable impairment to the analogue television reception in the area due to the transmit and receive sources being located significant distances away from the proposed wind farm.

Scattering

In this area, broadcast analogue television is transmitted from the Kordia tower at Sugarloaf, approximately 70 kilometres south of Greta Valley. TV One, TV2, TV3, TV4, SKY (encrypted analogue services), Prime, CTV and Maori TV are broadcast to locations, free-to-air using the VHF and UHF bands. Analogue television is also transmitted from two low-power VHF television repeaters: Mt Alexander and Cat Hill Road, which are located within the 20 kilometre radius of the wind farm. Using the VHF bands, TV One, TV2 and TV3 are broadcast from Mt Alexander; with TV One and TV2 broadcast from Cat Hill Road.

Local dwellings will be receiving their TV services either via a roof top antenna (analogue and digital FreeviewHD), or alternatively by SKY or TVNZ (Freeview) satellite. It is expected that the majority of dwellings will be receiving services from Sugarloaf, with a small number, located at a close distance to the low-power repeaters, using either of these repeaters.

The turbine tower, nacelle and blades can reflect a certain amount of the incident radio signals. This can cause delayed echoes of the television signal to arrive at the receiving antenna resulting in ghosting of the picture.

In the case of the turbine blades, the chance of a reflection causing noticeable interference is determined by a combination of the rotor azimuth (bearing) and blade pitch. These are dependent upon the wind direction and speed respectively.

The coverage obstruction (shadow) loss from the serving transmitter to each building point was calculated as well as the shadow loss from the transmitter to the wind turbines and the wind turbines to each building point. Using this information, a net obstruction loss was calculated for each building point and this was used to determine the potential for interference.

For this report, radio coverage prediction models were used to assess the extent of the areas that could be affected. A highly conservative area of 20 kilometres surrounding the wind farm was used in this assessment. This area is large enough to ensure that all possible affected building points are considered in our analysis. Building points located beyond this distance are unlikely to be line-of-sight to the turbines. This area of study is shown in Figure 2. Building point data that includes residential dwelling data^[1] was used to identify the locations of affected building points and the estimated number of dwellings. Dwellings in this area are likely to be viewing television services from the main transmitter (Sugarloaf), with some receiving services from one of the two low-power VHF repeaters, mentioned above, depending on their signal quality and location. For this reason, each building point was assessed with respect to each of these three transmitters.

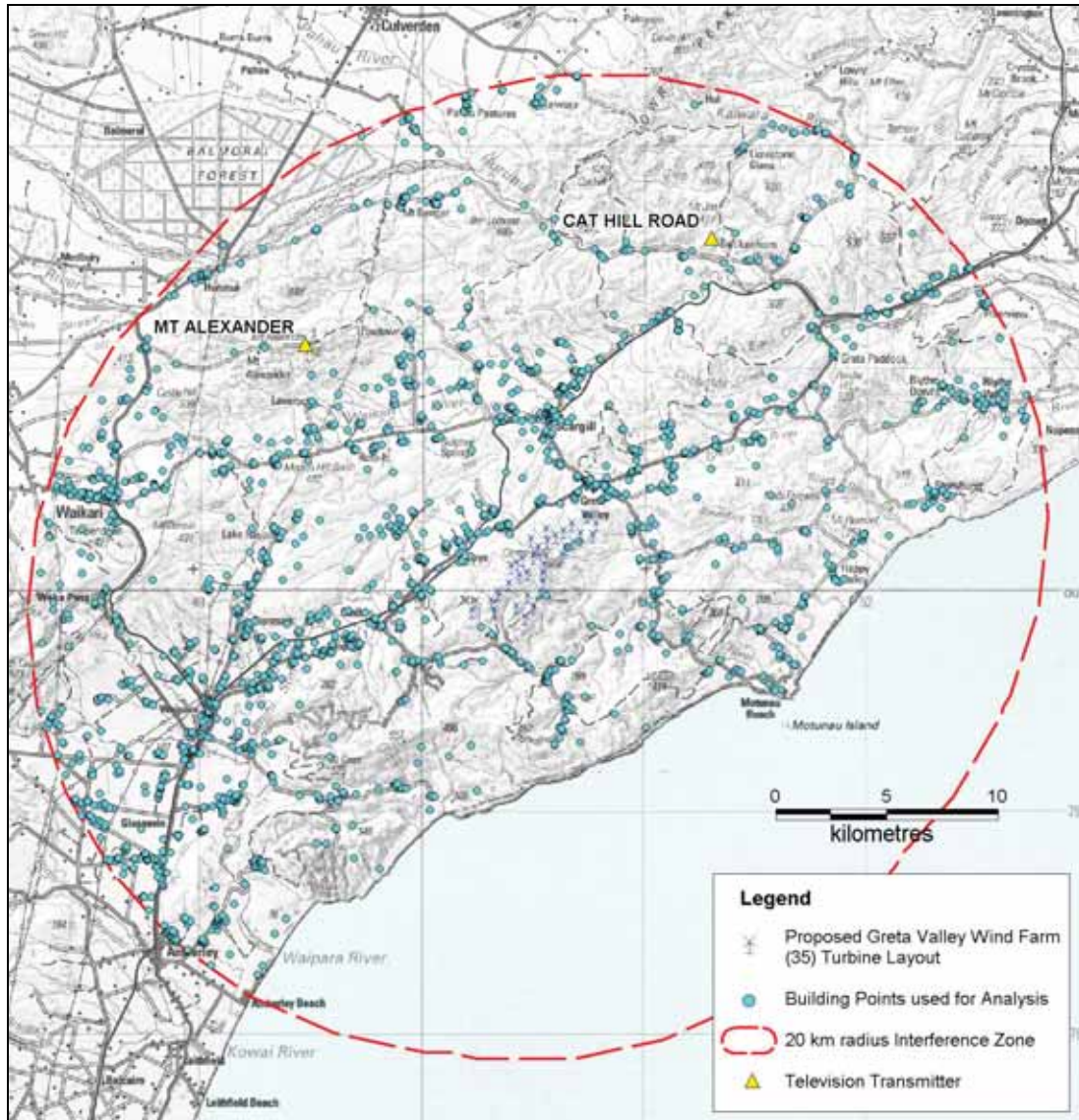


Figure 2: 20 kilometres radius area of analysis of the proposed wind farm.

We estimate that there are up to 2,131 buildings points in the area of study. The building point data used in this assessment contains locations for buildings of all types including: dwellings, sheds and barns, as well as an Occupancy Ratio. This ratio gives a statistical estimate for each building point being an occupied dwelling. Our assessment has not used this ratio; instead we have used aerial orthophotographic images to enable a better judgement of whether each building point is likely to be an occupied dwelling.

Within the 20 kilometre area of study our desktop analysis has indicated that 32 building points are at risk of experiencing multipath interference caused by the wind farm. These are shown in Figure 3 and in Figure 4 on a smaller scale.

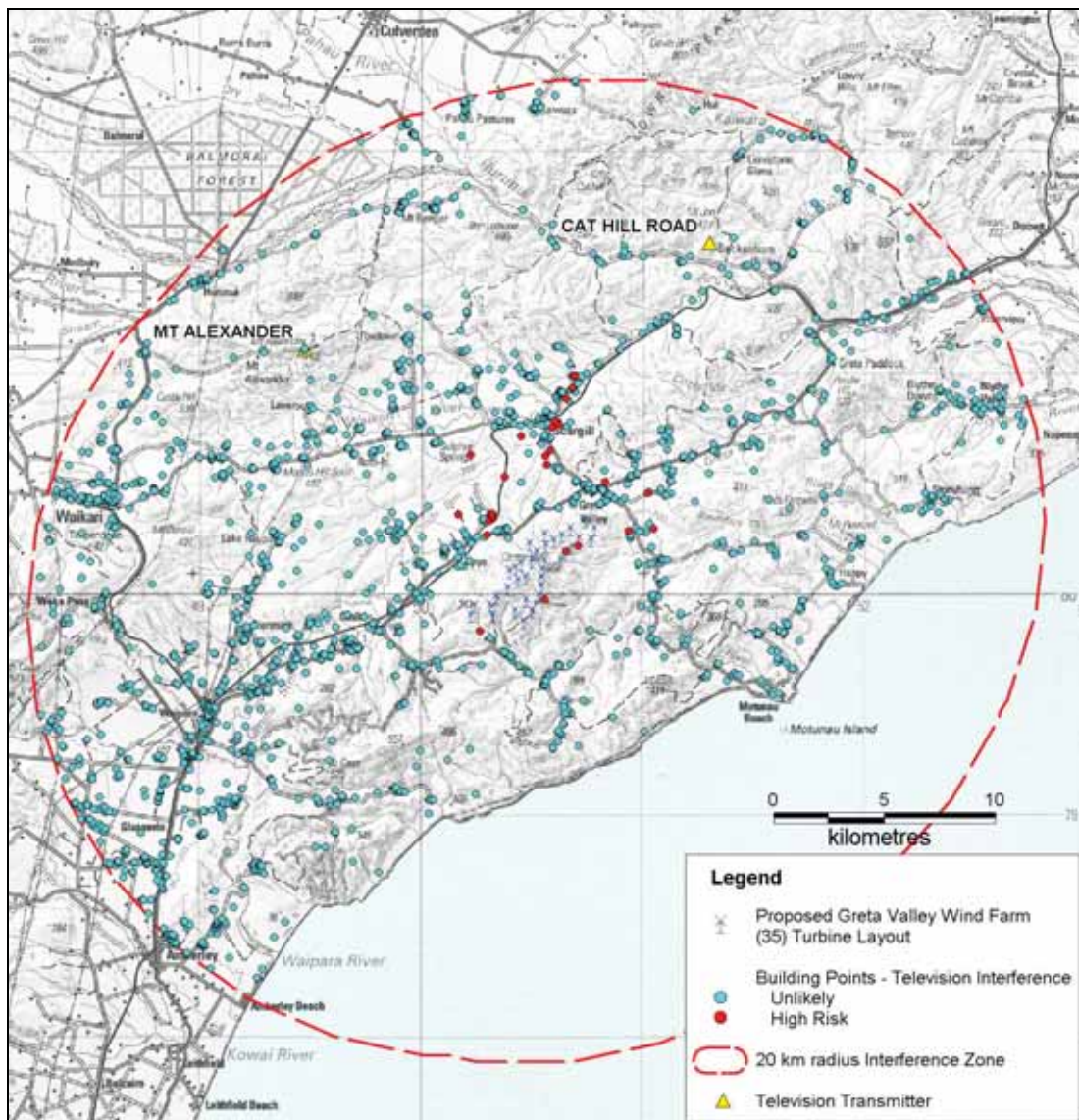


Figure 3: Building points likely to experience multipath interference caused by the proposed wind farm

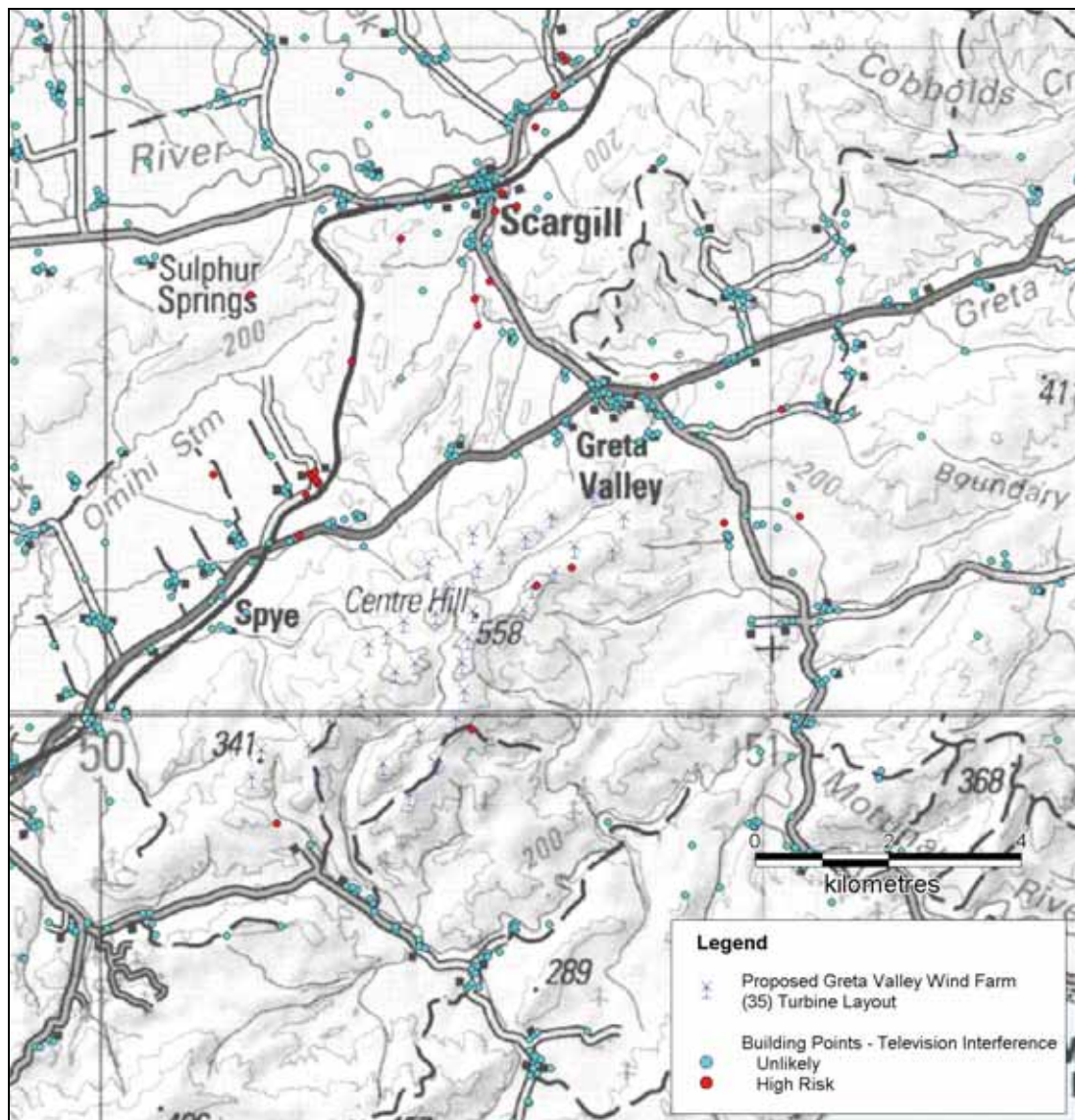


Figure 4: Local map of building points likely to experience multipath interference caused by the proposed wind farm

Using aerial orthophotographic images of the area of interest, the 32 potentially affected building points were inspected to determine which are likely to be dwellings. This visual inspection showed that up to 13 of the 32 affected building points were identified as likely to be dwellings. These dwellings are listed in Table 3 and plotted on a map in Figure 5.

Building Pt ID	Easting	Northing
144105	2503038	5803307
144130	2503128	5803587
144132	2503217	5803460
144235	2505810	5806519
144251	2505894	5807579
144284	2505984	5807861
144374	2506808	5809319
144375	2506786	5809336
144388	2506949	5809853
147647	2509330	5802870
147813	2508035	5804791
147825	2508282	5805087
147858	2510204	5804593

Table 3: Potentially affected dwellings (NZMG locations)

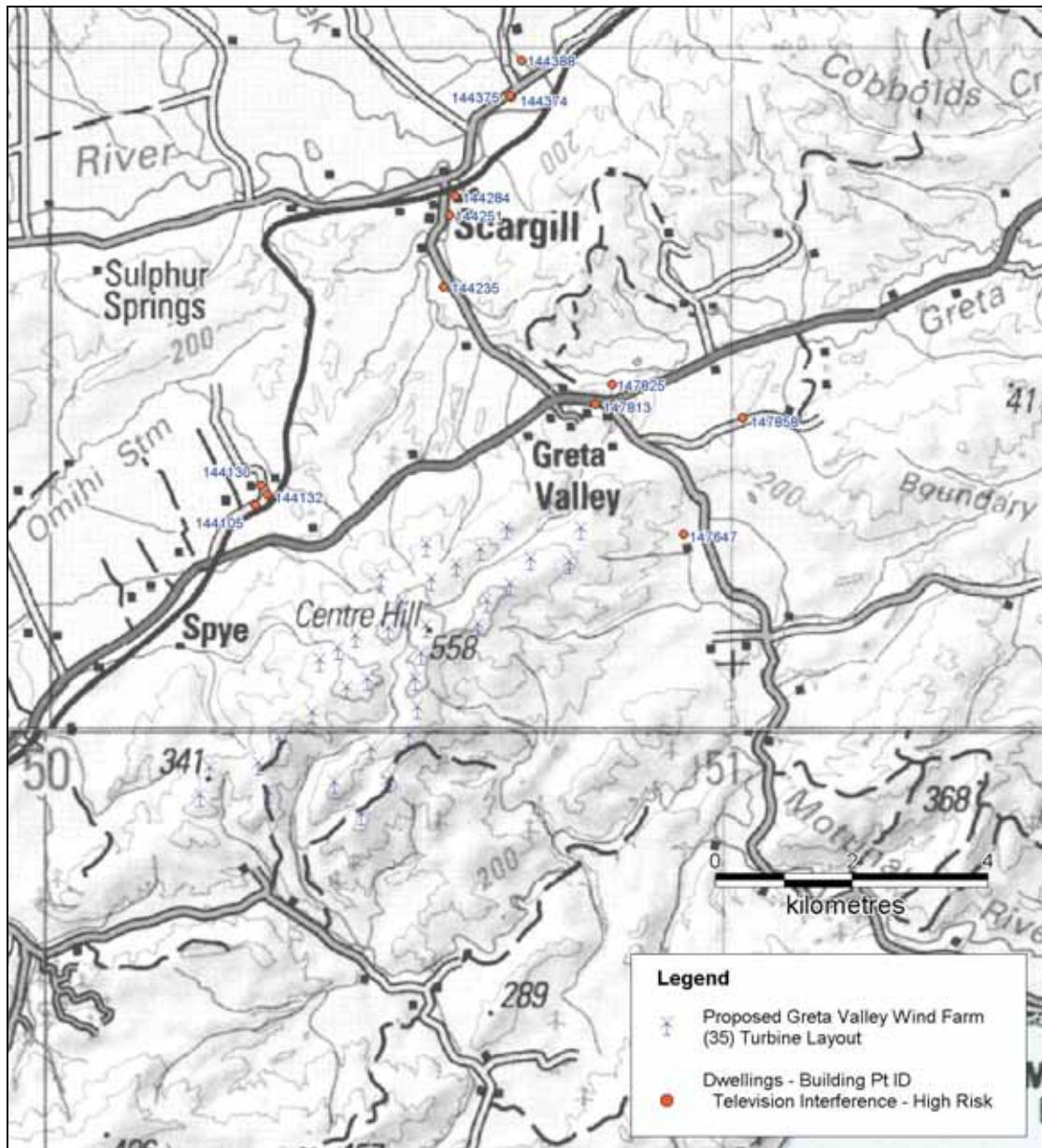


Figure 5: Local map of potentially affected dwellings points likely to experience multipath interference caused by the proposed wind farm

Specific information on dwellings in the area of assessment receiving television via digital terrestrial or via digital satellite services was not available to Kordia at the time of producing the report. However, past experience gained by Kordia from carrying out similar assessments in rural New Zealand locations, suggests that if this information can be obtained, the number of affected dwellings could reduce by more than 50 percent.

Meridian has built and operates three wind farms in New Zealand: Te Apiti in the Manawatu (55 turbines), White Hill in Southland (29 turbines) and West Wind in Wellington (62 turbines). To date none of these projects have resulted in any complaints regarding television interference.

It is difficult to predict the level of ghosting that will occur at any given location. However, the following comments are offered:

- The level of reflection from a turbine blade will tend to fluctuate as the blades rotate and there is only a small chance that it will reflect perfectly to any location at any given time.
- If it does occur, the ghosting will be readily identifiable as emanating from the operation of the wind farm. It will appear as a periodic disturbance of the picture (and also possibly sound and Teletext disturbances).
- Recommendation ITU-R BT.805_[6] provides a method to calculate the scattering factor. However, in practice this method has been found to overestimate the amount of energy actually scattered, and therefore has not been adopted in this assessment.

Any interference that does occur can be easily identified by an experienced radio engineer as being caused by the wind turbines, as opposed to any other structure or landmass that was causing ghosting prior to the construction of the wind farm.

It is also noted that at the Digital Future Summit in Auckland, the Minister of Broadcasting announced that a final date for analogue television switch-off will be announced in 2012, or when digital television is available in 75% of New Zealand households – whichever happens first.

In the event of any adverse effects to analogue television reception associated with the Greta Valley Wind Farm, there are some simple mitigation options available such as:

- Improving or upgrading receiver antenna systems, or
- Using alternative digital satellite or digital terrestrial services.

4.4.2 DIGITAL TERRESTRIAL TELEVISION

Digital terrestrial television, known as FreeviewHD, is also broadcast from the Kordia tower at Sugarloaf and may be available to some locations in the area. Since the reception of digital television is more robust than its analogue counter-part, (especially against multipath interference) we can interpret the analogue television analysis as a worst case scenario for all television broadcasting. Due to the more robust digital transmissions, we do not expect to see any adverse effects to the reception of digital television, therefore no mitigation is required.

4.5 FIXED RADIO LINKING

Fixed radio links generally present less of a problem than wide area services, because only the relatively narrow microwave corridor requires protection. Fixed radio linking can suffer from signal strength loss due to path obstruction and interference due to scattering. The two factors that mainly control whether diffraction or scattering will result in an effect on a radio service are:

- The operating radio frequency
- The distance of the closest transmitting or receiving antenna to the diffracting/scattering object.

Each of the four mechanisms of interference, as previously described in Section 3.0 of this report have been examined with respect to fixed radio linking in the vicinity of the Greta Valley Wind Farm and are summarised in the following sections. A search was conducted over an area of a 150 kilometre radius from the wind farm. 150 kilometres is used because it is a wide enough area to capture any fixed link that may pass close to or through the wind farm. A total of 2,350 links operating within a 150 kilometres radius of the wind farm were identified. For further assessment, only the links operating within the 20 kilometre radius of the wind farm and those that directly pass through the wind farm from a greater distance were examined. These fixed radio links are listed in Appendix B of the report.

According to the MED Licence database there are a number of fixed radio links operating within the area, with one bi-directional fixed radio link that propagates directly through the proposed wind farm.

4.5.1 ELECTROMAGNETIC INTERFERENCE (EMI)

As indicated earlier in Section 3.1 of this report, it is highly unlikely that fixed radio linking services within the general vicinity of the proposed Greta Valley Wind Farm will be affected by EMI. The turbine components being considered for use at the wind farm site have fully enclosed generators. This will further reduce the likelihood for potential EMI interference effects.

4.5.2 NEAR-FIELD EFFECTS

If the Greta Valley Wind Farm turbines are positioned too close to an existing antenna then the performance of the antenna could be modified. However, this type of interference mechanism does not generally affect fixed radio linking services. Also, given that no antenna will be within 20 metres of any turbines, near-field effects are not considered to be an issue.

4.5.3 REFLECTION (OR SCATTERING)

Fixed radio links assessed for the proposed Greta Valley Wind Farm all have very large clearance distances from any of the proposed turbine locations. The closest wind farm turbine zone is located approximately 5 kilometres away from the nearest receiver, which is located at Montserrat (NZMG: 2504300E, 5793500N, according to the MED Licence database). These large clearance distances alone (without considering any specific antenna discrimination characteristics) will mean that scattering interference will not be an issue for the proposed wind farm, and can be ignored.

4.5.4 DIFFRACTION (OR OBSTRUCTION)

To investigate the possibility of obstructions to fixed radio linking in the general vicinity of the proposed wind farm site, a search was performed on the Ministry of Economic Development frequency licence database. Transmit and receive locations for each link were then mapped. These are shown in Figure 6.

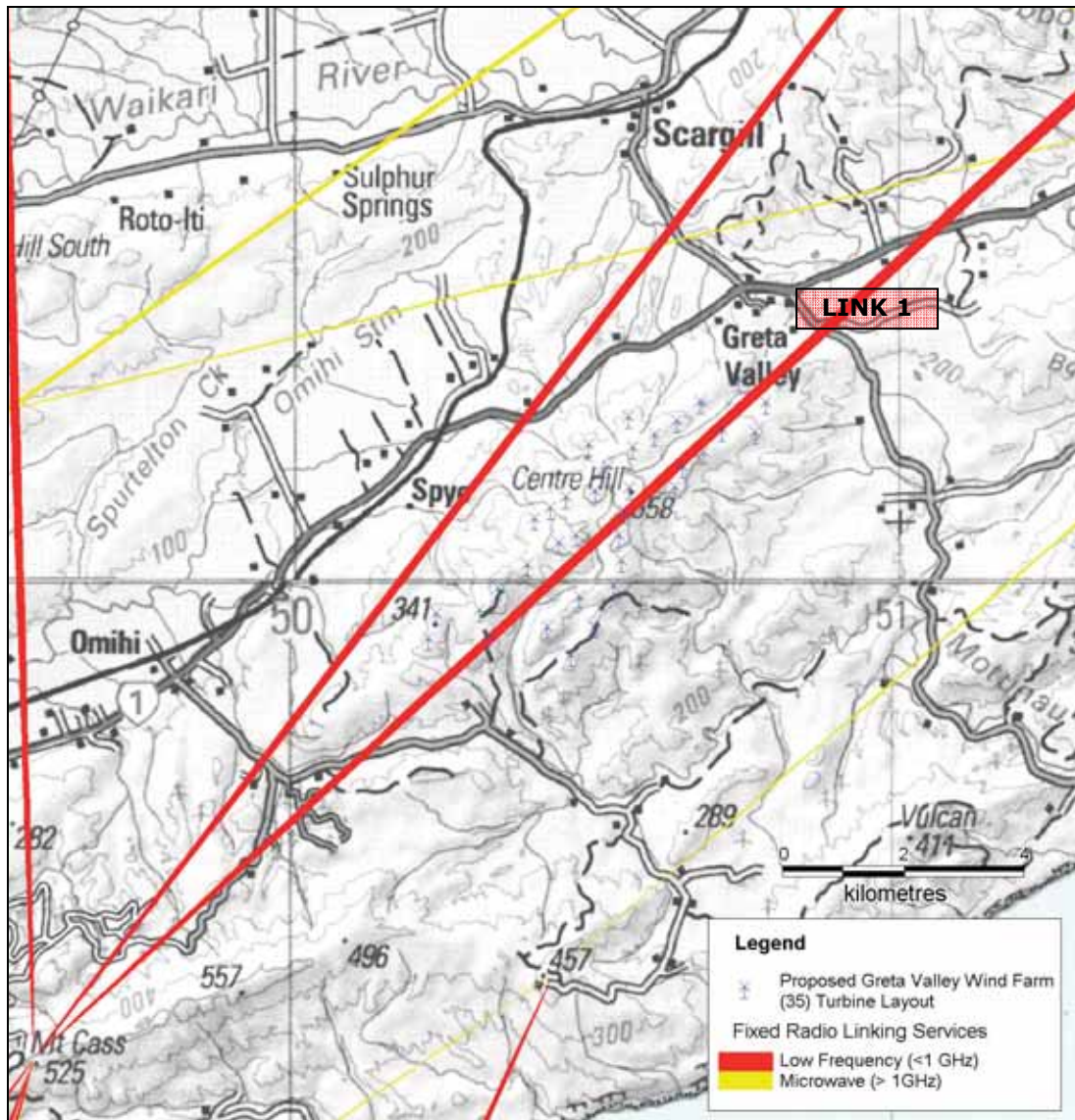


Figure 6: All Fixed Radio Linking Services operating near the Greta Valley Wind Farm

Each of the fixed radio links in the area near the wind farm was mapped according to its first Fresnel zone radius (the zone usually considered as containing the useful transmitted power in the direction of the receiver).

Fixed radio links of 1 GHz and over (shaded yellow) are commonly referred to as microwave links. It is the general rule that the first Fresnel zones of microwave links should be kept clear of any obstructions in order to avoid diffraction loss.

Fixed radio links of lower frequencies (under 1 GHz, shaded red) present less of a problem with regards to obstructions. This is because the first Fresnel zone is much larger, which means that these links are more able to sustain a degree of path obstruction. However, it is still good practice to keep the first Fresnel zone of the low frequency links clear of obstructions, or at the very least to keep the obstructions to a minimum.

A number of wind turbine locations have the potential to cause some degree of obstruction to one radio linking service. This service is listed in Table 4 and shown in Figure 7.

Link	Licence No.s	Transmit/Receive Locations	Transmit/Receive Locations	Freq (MHz)	Licence Owner
1	175167/ 175171	Mt Cass/Beltana	Beltana/Mt Cass	420.1125/ 425.125	NZ Railways Corporation (ONTRACK)

Table 4: Potentially Affected Fixed Radio Link

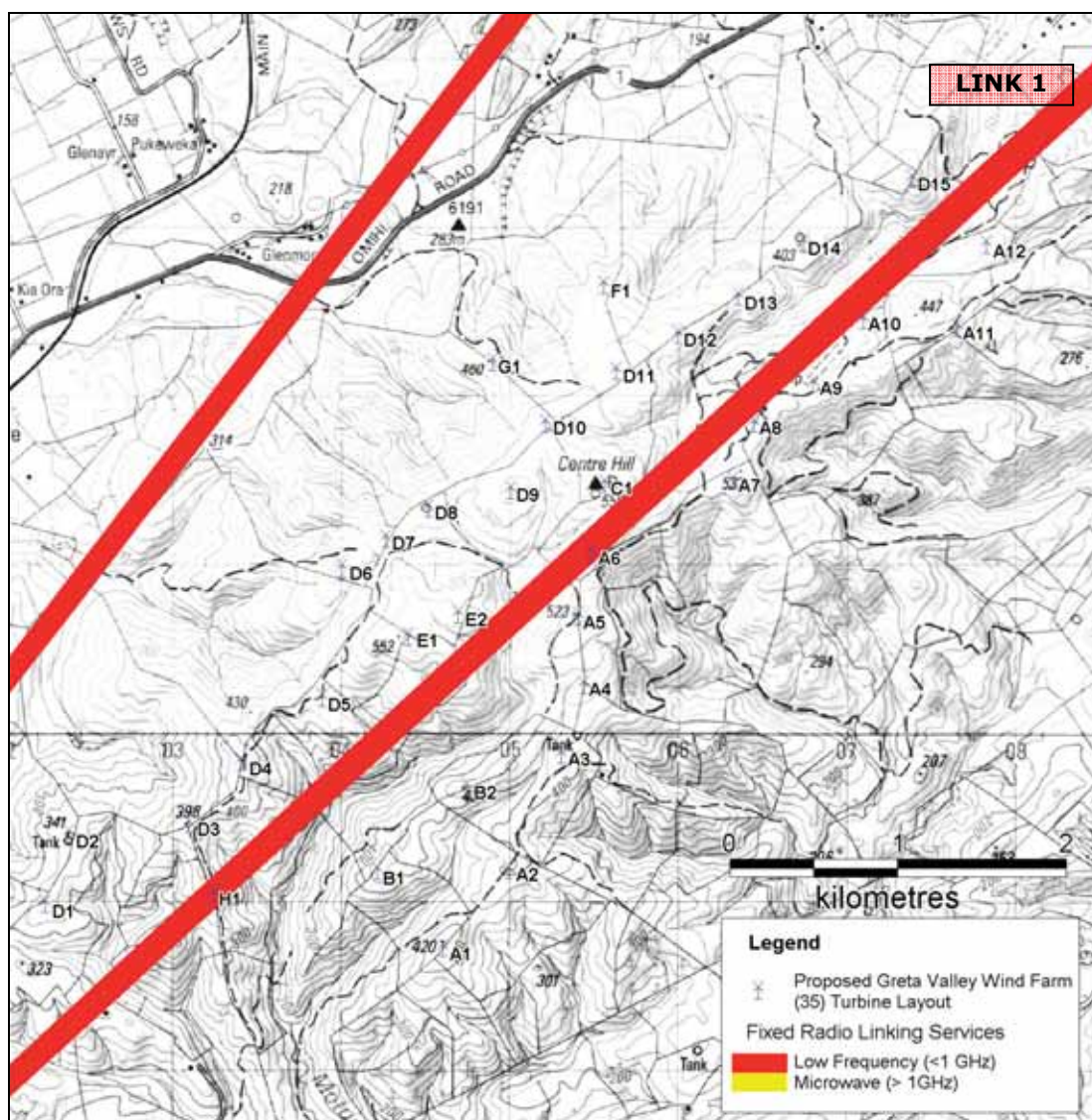


Figure 7: Fixed Radio Linking Services operating near the Greta Valley Wind Farm

The plan view in Figure 7 shows the path from Mt Cass to Beltana¹ operated by ONTRACK. This Figure shows that Turbines H1 and A6 intrude into the first Fresnel zone of this link. A path profile was calculated to see if these turbines have sufficient vertical clearance. This is shown in Figure 8 and shows that the UHF radio link is currently a terrain-obstructed path. The proposed turbines are typically 10 km from one end and 45 km from the other. At these distances any reflection would be well below the strength of the direct signal, and can be ignored.

Turbine H1 will have sufficient vertical clearance, with A6 being line-of-sight to both ends of the path. Considering the path is already terrain-obstructed, with the signal transmitted in the UHF band, this proposed turbine [A6] is not expected to have any effect on the performance of this link. It is also worth noting that the emission status of this link is specified as voice traffic. Voice traffic can tolerate higher levels of interference (compared to data traffic). This link is owned by the NZ Railways Corporation (ONTRACK).

¹ The Beltana site is also known as "Parnassus" by ONTRACK).

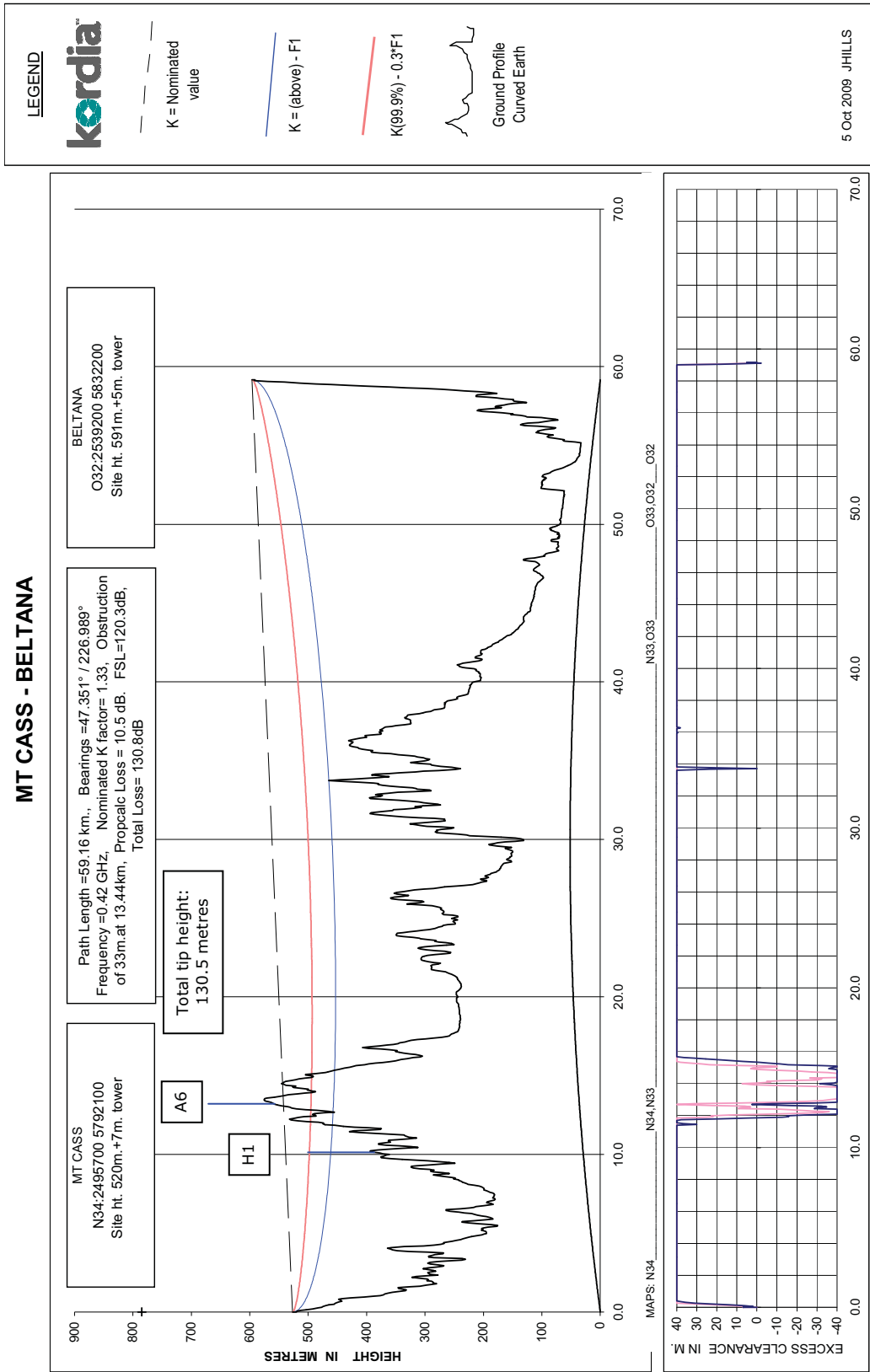


Figure 8: Vertical Link Analysis for Link 1

4.6 AERONAUTICAL RADAR

4.6.1 POTENTIAL EFFECTS OF WIND FARMS

There have been reports of artifacts being generated in RADAR systems due to wind farms^{[7][8]}. There are two types of artifacts that can appear on RADAR screens. They are either:

- Actual traces but with potentially distorted information about height and location
- False 'targets'

Because different manufacturers will use different construction techniques and materials, there will be significant variations in the RADAR reflection characteristics of wind turbines. The shape of the surfaces can be more important than the materials used.

The chance of blade reflection is very low, but the magnitude of a blade "flash" could be the same as that from the tower if the alignment is just right. It seems that the nature of the effects is very specific to the exact geometry of the machines, their location and the configuration of the RADAR. Butler and Johnson^[8] found that tower, nacelle and blade design can have a major influence over the RADAR signature of a wind turbine. Even details like climbing ladders or weather vanes on turbines can enhance the RADAR cross section (RCS).

Complete avoidance of a changed RADAR echo characteristic can be difficult or impossible if the turbines are visible to the RADAR, although the echo characteristics can usually be accounted for in the RADAR software system.

4.6.2 GRETA VALLEY EFFECTS ASSESSMENT

A search was performed on the MED Licence database for all the aeronautical radio and RADAR transmitting services within a 200 kilometre radius from the Greta Valley Wind Farm.

The nearest RADAR service is located at Mt Cass more than 70 kilometres away, with the nearest aeronautical radio service located at Woodend, approximately 40 kilometres away. Considering this equipment is located a sufficient distance away from the wind farm, it is not expected that the proposed Greta Valley Wind Farm will have any effect to these services.

Based on Kordia's experience we do not believe there will be any issues to aeronautical RADAR services from the proposed wind farm. However, RADAR is a specialised technology and Kordia does not offer an interference analysis service. We recommend that Meridian contact Airways Corporation of NZ for further comments.

4.7 OTHER WIDE AREA COVERAGE SERVICES

This section assesses the potential effect from the proposed wind turbines to other wide-area coverage services in respect of scattering interference. These services are more vulnerable since they intentionally transmit and unintentionally receive signals in the directions of wind turbines – examples are cellular services, mobile radio services, broadband wireless services and AM & FM radio. The analogue and digital terrestrial television services were analysed in detail in Section 4.4.

It is very unlikely that AM or FM modulated radio services will be noticeably affected by reflections from the wind farm. These signal types are considered very tolerant to this type of interference such that no further consideration is required.

Services in the general vicinity of the proposed wind farm that are to be considered include VHF mobile radio, cellular services and broadband wireless access services (fixed or mobile).

These services can be assessed by estimating a minimum required separation distance from wind turbines for each service type – locations beyond this distance will have a low likelihood of interference problems and can be ruled out.

The maximum scatter to signal ratios ($\frac{P_{Scatter}}{P_{Signal}}$) required for each service are estimated below,

- VHF and UHF FM land mobile, -26 dB
- Cellular services, -18 dB
- Cellular (voice only), -12 dB
- Broadband wireless access services, -24 dB

These services include an additional 6 dB factor to ensure that the scattered signal imposes only a 1 dB reduction in fade margin (this is an appropriate criterion chosen to protect data services, but is conservative for voice services).

The estimated minimum separation distances (in metres) between a radio service and a wind turbine are given in Table 5 for the maximum typical RCS (from multiple hypothetical wind turbines) of 3,162 m², neglecting any antenna directivity and obstruction loss to wanted or unwanted signals.

Service	Separation Distance (m)
VHF land mobile, 160 MHz, -26 dB	600
UHF land mobile, 400 MHz, -26 dB	600
Cellular services, 950 MHz, -18 dB	<100
Cellular (voice only), 950 MHz, -12 dB	<100
BWA, 2100 MHz, -24 dB	400

Table 5: Estimated minimum separation distances

It can be seen that the minimum separation distances are quite small, and drawing a 600 metre co-ordination contour, as shown in Figure 9, around the wind turbines would protect all services listed in Table 5.

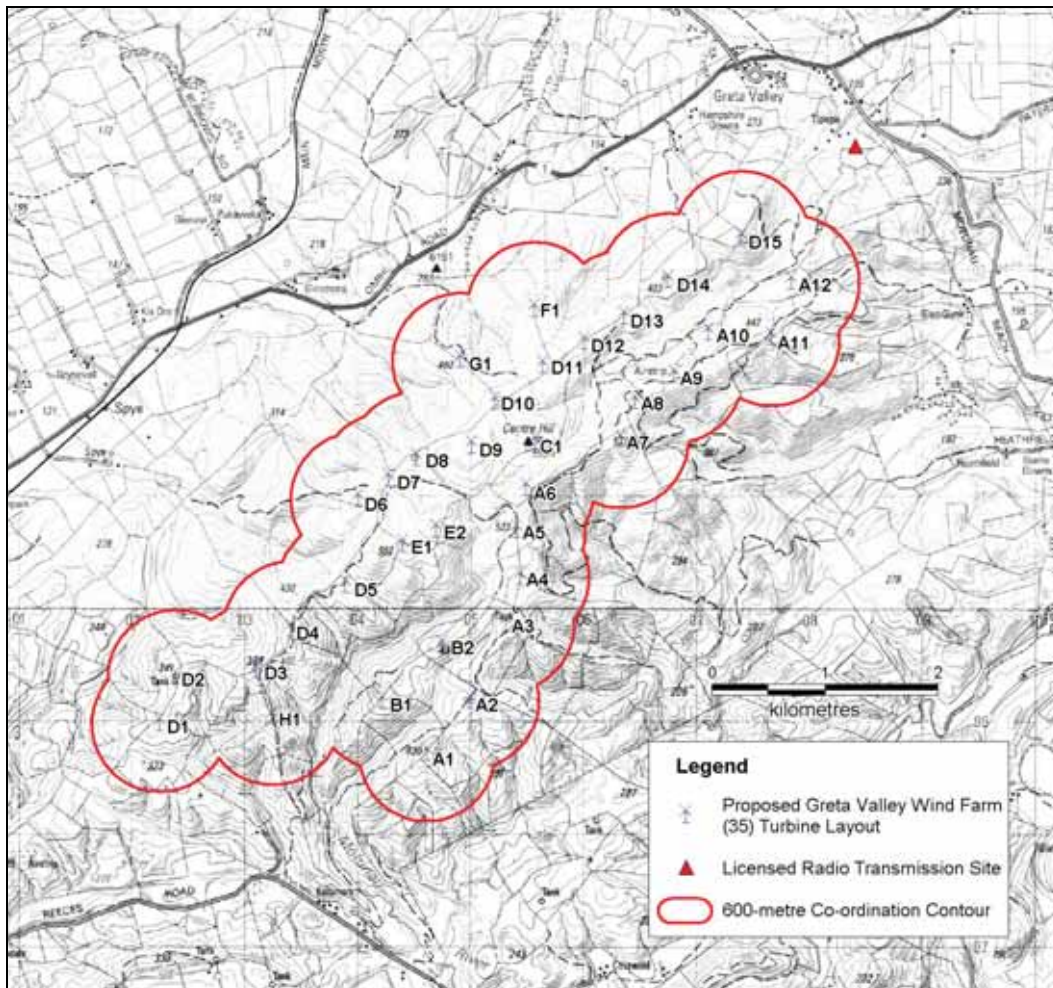


Figure 9: Co-ordination Zone for protection of wide area coverage services

As can be seen in Figure 9, our assessment has found that there are no licensed wide area coverage services operating within the co-ordination contour of the proposed Greta Valley Wind Farm turbine layout. The nearest licensed transmission is approximately 1.3 kilometres from Turbines D15 and A12, with licence details given in Table 6. At this distance, it is not likely that the proposed wind farm will have any effect on this UHF service. It is Kordia’s opinion that no “wide area coverage services” are at risk of experiencing interference.

Licence ID:	69952
Licence No:	170346
Client Name:	Hurunui District Council
Frequency (MHz):	471.45
Licence Type:	Telemetry/Telecommand (Uni-directional)
Location:	Maxwell 1 Pump House
Grid Reference (MED):	NZMG 2508400E 5804100N

Table 6: Licence details of mobile repeater

As there were no marine-to-shore type communication sites that fall within the co-ordination zones, the proposed wind farm should not be a safety concern to maritime users. A list of all transmitters within a 20 kilometre radius of the wind farm can be found in Appendix A.

5 MITIGATION STRATEGIES

This study has found that possible risks in the vicinity of the proposed Greta Valley Wind Farm are limited to licensed analogue terrestrial television services.

Once the wind farm is operational, an experienced radio engineer could readily identify whether any adverse effects on television reception were caused by the wind turbines. This would be done by visual inspection of the interference and analysis of the ghosting pattern.

If interference is shown to occur the following mitigation strategies are recommended:

- First check and address any receive antenna installation and maintenance issues.
- If unacceptable levels of interference still exist, then provide and install an alternative reception source, such as terrestrial (if available) or satellite digital TV.

Note: Terrestrial digital television, also known as FreeviewHD, can be received free to air with no ongoing fees, by purchasing a suitable decoder and connecting to an existing UHF antenna. SKY Digital (satellite) is also an option; however, this involves both installation costs plus an ongoing monthly fee.

6 CONCLUSION

A study has been conducted to ascertain the risk of interference to licensed radio services from the proposed Greta Valley Wind Farm.

The licensed radio services that could experience radio interference from the proposed wind farm are:

Analogue Television

Our analysis indicates up to 13 dwellings could experience analogue television multipath interference caused by the proposed wind farm. Any impairment to reception is likely to be mild and will be sporadic in nature.

It is important to note that these 13 dwellings at risk may already be receiving television via digital satellite services. Past experience gained by Kordia, from carrying out similar assessments in rural New Zealand locations, suggests that if this information can be obtained the number of affected dwellings could reduce by more than 50 percent.

Mitigation strategies such as upgrading receiver antennas or providing alternative reception options exist if interference does occur.

7 REFERENCES

- [1] Residential data (building points) provided by Critchlow business mapping solutions, June 2007.
- [2] Electromagnetic compatibility (EMC) – Generic emission standard, Part 2: Industrial Environments, Standards Australia/Standards New Zealand, AS/NZS 4251.2:1999, (IEC 611000-6-4:1997).
- [3] *Fixed-link wind-turbine exclusion zone method*, Version 1.1, D F Bacon, Radio communications Agency.
- [4] *Wind Farms Impact On Radar Aviation Interests - Final Report*, FES W/14/00614/00/REP, DTI PUB URN 03/1294, Gavin J Poupart, QinetiQ, September 2003.
- [5] *Effects of Wind Turbines on UHF Television Reception*, D.T.Wright, C.Eng., M.I.E.E, BBC RD 1992/7 Research Department Report.
- [6] Assessment of impairment caused to television reception by a wind turbine, ITU-R BT.805, International Telecommunications Union 1992.
- [7] *'Twinkle Effect' Blocks Wind Farms*, Energy & Environmental Management, July-August 2002 p14(1).
- [8] *Feasibility of Mitigating the Effects of Wind Farms on Primary RADAR*, ETSU W/14/00623/REP, DTI PUB URN No. 03/976, M.M. Butler, D.A. Johnson, Alenia Marconi Systems Limited, 2003.
- [9] Hook Technologies website - importers and distributors of Digital Satellite Receive Equipment, <http://www.hooktech.co.nz> [Accessed:23rd April 2008].
- [10] All terrain maps in this report were provided by and © TERRALINK

8 APPENDICES

Appendix A – List of all transmitters within a 20 kilometre radius of the proposed Greta Valley Wind Farm

Appendix B – List of Fixed Radio Links Analysed within 20 kilometre radius of the proposed Greta Valley Wind Farm

Appendix C – List of all RADAR transmit services within a 200 kilometre radius of the proposed Greta Valley Wind Farm

8.1 APPENDIX A - LIST OF ALL TRANSMITTERS WITHIN A 20 KM RADIUS OF THE PROPOSED GRETA VALLEY WIND FARM

(Refer to Sections 4.4 & 4.7)

Lic No	Lic ID	Licence Type	Rightholder Name	Freq (MHz)	Location	Easting	Northing
4623	46949	VHF TV <10dBW (Spectrum)	TELEVISION NEW ZEALAND LIMITED	62.24	CAT HILL ROAD	2512998	5815800
4624	46950	VHF TV <10dBW (Spectrum)	TELEVISION NEW ZEALAND LIMITED	203.25	CAT HILL ROAD	2512998	5815800
125595	2486	Land Repeater NZ Wide; BW >12.5kHz Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directional)	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	152.05	ETHELTON	2513800	5815700
175219	79082	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	426.575	ETHELTON	2513800	5815700
214482	121638	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	152.037	ETHELTON	2513800	5815700
213665	121800	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	151.95	ETHELTON	2513800	5815700
214488	121789	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	161.056	ETHELTON	2513800	5815700
214487	121788	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	161.044	ETHELTON	2513800	5815700
214489	121790	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	161.069	ETHELTON	2513800	5815700
214483	121639	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	152.05	ETHELTON	2513800	5815700
214484	121640	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	152.063	ETHELTON	2513800	5815700
214485	121641	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	152.35	ETHELTON	2513800	5815700
214486	121787	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	152.363	ETHELTON	2513800	5815700
214490	121791	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	161.081	ETHELTON	2513800	5815700
151146	25293	Land Simplex; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	143.563	HURUNUI DIST COUNCIL	2490200	5814200
151146	25293	Land Simplex; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	140.988	HURUNUI DIST COUNCIL	2490200	5814200
168213	66432	Telemetry/Telecommand (Uni-directional)	HURUNUI DISTRICT COUNCIL	471.45	GRETA PADDOCK PUMPHOUSE	2518600	5811800
207576	111578	Land Simplex NZ Wide; BW >12.5kHz & <=25kHz	BEECH COMMUNICATIONS LTD	476.25	MT ALEXANDER	2495500	5811600
100075	18903	Fixed Bi-directional Point-to-Multipoint	HURUNUI DISTRICT COUNCIL	427.325	BLYTHE	2526100	5811100
135653	36949	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	7624	MT ALEXANDER	2494700	5811100
135655	36951	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	7680	MT ALEXANDER	2494700	5811100
146023	26332	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directional)	TELECOM NEW ZEALAND LTD	426.225	MT ALEXANDER	2494700	5811100
150169	18166	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	1460.5	MT ALEXANDER	2494700	5811100
4322	46648	VHF TV >=10 & < 30dBW (Spectrum)	TELEVISION NEW ZEALAND LIMITED	175.26	MT ALEXANDER	2494700	5811100
4834	47160	VHF TV >=10 & < 30dBW (Spectrum)	TELEVISION NEW ZEALAND LIMITED	217.26	MT ALEXANDER	2494700	5811100
9253	55884	Other <10dBW (Spectrum)	TELECOM NEW ZEALAND LTD	1736.25	MT ALEXANDER	2494700	5811100
9288	56027	Other >=10 & <20dBW (Spectrum)	TELECOM NEW ZEALAND LTD	1743.25	MT ALEXANDER	2494700	5811100
164971	61695	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directional)	TEAMTALK LTD	425.025	MT ALEXANDER	2494400	5811100
9008	56253	Other >=10 & <20dBW (Spectrum)	TELECOM NEW ZEALAND LTD	1732.75	MT ALEXANDER	2494700	5811100
168765	67066	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	12821	MT ALEXANDER	2494700	5811100
165141	61989	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directional)	TEAMTALK LTD	425.725	MT ALEXANDER	2494700	5811100
165143	61991	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directional)	TEAMTALK LTD	459.5	MT ALEXANDER	2494700	5811100
165145	61993	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directional)	TEAMTALK LTD	425.775	MT ALEXANDER	2494700	5811100
168435	66693	Land Repeater NZ Wide; BW <=12.5kHz	AMBULANCE NEW ZEALAND	141.463	MT ALEXANDER	2494400	5811100
167288	65291	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	12793	MT ALEXANDER	2494700	5811100
12467	75145	Other >=20 & <30dBW (Spectrum)	TELECOM NEW ZEALAND LTD	1739.75	MT ALEXANDER	2494700	5811100
171020	71522	Land Repeater >5W; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	142.9	MT ALEXANDER	2494700	5811100
172500	74775	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	7624	MT ALEXANDER	2494700	5811100
201132	101490	Other >=20 & <30dBW (Spectrum)	TELECOM NEW ZEALAND LTD	1752	MT ALEXANDER	2494700	5811100
204085	106747	Land Repeater NZ Wide; BW <=12.5kHz	TEAMTALK LTD	416.538	MT ALEXANDER	2494400	5811100
204648	107307	Land Repeater NZ Wide; BW <=12.5kHz	AMBULANCE NEW ZEALAND	141.425	MT ALEXANDER	2494400	5811100
209099	114259	Fixed >=1GHz & <14GHz (Bi-directional)	TEAMTALK LTD	7777.35	MT ALEXANDER	2494400	5811100
210395	115423	Land Repeater NZ Wide; BW <=12.5kHz	TEAMTALK LTD	416.288	MT ALEXANDER	2494400	5811100
211388	118212	Land Repeater NZ Wide; BW <=12.5kHz	TEAMTALK LTD	416.038	MT ALEXANDER	2494400	5811100
210307	116189	Land Repeater NZ Wide; BW >12.5kHz	TEAMTALK LTD	152.2	MT ALEXANDER	2494400	5811100
210421	115215	Land Repeater NZ Wide; BW <=12.5kHz	TEAMTALK LTD	414.288	MT ALEXANDER	2494400	5811100
209104	114261	Fixed >=1GHz & <14GHz (Bi-directional)	TEAMTALK LTD	7807	MT ALEXANDER	2494700	5811100
210461	115292	Land Repeater NZ Wide; BW <=12.5kHz	TEAMTALK LTD	415.038	MT ALEXANDER	2494400	5811100
210311	116185	Land Repeater NZ Wide; BW >12.5kHz	TEAMTALK LTD	151.75	MT ALEXANDER	2494700	5811100
216915	127306	Land Repeater NZ Wide; BW <=12.5kHz	TEAMTALK LTD	415.538	MT ALEXANDER	2494400	5811100
217013	127294	Paging - NZ Wide	TELECOM MOBILE LIMITED	157.95	MT ALEXANDER	2494400	5811100
217014	127293	Paging - NZ Wide	TELECOM MOBILE LIMITED	157.925	MT ALEXANDER	2494400	5811100

217545	127997	Land Repeater NZ Wide; BW <=12.5kHz	TEAMTALK LTD	859.563	MT ALEXANDER	2494400	5811100
217546	128000	Land Repeater NZ Wide; BW <=12.5kHz	TEAMTALK LTD	863.563	MT ALEXANDER	2494400	5811100
217544	127995	Land Repeater NZ Wide; BW <=12.5kHz	TEAMTALK LTD	860.563	MT ALEXANDER	2494400	5811100
217548	128004	Land Repeater NZ Wide; BW >12.5kHz	TEAMTALK LTD	861.612	MT ALEXANDER	2494400	5811100
217547	128002	Land Repeater NZ Wide; BW >12.5kHz	TEAMTALK LTD	862.612	MT ALEXANDER	2494400	5811100
219143	129899	Other >=20 & <30dBW (Spectrum)	TELECOM NEW ZEALAND LTD	1752	MT ALEXANDER	2494700	5811100
2571	44860	Other >=30dBW (Spectrum)	TELECOM MOBILE LIMITED	875.01	MT ALEXANDER	2494700	5811000
178755	84354	Land Repeater NZ Wide; BW <=12.5kHz	HELICOPTERS OTAGO LTD	165.213	MT ALEXANDER	2494700	5811000
214794	122685	Other >=30dBW (Spectrum)	TELECOM MOBILE LIMITED	882.5	MT ALEXANDER	2494700	5811000
146024	26372	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	TELECOM NEW ZEALAND LTD	421.212	MT ALEXANDER FARM	2492800	5810900
9653	59981	VHF TV >=10 & < 30dBW (Spectrum)	TVWORKSLIMITED	196.24	MT ALEXANDER	2494600	5810900
218166	129449	Paging - NZ Wide	AMBULANCE NEW ZEALAND	157.975	MT ALEXANDER	2494600	5810900
218169	129448	Land Simplex NZ Wide; BW <=12.5kHz	AMBULANCE NEW ZEALAND	140.637	MT ALEXANDER	2494600	5810900
168212	66429	Telemetry/Telecommand (Uni-directional)	HURUNUI DISTRICT COUNCIL	471.45	THE ACHERON RESERVOIR	2516400	5810700
208761	113289	Other >=30dBW (Spectrum)	VODAFONE NEW ZEALAND LIMITED	952	WAIPARA	2487799	5809900
172213	74250	Land Repeater >5W; BW <=12.5kHz	KILMARNOCK FARM LTD	151.287	KILMARNOCK RIDGE	2520700	5809900
89977	12073	Land Simplex; BW <=12.5kHz	MR J F D PEACH	84.225	PENDLE HILL	2518100	5809100
5824	48044	Other >=30dBW (Spectrum)	TELECOM MOBILE LIMITED	875.01	PENDLE HILL	2519175	5809001
215098	122801	Other >=30dBW (Spectrum)	TELECOM MOBILE LIMITED	882.5	PENDLE HILL	2519175	5809001
156830	4677	Fixed >=1GHz & <14GHz (Bi-directional)	VODAFONE NEW ZEALAND LIMITED	7187.5	PENDLE HILL	2519499	5809000
160089	51303	Fixed >=1GHz & <14GHz (Bi-directional)	VODAFONE NEW ZEALAND LIMITED	7201.5	PENDLE HILL	2519499	5809000
160708	52907	Fixed >=1GHz & <14GHz (Bi-directional)	VODAFONE NEW ZEALAND LIMITED	7201.5	PENDLE HILL	2519499	5809000
9413	55988	Other <10dBW (Spectrum)	TELECOM NEW ZEALAND LTD	1827.25	PENDLE HILL	2519499	5809000
168766	67068	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	13087	PENDLE HILL	2519499	5809000
208745	113265	Other >=30dBW (Spectrum)	VODAFONE NEW ZEALAND LIMITED	952	GRETA VALLEY	2519400	5809000
216056	125516	Fixed >=1GHz & <14GHz (Bi-directional)	VODAFONE NEW ZEALAND LIMITED	7777.35	PENDLE HILL	2519499	5809000
216062	125530	Fixed >=1GHz & <14GHz (Bi-directional)	VODAFONE NEW ZEALAND LIMITED	7955.25	PENDLE HILL	2519499	5809000
90949	30861	Land Simplex; BW >12.5kHz & <=25kHz	MR J C DOUGLAS-CLIFFORD	153.431	STONEHURST	2523100	5804300
170346	69952	Telemetry/Telecommand (Uni-directional)	HURUNUI DISTRICT COUNCIL	471.45	MAXWELL 1 PUMP HOUSE	2508400	5804100
159458	9803	Fixed >=1GHz & <14GHz (Bi-directional)	VODAFONE NEW ZEALAND LIMITED	13104.5	WAIPARA	2487600	5800900
160095	51296	Fixed >=1GHz & <14GHz (Bi-directional)	VODAFONE NEW ZEALAND LIMITED	7362.5	WAIPARA	2487600	5800900
160709	52910	Fixed >=1GHz & <14GHz (Bi-directional)	VODAFONE NEW ZEALAND LIMITED	7362.5	WAIPARA	2487600	5800900
167289	65292	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	13059	WAIPARA	2487600	5800900
12227	74048	Other >=30dBW (Spectrum)	TELECOM MOBILE LIMITED	875	WAIPARA	2487700	5800900
211517	118658	Fixed >=1GHz & <14GHz (Bi-directional)	Araneo Ltd	6226.89	WAIPARA	2487700	5800900
212837	120751	Other >=30dBW (Spectrum)	TELECOM MOBILE LIMITED	882.5	WAIPARA	2487700	5800900
216057	125519	Fixed >=1GHz & <14GHz (Bi-directional)	VODAFONE NEW ZEALAND LIMITED	8088.67	WAIPARA	2487600	5800900
216055	125512	Fixed >=1GHz & <14GHz (Bi-directional)	VODAFONE NEW ZEALAND LIMITED	8118.32	WAIPARA	2487600	5800900
137016	11912	Land Repeater <=5W; BW <=12.5kHz	WEKA PASS RAILWAY INC	152.762	WEKA PASS	2486999	5800400
92461	30848	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directional)	TRANSPower NEW ZEALAND LIMITED	460.1	WAIPARA	2490200	5794900
153011	20319	Fixed Bi-directional Point-to-Multipoint	MAINPOWER NEW ZEALAND LTD	450.087	WAIPARA	2490200	5794900
173392	76277	Fixed >=1GHz & <14GHz (Bi-directional)	TRANSPower NEW ZEALAND LIMITED	1438.5	WAIPARA	2490200	5794900
58696	22447	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	7080	MONTERRAT	2504300	5793500
58697	22448	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	7080	MONTERRAT	2504300	5793500
58742	22489	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	7000	MONTERRAT	2504300	5793500
58743	22490	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	7000	MONTERRAT	2504300	5793500
58782	22528	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	6920	MONTERRAT	2504300	5793500
58783	22529	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	6920	MONTERRAT	2504300	5793500
58835	22576	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	6840	MONTERRAT	2504300	5793500
58836	22577	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	6840	MONTERRAT	2504300	5793500
58495	22262	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	7040	MONTERRAT	2504300	5793500
58497	22264	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	6960	MONTERRAT	2504300	5793500
58499	22266	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	6880	MONTERRAT	2504300	5793500
58501	22268	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	6800	MONTERRAT	2504300	5793500
58503	22270	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	7040	MONTERRAT	2504300	5793500
58505	22272	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	6960	MONTERRAT	2504300	5793500
58507	22274	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	6880	MONTERRAT	2504300	5793500
58509	22276	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM NEW ZEALAND LTD	6800	MONTERRAT	2504300	5793500
208186	112252	Land Simplex; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	5.3844	MONTERRAT	2504300	5793500
208186	112252	Land Simplex; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	2.0254	MONTERRAT	2504300	5793500
208186	112252	Land Simplex; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	3.3534	MONTERRAT	2504300	5793500
208186	112252	Land Simplex; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	3.3554	MONTERRAT	2504300	5793500
208186	112252	Land Simplex; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	3.3614	MONTERRAT	2504300	5793500
208186	112252	Land Simplex; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	5.3874	MONTERRAT	2504300	5793500
208186	112252	Land Simplex; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	5.3934	MONTERRAT	2504300	5793500
208186	112252	Land Simplex; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	2.0224	MONTERRAT	2504300	5793500
208186	112252	Land Simplex; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	5.4084	MONTERRAT	2504300	5793500
208186	112252	Land Simplex; BW <=12.5kHz	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	2.0314	MONTERRAT	2504300	5793500
213701	121928	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	424.262	MONTERRAT	2504300	5793500
35416	15127	Land Simplex; BW >12.5kHz & <=25kHz	HOSPITALLER ORDER OF ST JOHN OF JERUSALEM	453.363	CAMP DAVID	2489500	5792800
125595	2486	Land Repeater NZ Wide; BW >12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	152.05	MT CASS	2495700	5792100

155118	491	Land Repeater >5W; BW >12.5kHz	MAINPOWER NEW ZEALAND LTD	461.925	MT CASS	2495700	5792100
155128	576	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MAINPOWER NEW ZEALAND LTD	459.087	MT CASS	2495700	5792100
175167	79028	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	420.113	MT CASS	2495700	5792100
175220	79083	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	421.563	MT CASS	2495700	5792100
177572	82761	Land Repeater >5W; BW <=12.5kHz	MAINPOWER NEW ZEALAND LTD	164.225	MT CASS	2495700	5792100
177636	82964	Fixed Bi-directional Point-to-Multipoint	MAINPOWER NEW ZEALAND LTD	458.837	MT CASS	2495700	5792100
174827	78564	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	429.675	MT CASS	2495700	5792100
175507	79485	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	429.675	MT CASS	2495700	5792100
176984	81552	Land Repeater >5W; BW <=12.5kHz	CANTERBURY WASTE SERVICES LTD	164.675	MT CASS	2495700	5792100
201011	101894	Fixed >=1GHz & <14GHz (Bi-directional)	TAIT ELECTRONICS LTD	1429.38	MT CASS	2495700	5792100
207409	111459	Land Repeater >5W; BW <=12.5kHz	TAIT ELECTRONICS LTD	858.038	MT CASS	2495700	5792100
214487	121788	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	161.044	MT CASS	2495700	5792100
213665	121800	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	151.95	MT CASS	2495700	5792100
214488	121789	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	161.056	MT CASS	2495700	5792100
214489	121790	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	161.069	MT CASS	2495700	5792100
214484	121640	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	152.063	MT CASS	2495700	5792100
214483	121639	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	152.05	MT CASS	2495700	5792100
214368	123594	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MAINPOWER NEW ZEALAND LTD	459.962	MT CASS	2495700	5792100
214486	121787	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	152.363	MT CASS	2495700	5792100
214375	123597	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MAINPOWER NEW ZEALAND LTD	459.313	MT CASS	2495700	5792100
214485	121641	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	152.35	MT CASS	2495700	5792100
214490	121791	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	161.081	MT CASS	2495700	5792100
214482	121638	Land Repeater NZ Wide; BW <=12.5kHz	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	152.037	MT CASS	2495700	5792100
177631	82970	Land Simplex; BW <=12.5kHz	CANTERBURY WASTE SERVICES LTD	153.444	KATE VALLEY LANDFILL	2497100	5790700
208685	113041	Other >=30dBW (Spectrum)	VODAFONE NEW ZEALAND LIMITED	952	KATE VALLEY	2496542	5789074
5786	48006	Other >=30dBW (Spectrum)	TELECOM MOBILE LIMITED	875.01	AMBERLEY	2488375	5785270
212150	119833	Other >=30dBW (Spectrum)	TELECOM MOBILE LIMITED	882.5	AMBERLEY	2488375	5785270
159457	8570	Fixed >=1GHz & <14GHz (Bi-directional)	VODAFONE NEW ZEALAND LIMITED	12838.5	AMBERLEY	2488300	5785100
208541	113251	Other >=30dBW (Spectrum)	VODAFONE NEW ZEALAND LIMITED	952	AMBERLY	2488300	5785100

8.2 APPENDIX B - LIST OF FIXED RADIO LINKS ANALYZED WITHIN 20 KILOMETRE RADIUS OF THE PROPOSED GRETA VALLEY WIND FARM

(Refer to Section 4.5)

(I) LOW FREQUENCY FIXED RADIO LINKING SERVICES

Licence No.	Client	Freq (MHz) Power (dBW)	LicenceType	TxLocation	TxE	TxN	RxLocation	RxE	RxN
164970	TEAMTALK LTD	420.012 16	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	POPLARS RIDGE	2460200	5850300	MT ALEXANDER	2494400	5811100
165140	TEAMTALK LTD	420.712 19	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	POPLARS RIDGE	2460200	5850300	MT ALEXANDER	2494700	5811100
92460	TRANSPower NEW ZEALAND LIMITED	465.313 7	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT GREY(BCL)	2473200	5787200	WAIPARA	2490200	5794900
153009	MAINPOWER NEW ZEALAND LTD	454.188 0	Fixed Bi-directional Point-to-Multipoint	MT GREY(MAINPOWER)	2473280	5787230	AMBERLEY SUBSTATION	2485900	5783500
153009	MAINPOWER NEW ZEALAND LTD	454.188 0	Fixed Bi-directional Point-to-Multipoint	MT GREY(MAINPOWER)	2473280	5787230	WAIPARA	2490200	5794900
175506	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	424.663 5	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MIDDLETON RAILYARDS	2476495	5740695	MT CASS	2495700	5792100
214376	MAINPOWER NEW ZEALAND LTD	454.275 3	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	RANGIORA (MAINPOWER HO)	2477491	5767056	MT CASS	2495700	5792100
214369	MAINPOWER NEW ZEALAND LTD	454.925 5	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	RANGIORA (MAINPOWER HO)	2477491	5767056	MT CASS	2495700	5792100
165144	TEAMTALK LTD	420.762 20	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MARLEYS HILL	2480500	5732800	MT ALEXANDER	2494700	5811100
213700	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	429.275 10	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	96 HEREFORD STREET CHRISTCHURCH	2480507	5741606	MONTERRAT	2504300	5793500
174826	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	424.663 5	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	CHRISTCHURCH	2480900	5740700	MT CASS	2495700	5792100
92461	TRANSPower NEW ZEALAND LIMITED	460.1 7	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	WAIPARA	2490200	5794900	MT GREY(BCL)	2473200	5787200
153011	MAINPOWER NEW ZEALAND LTD	450.087 7	Fixed Bi-directional Point-to-Multipoint	WAIPARA	2490200	5794900	MT GREY(MAINPOWER)	2473280	5787230
146024	TELECOM NEW ZEALAND LTD	421.212 -3	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT ALEXANDER FARM	2492800	5810900	MT ALEXANDER	2494700	5811100
177635	MAINPOWER NEW ZEALAND LTD	453.8 23	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	WALLACE PEAK	2494100	5846000	MT CASS	2495700	5792100
164971	TEAMTALK LTD	425.025 16	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT ALEXANDER	2494400	5811100	POPLARS RIDGE	2460200	5850300
165141	TEAMTALK LTD	425.725 21	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT ALEXANDER	2494700	5811100	POPLARS RIDGE	2460200	5850300
165145	TEAMTALK LTD	425.775 20	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT ALEXANDER	2494700	5811100	MARLEYS HILL	2480500	5732800
146023	TELECOM NEW ZEALAND LTD	426.225 -3	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT ALEXANDER	2494700	5811100	MT ALEXANDER FARM	2492800	5810900
165143	TEAMTALK LTD	459.5 12	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT ALEXANDER	2494700	5811100	BELTANA	2538700	5832900
175507	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	429.675 4	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT CASS	2495700	5792100	MIDDLETON RAILYARDS	2476495	5740695
214375	MAINPOWER NEW ZEALAND LTD	459.313 3	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT CASS	2495700	5792100	RANGIORA (MAINPOWER HO)	2477491	5767056
214368	MAINPOWER NEW ZEALAND LTD	459.962 3	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT CASS	2495700	5792100	RANGIORA (MAINPOWER HO)	2477491	5767056
174827	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	429.675 5	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT CASS	2495700	5792100	CHRISTCHURCH	2480900	5740700
177636	MAINPOWER NEW ZEALAND LTD	458.837 23	Fixed Bi-directional Point-to-Multipoint	MT CASS	2495700	5792100	WALLACE PEAK	2494100	5846000
175220	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	421.563 0	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT CASS	2495700	5792100	ETHELTON	2513800	5815700
175167	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	420.113 4.8	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT CASS	2495700	5792100	BELTANA	2539200	5832200
177636	MAINPOWER NEW ZEALAND LTD	458.837 23	Fixed Bi-directional Point-to-Multipoint	MT CASS	2495700	5792100	BELTANA	2539200	5832200
155128	MAINPOWER NEW ZEALAND LTD	459.087 19	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MT CASS	2495700	5792100	BELTANA	2539200	5832200
213701	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	424.262 10	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	MONTERRAT	2504300	5793500	6 HEREFORD STREET CHRISTCHURCH	2480507	5741606
175219	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	426.575 0	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	ETHELTON	2513800	5815700	MT CASS	2495700	5792100
100075	HURUNUI DISTRICT COUNCIL	427.325 3	Fixed Bi-directional Point-to-Multipoint	BLYTHE	2526100	5811100	CHEVIOT RESERVOIR	2532300	5822300
100074	HURUNUI DISTRICT COUNCIL	422.313 -3	Fixed Bi-directional Point-to-Multipoint	CHEVIOT RESERVOIR	2532300	5822300	BLYTHE	2526100	5811100
165142	TEAMTALK LTD	454.488 12	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	BELTANA	2538700	5832900	MT ALEXANDER	2494700	5811100

175171	NEW ZEALAND RAILWAYS CORPORATION (ONTRACK)	425.125 4.8	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	BELTANA	2539200	5832200	MT CASS	2495700	5792100
177637	MAINPOWER NEW ZEALAND LTD	453.8 23	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	BELTANA	2539200	5832200	MT CASS	2495700	5792100
155129	MAINPOWER NEW ZEALAND LTD	454.05 19	Fixed < 1GHz; BW >12.5kHz & <=50kHz (Bi-directiona	BELTANA	2539200	5832200	MT CASS	2495700	5792100

(II) MICROWAVE FIXED RADIO LINKING SERVICES

Licence No.	Client	Freq (MHz) Power (dBW)	LicenceType	TxLocation	TxE	TxN	RxLocation	RxE	RxN
150170	TELECOM NEW ZEALAND LTD	1521 14	Fixed >=1GHz & <14GHz (Bi-directional)	HORSESHOE HILL	2455798	5817200	MT ALEXANDER	2494700	5811100
173391	TRANSPower NEW ZEALAND LIMITED	1499 14	Fixed >=1GHz & <14GHz (Bi-directional)	MT GREY(BCL)	2473200	5787200	WAIPARA	2490200	5794900
209103	TEAMTALK LTD	8118.32 34	Fixed >=1GHz & <14GHz (Bi-directional)	MT GREY(BCL)	2473200	5787200	MT ALEXANDER	2494700	5811100
58502	TELECOM NEW ZEALAND LTD	6460 42	Fixed >=1GHz & <14GHz (Bi-directional)	ASHLEY FOREST	2476100	5774300	MONTERRAT	2504300	5793500
58843	TELECOM NEW ZEALAND LTD	6500 42	Fixed >=1GHz & <14GHz (Bi-directional)	ASHLEY FOREST	2476100	5774300	MONTERRAT	2504300	5793500
58500	TELECOM NEW ZEALAND LTD	6540 42	Fixed >=1GHz & <14GHz (Bi-directional)	ASHLEY FOREST	2476100	5774300	MONTERRAT	2504300	5793500
58793	TELECOM NEW ZEALAND LTD	6580 42	Fixed >=1GHz & <14GHz (Bi-directional)	ASHLEY FOREST	2476100	5774300	MONTERRAT	2504300	5793500
58498	TELECOM NEW ZEALAND LTD	6620 42	Fixed >=1GHz & <14GHz (Bi-directional)	ASHLEY FOREST	2476100	5774300	MONTERRAT	2504300	5793500
58750	TELECOM NEW ZEALAND LTD	6660 42	Fixed >=1GHz & <14GHz (Bi-directional)	ASHLEY FOREST	2476100	5774300	MONTERRAT	2504300	5793500
58496	TELECOM NEW ZEALAND LTD	6700 42	Fixed >=1GHz & <14GHz (Bi-directional)	ASHLEY FOREST	2476100	5774300	MONTERRAT	2504300	5793500
58707	TELECOM NEW ZEALAND LTD	6740 42	Fixed >=1GHz & <14GHz (Bi-directional)	ASHLEY FOREST	2476100	5774300	MONTERRAT	2504300	5793500
160094	VODAFONE NEW ZEALAND LIMITED	7201.5 27	Fixed >=1GHz & <14GHz (Bi-directional)	SOUTHBROOK SUBSTATION	2477299	5764300	WAIPARA	2487600	5800900
216054	VODAFONE NEW ZEALAND LIMITED	7807 30.5	Fixed >=1GHz & <14GHz (Bi-directional)	RANGIORA	2477456	5764425	WAIPARA	2487600	5800900
201012	TAIT ELECTRONICS LTD	1523.88 24	Fixed >=1GHz & <14GHz (Bi-directional)	MARLEYS HILL (TAIT)	2480430	5732990	MT CASS	2495700	5792100
211516	Araneo Ltd	5974.85 35.5	Fixed >=1GHz & <14GHz (Bi-directional)	TELECOM HOUSE CH	2480599	5741800	WAIPARA	2487700	5800900
160095	VODAFONE NEW ZEALAND LIMITED	7362.5 27	Fixed >=1GHz & <14GHz (Bi-directional)	WAIPARA	2487600	5800900	SOUTHBROOK SUBSTATION	2477299	5764300
216055	VODAFONE NEW ZEALAND LIMITED	8118.32 30.7	Fixed >=1GHz & <14GHz (Bi-directional)	WAIPARA	2487600	5800900	RANGIORA	2477456	5764425
159458	VODAFONE NEW ZEALAND LIMITED	13104.5 29	Fixed >=1GHz & <14GHz (Bi-directional)	WAIPARA	2487600	5800900	AMBERLEY	2488300	5785100
167289	TELECOM NEW ZEALAND LTD	13059 24	Fixed >=1GHz & <14GHz (Bi-directional)	WAIPARA	2487600	5800900	MT ALEXANDER	2494700	5811100
160709	VODAFONE NEW ZEALAND LIMITED	7362.5 30.9	Fixed >=1GHz & <14GHz (Bi-directional)	WAIPARA	2487600	5800900	PENDLE HILL	2519499	5809000
216057	VODAFONE NEW ZEALAND LIMITED	8088.67 30.7	Fixed >=1GHz & <14GHz (Bi-directional)	WAIPARA	2487600	5800900	PENDLE HILL	2519499	5809000
211517	Araneo Ltd	6226.89 35.5	Fixed >=1GHz & <14GHz (Bi-directional)	WAIPARA	2487700	5800900	TELECOM HOUSE CH	2480599	5741800
159457	VODAFONE NEW ZEALAND LIMITED	12838.5 29	Fixed >=1GHz & <14GHz (Bi-directional)	AMBERLEY	2488300	5785100	WAIPARA	2487600	5800900
173392	TRANSPower NEW ZEALAND LIMITED	1438.5 5	Fixed >=1GHz & <14GHz (Bi-directional)	WAIPARA	2490200	5794900	MT GREY(BCL)	2473200	5787200
201133	TELECOM NEW ZEALAND LTD	1846.5 25	Other >=20 & <30dBW (Spectrum)	WALLACE PEAK	2493999	5845700	MT ALEXANDER	2494700	5811100
172501	TELECOM NEW ZEALAND LTD	7463 29	Fixed >=1GHz & <14GHz (Bi-directional)	WALLACE PEAK	2493999	5845700	MT ALEXANDER	2494700	5811100
209099	TEAMTALK LTD	7777.35 37	Fixed >=1GHz & <14GHz (Bi-directional)	MT ALEXANDER	2494400	5811100	BELTANA	2538600	5833600
150169	TELECOM NEW ZEALAND LTD	1460.5 22	Fixed >=1GHz & <14GHz (Bi-directional)	MT ALEXANDER	2494700	5811100	HORSESHOE HILL	2455798	5817200
209104	TEAMTALK LTD	7807 34	Fixed >=1GHz & <14GHz (Bi-directional)	MT ALEXANDER	2494700	5811100	MT GREY(BCL)	2473200	5787200
167288	TELECOM NEW ZEALAND LTD	12793 24	Fixed >=1GHz & <14GHz (Bi-directional)	MT ALEXANDER	2494700	5811100	WAIPARA	2487600	5800900
201132	TELECOM NEW ZEALAND LTD	1752 25	Other >=20 & <30dBW (Spectrum)	MT ALEXANDER	2494700	5811100	WALLACE PEAK	2493999	5845700
172500	TELECOM NEW ZEALAND LTD	7624 41.8	Fixed >=1GHz & <14GHz (Bi-directional)	MT ALEXANDER	2494700	5811100	WALLACE PEAK	2493999	5845700
9253	TELECOM NEW ZEALAND LTD	1736.25 4	Other <10dBW (Spectrum)	MT ALEXANDER	2494700	5811100	PENDLE HILL	2519499	5809000
168765	TELECOM NEW ZEALAND LTD	12821 34.8	Fixed >=1GHz & <14GHz (Bi-directional)	MT ALEXANDER	2494700	5811100	PENDLE HILL	2519499	5809000
9008	TELECOM NEW ZEALAND LTD	1732.75 12	Other >=10 & <20dBW (Spectrum)	MT ALEXANDER	2494700	5811100	CAMELS HUMP	2534500	5821100
12467	TELECOM NEW ZEALAND LTD	1739.75 25	Other >=20 & <30dBW (Spectrum)	MT ALEXANDER	2494700	5811100	CAMELS HUMP	2534500	5821100
219143	TELECOM NEW ZEALAND LTD	1752 26	Other >=20 & <30dBW (Spectrum)	MT ALEXANDER	2494700	5811100	CAMELS HUMP	2534500	5821100
9288	TELECOM NEW ZEALAND LTD	1743.25 12.3	Other >=10 & <20dBW (Spectrum)	MT ALEXANDER	2494700	5811100	MT CAVERHILL	2536399	5823100
135653	TELECOM NEW ZEALAND LTD	7624 36.5	Fixed >=1GHz & <14GHz (Bi-directional)	MT ALEXANDER	2494700	5811100	BELTANA	2538700	5832900
135655	TELECOM NEW ZEALAND LTD	7680 36.5	Fixed >=1GHz & <14GHz (Bi-directional)	MT ALEXANDER	2494700	5811100	BELTANA	2538700	5832900
201011	TAIT ELECTRONICS LTD	1429.38 23	Fixed >=1GHz & <14GHz (Bi-directional)	MT CASS	2495700	5792100	MARLEYS HILL (TAIT)	2480430	5732990
58501	TELECOM NEW ZEALAND LTD	6800 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTERRAT	2504300	5793500	ASHLEY FOREST	2476100	5774300

58835	TELECOM NEW ZEALAND LTD	6840 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	ASHLEY FOREST	2476100	5774300
58499	TELECOM NEW ZEALAND LTD	6880 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	ASHLEY FOREST	2476100	5774300
58782	TELECOM NEW ZEALAND LTD	6920 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	ASHLEY FOREST	2476100	5774300
58497	TELECOM NEW ZEALAND LTD	6960 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	ASHLEY FOREST	2476100	5774300
58742	TELECOM NEW ZEALAND LTD	7000 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	ASHLEY FOREST	2476100	5774300
58495	TELECOM NEW ZEALAND LTD	7040 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	ASHLEY FOREST	2476100	5774300
58696	TELECOM NEW ZEALAND LTD	7080 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	ASHLEY FOREST	2476100	5774300
58509	TELECOM NEW ZEALAND LTD	6800 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	GLENKENS	2537500	5822000
58836	TELECOM NEW ZEALAND LTD	6840 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	GLENKENS	2537500	5822000
58507	TELECOM NEW ZEALAND LTD	6880 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	GLENKENS	2537500	5822000
58783	TELECOM NEW ZEALAND LTD	6920 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	GLENKENS	2537500	5822000
58505	TELECOM NEW ZEALAND LTD	6960 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	GLENKENS	2537500	5822000
58743	TELECOM NEW ZEALAND LTD	7000 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	GLENKENS	2537500	5822000
58503	TELECOM NEW ZEALAND LTD	7040 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	GLENKENS	2537500	5822000
58697	TELECOM NEW ZEALAND LTD	7080 44	Fixed >=1GHz & <14GHz (Bi-directional)	MONTSEERRAT	2504300	5793500	GLENKENS	2537500	5822000
160708	VODAFONE NEW ZEALAND LIMITED	7201.5 30.9	Fixed >=1GHz & <14GHz (Bi-directional)	PENDLE HILL	2519499	5809000	WAIPARA	2487600	5800900
216056	VODAFONE NEW ZEALAND LIMITED	7777.35 30.7	Fixed >=1GHz & <14GHz (Bi-directional)	PENDLE HILL	2519499	5809000	WAIPARA	2487600	5800900
9413	TELECOM NEW ZEALAND LTD	1827.25 4	Other <10dBW (Spectrum)	PENDLE HILL	2519499	5809000	MT ALEXANDER	2494700	5811100
168766	TELECOM NEW ZEALAND LTD	13087 34.8	Fixed >=1GHz & <14GHz (Bi-directional)	PENDLE HILL	2519499	5809000	MT ALEXANDER	2494700	5811100
156830	VODAFONE NEW ZEALAND LIMITED	7187.5 23	Fixed >=1GHz & <14GHz (Bi-directional)	PENDLE HILL	2519499	5809000	MT CAVERHILL	2536399	5823100
160089	VODAFONE NEW ZEALAND LIMITED	7201.5 38	Fixed >=1GHz & <14GHz (Bi-directional)	PENDLE HILL	2519499	5809000	HUNDALEE	2544700	5850200
216062	VODAFONE NEW ZEALAND LIMITED	7955.25 30.7	Fixed >=1GHz & <14GHz (Bi-directional)	PENDLE HILL	2519499	5809000	HUNDALEE	2544700	5850200
219135	TELECOM NEW ZEALAND LTD	1834.25 16	Other >=10 & <20dBW (Spectrum)	RANDOM SPUR	2522398	5817600	BOSCARNE	2529100	5811500
9459	TELECOM NEW ZEALAND LTD	1837.75 -8	Other <10dBW (Spectrum)	RANDOM SPUR	2522398	5817600	BOSCARNE	2529100	5811500
9431	TELECOM NEW ZEALAND LTD	1830.75 23	Other >=20 & <30dBW (Spectrum)	RANDOM SPUR	2522398	5817600	HUNDALEE	2544799	5850000
219134	TELECOM NEW ZEALAND LTD	1743.25 16	Other >=10 & <20dBW (Spectrum)	BOSCARNE	2529100	5811500	RANDOM SPUR	2522398	5817600
9301	TELECOM NEW ZEALAND LTD	1746.75 -8	Other <10dBW (Spectrum)	BOSCARNE	2529100	5811500	RANDOM SPUR	2522398	5817600
9406	TELECOM NEW ZEALAND LTD	1823.75 15.8	Other >=10 & <20dBW (Spectrum)	CAMELS HUMP	2534500	5821100	MT ALEXANDER	2494700	5811100
219144	TELECOM NEW ZEALAND LTD	1846.5 26	Other >=20 & <30dBW (Spectrum)	CAMELS HUMP	2534500	5821100	MT ALEXANDER	2494700	5811100
9440	TELECOM NEW ZEALAND LTD	1834.25 12.3	Other >=10 & <20dBW (Spectrum)	MT CAVERHILL	2536399	5823100	MT ALEXANDER	2494700	5811100
156831	VODAFONE NEW ZEALAND LIMITED	7348.5 23	Fixed >=1GHz & <14GHz (Bi-directional)	MT CAVERHILL	2536399	5823100	PENDLE HILL	2519499	5809000
58510	TELECOM NEW ZEALAND LTD	6460 45.4	Fixed >=1GHz & <14GHz (Bi-directional)	GLENKENS	2537500	5822000	MONTSEERRAT	2504300	5793500
58844	TELECOM NEW ZEALAND LTD	6500 45.4	Fixed >=1GHz & <14GHz (Bi-directional)	GLENKENS	2537500	5822000	MONTSEERRAT	2504300	5793500
58508	TELECOM NEW ZEALAND LTD	6540 45.4	Fixed >=1GHz & <14GHz (Bi-directional)	GLENKENS	2537500	5822000	MONTSEERRAT	2504300	5793500
58794	TELECOM NEW ZEALAND LTD	6580 45.4	Fixed >=1GHz & <14GHz (Bi-directional)	GLENKENS	2537500	5822000	MONTSEERRAT	2504300	5793500
58506	TELECOM NEW ZEALAND LTD	6620 45.4	Fixed >=1GHz & <14GHz (Bi-directional)	GLENKENS	2537500	5822000	MONTSEERRAT	2504300	5793500
58751	TELECOM NEW ZEALAND LTD	6660 45.4	Fixed >=1GHz & <14GHz (Bi-directional)	GLENKENS	2537500	5822000	MONTSEERRAT	2504300	5793500
58504	TELECOM NEW ZEALAND LTD	6700 45.4	Fixed >=1GHz & <14GHz (Bi-directional)	GLENKENS	2537500	5822000	MONTSEERRAT	2504300	5793500
58708	TELECOM NEW ZEALAND LTD	6740 45.4	Fixed >=1GHz & <14GHz (Bi-directional)	GLENKENS	2537500	5822000	MONTSEERRAT	2504300	5793500
209100	TEAMTALK LTD	8088.67 34	Fixed >=1GHz & <14GHz (Bi-directional)	BELTANA	2538600	5833600	MT ALEXANDER	2494400	5811100
135654	TELECOM NEW ZEALAND LTD	7463 38.2	Fixed >=1GHz & <14GHz (Bi-directional)	BELTANA	2538700	5832900	MT ALEXANDER	2494700	5811100
135656	TELECOM NEW ZEALAND LTD	7519 38.2	Fixed >=1GHz & <14GHz (Bi-directional)	BELTANA	2538700	5832900	MT ALEXANDER	2494700	5811100
160088	VODAFONE NEW ZEALAND LIMITED	7362.5 38	Fixed >=1GHz & <14GHz (Bi-directional)	HUNDALEE	2544700	5850200	PENDLE HILL	2519499	5809000
216063	VODAFONE NEW ZEALAND LIMITED	8266.57 30.7	Fixed >=1GHz & <14GHz (Bi-directional)	HUNDALEE	2544700	5850200	PENDLE HILL	2519499	5809000
9277	TELECOM NEW ZEALAND LTD	1739.75 23	Other >=20 & <30dBW (Spectrum)	HUNDALEE	2544799	5850000	RANDOM SPUR	2522398	5817600

8.3 APPENDIX C - LIST OF ALL RADAR TRANSMIT SERVICES WITHIN A 200 KILOMETRE RADIUS OF THE PROPOSED GRETA VALLEY WIND FARM

(Refer to Section 4.6)

No.	TxLic No.	TxLic ID	Client Name	Freq (MHz)	Power (dBW)	Licence Type	Location	Easting	Northing
1	105188	21459	AIRWAYS CORPORATION OF NZ LTD	114.6	21	Radiodet - Radio Beacons (VOR, NDB)	NARAWHIA	2624199	6001400
2	105180	3955	AIRWAYS CORPORATION OF NZ LTD	1180	38	Radiodet - Radionav (incl DME)	NARAWHIA	2624199	6001400
3	75112	22830	AIRWAYS CORPORATION OF NZ LTD	0.358	17	Radiodet - Radio Beacons (VOR, NDB)	NEWLANDS	2663200	5995900
4	206956	110363	NELSON COASTGUARD INC	119	14	Aero Base (Off Route)	NELSON	2532500	5993700
5	206956	110363	NELSON COASTGUARD INC	119.1	14	Aero Base (Off Route)	NELSON	2532500	5993700
6	126170	35748	NEW ZEALAND POLICE	119.1	14	Aero Base (Off Route)	SADDLE HILL(NN)	2546200	5992300
7	126170	35748	NEW ZEALAND POLICE	131.3	14	Aero Base (Off Route)	SADDLE HILL(NN)	2546200	5992300
8	175088	78886	FARR DEVELOPMENTS LTD	131.35	14	Aero Mobile	NELSON DISTRICT	2533600	5992200
9	55496	4293	HELICOPTERS (NZ) LTD	3.0334	20	Aero Base (Off Route)	NELSON A/HOURS	2533500	5991400
10	55496	4293	HELICOPTERS (NZ) LTD	4.7119	20	Aero Base (Off Route)	NELSON A/HOURS	2533500	5991400
11	138492	5985	SATRAK DATA LTD	1.8185	20	Radiodet - Radio Beacons (VOR, NDB)	TINAKORI HILL	2657799	5991100
12	133230	9955	CAPITAL COAST HEALTH LTD	133.2	14	Aero Mobile	WELLINGTON AREA	2658900	5990600
13	80126	14174	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	119.1	14	Aero Mobile	BEEHIVE	2658700	5990500
14	110830	27809	AIRWAYS CORPORATION OF NZ LTD	116.4	21	Radiodet - Radio Beacons (VOR, NDB)	NELSON	2521200	5990200
15	110809	23446	AIRWAYS CORPORATION OF NZ LTD	1198	38	Radiodet - Radionav (incl DME)	NELSON	2521200	5990200
16	35384	15113	HELICOPTERS (NZ) LTD	3.0334	20	Aero Base (Route)	NELSON	2529100	5990000
17	35384	15113	HELICOPTERS (NZ) LTD	4.7119	20	Aero Base (Route)	NELSON	2529100	5990000
18	35384	15113	HELICOPTERS (NZ) LTD	5.4014	20	Aero Base (Route)	NELSON	2529100	5990000
19	35384	15113	HELICOPTERS (NZ) LTD	7.8494	20	Aero Base (Route)	NELSON	2529100	5990000
20	55172	9854	WELLINGTON INTERNATIONAL AIRPORT LTD	121.9	14	Aero Mobile	WELLINGTON DIST AREA	2666000	5990000
21	55497	9846	HELICOPTERS (NZ) LTD	133.15	14	Aero Base (Off Route)	NELSON	2529100	5990000
22	84780	29885	MR I A B BARBER	133.55	14	Aero Mobile	WELLINGTON DIST AREA	2666000	5990000
23	89408	31390	AIRWAYS CORPORATION OF NZ LTD	123.3	14	Aero Base (Route)	NELSON AIRPORT	2528800	5989900
24	141855	12801	TANDEM SKYDIVE NELSON LTD	127.4	14	Aero Mobile	NELSON AIRPORT AREA	2528900	5989900
25	205636	109388	FLIGHT CORPORATION LTD	131.1	14	Aero Base (Off Route)	NELSON AIRPORT	2528800	5989900
26	168096	66336	AIR NEW ZEALAND LTD	131.4	14	Aero Base (Route)	NELSON AIRPORT	2528800	5989900
27	103340	13444	NELSON AIRPORT FIRE SERVICE LTD	118.1	14	Aero Mobile	NELSON AIRPORT	2528800	5989700
28	168094	66334	AIR NEW ZEALAND LTD	133.85	14	Aero Base (Route)	NELSON AIRPORT	2528800	5989700
29	203217	105257	AIRWAYS CORPORATION OF NZ LTD	127.4	14	Aero Base (Route)	NELSON AIRPORT	2528800	5989600
30	55529	31299	TELECOM NEW ZEALAND LTD	133.7	14	Aero Mobile	NELSON AREA	2530700	5989400
31	156208	3111	RADIOWORKS LTD	133.6	14	Aero Base (Off Route)	MANNERS PLAZA	2658699	5989200
32	168087	66327	AIR NEW ZEALAND LTD	130.35	14	Aero Base (Route)	MT VICTORIA	2660400	5988600
33	168088	66328	AIR NEW ZEALAND LTD	131.9	14	Aero Base (Route)	MT VICTORIA	2660400	5988600
34	52219	19454	SITA	131.55	14	Aero Base (Off Route)	MT VICTORIA	2660400	5988500
35	217644	128101	The Crown acting by and through the Chief Executive of the Department of Corrections	960	19	Aero Base (Off Route)	WELLINGTON PRISON	2663199	5988360
36	39658	16801	WELLINGTON GLIDING CLUB INC	6.7455	14	Aero Mobile	PORTABLE BASE(WN)	2655400	5988000
37	71557	23430	MR J B SAYER	119	14	Aero Mobile	PORTABLE BASE(WN)	2655400	5988000
38	35768	15288	MR A VAN DYK	119.1	14	Aero Mobile	PORTABLE BASE(WN)	2655400	5988000
39	39501	16733	UPPER VALLEY GLIDING CLUB INC	119.1	14	Aero Mobile	PORTABLE BASE(WN)	2655400	5988000
40	71557	23430	MR J B SAYER	119.1	14	Aero Mobile	PORTABLE BASE(WN)	2655400	5988000
41	71557	23430	MR J B SAYER	121.9	14	Aero Mobile	PORTABLE BASE(WN)	2655400	5988000
42	71557	23430	MR J B SAYER	133.2	14	Aero Mobile	PORTABLE BASE(WN)	2655400	5988000
43	35768	15288	MR A VAN DYK	133.55	14	Aero Mobile	PORTABLE BASE(WN)	2655400	5988000
44	35768	15288	MR A VAN DYK	134.85	14	Aero Mobile	PORTABLE BASE(WN)	2655400	5988000
45	72284	27967	METEOROLOGICAL SERVICE OF NEW ZEALAND LTD	5605	99.6	Meteorological Radar	OUTLOOK HILL	2647799	5987200
46	133231	21871	CAPITAL COAST HEALTH LTD	133.2	14	Aero Base (Off Route)	NEWTOWN	2659200	5987001
47	74938	13885	AIRWAYS CORPORATION OF NZ LTD	109.9	17	Radiodet - Aero ILS	WELLINGTON(ILS)	2661300	5986200
48	78973	28678	AIRWAYS CORPORATION OF NZ LTD	335	17	Radiodet - Aero ILS	WELLINGTON(ILS)	2661200	5985700
49	74948	17570	AIRWAYS CORPORATION OF NZ LTD	1001	17	Radiodet - Radionav (incl DME)	WELLINGTON(ILS)	2661200	5985700
50	108053	33273	AIRWAYS CORPORATION OF NZ LTD	118.8	14	Aero Base (Route)	HAWKINS HILL	2654999	5985400
51	75472	15051	AIRWAYS CORPORATION OF NZ LTD	119.3	14	Aero Base (Route)	HAWKINS HILL	2654999	5985400
52	102433	16426	AIRWAYS CORPORATION OF NZ LTD	120	14	Aero Base (Route)	HAWKINS HILL	2654999	5985400
53	102441	23460	AIRWAYS CORPORATION OF NZ LTD	121.3	14	Aero Base (Route)	HAWKINS HILL	2654999	5985400
54	174594	78148	AIRWAYS CORPORATION OF NZ LTD	121.5	14	Aero Base (Route)	HAWKINS HILL	2654999	5985400

55	102442	25533	AIRWAYS CORPORATION OF NZ LTD	122.3	14	Aero Base (Route)	HAWKINS HILL	2654999	5985400
56	92857	1803	AIRWAYS CORPORATION OF NZ LTD	126.5	14	Aero Base (Route)	HAWKINS HILL	2654999	5985400
57	89431	31411	AIRWAYS CORPORATION OF NZ LTD	126.9	14	Aero Base (Route)	HAWKINS HILL	2654999	5985400
58	174597	78144	QANTAS AIRWAYS LTD	133.875	14	Aero Base (Route)	HAWKINS HILL	2654999	5985400
59	202066	103403	VINCENT AVIATION LTD	133.8	14	Aero Base (Off Route)	WELLINGTON AIRPORT	2660899	5985300
60	203214	105252	AIRWAYS CORPORATION OF NZ LTD	118.8	14	Aero Base (Route)	WELLINGTON AIRPORT	2661399	5985200
61	57505	21732	MOBIL OIL (NZ) LTD	133	14	Aero Base (Route)	MIRAMAR	2661400	5985200
62	80299	28951	WELLINGTON INTERNATIONAL AIRPORT LTD	118.4	14	Aero Mobile	WELLINGTON AIRPORT AREA	2661300	5985100
63	80304	28953	WELLINGTON INTERNATIONAL AIRPORT LTD	118.8	14	Aero Mobile	WELLINGTON AIRPORT	2661000	5985100
64	80304	28953	WELLINGTON INTERNATIONAL AIRPORT LTD	119	14	Aero Mobile	WELLINGTON AIRPORT	2661000	5985100
65	80304	28953	WELLINGTON INTERNATIONAL AIRPORT LTD	119.1	14	Aero Mobile	WELLINGTON AIRPORT	2661000	5985100
66	80304	28953	WELLINGTON INTERNATIONAL AIRPORT LTD	120	14	Aero Mobile	WELLINGTON AIRPORT	2661000	5985100
67	169477	68434	CIVIL AVIATION AUTHORITY	121.7	14	Aero Mobile	WELLINGTON AIRPORT AREA	2661300	5985100
68	174668	78334	AIRWAYS CORPORATION OF NZ LTD	121.9	14	Aero Base (Route)	WELLINGTON AIRPORT	2661000	5985100
69	80299	28951	WELLINGTON INTERNATIONAL AIRPORT LTD	121.9	14	Aero Mobile	WELLINGTON AIRPORT AREA	2661300	5985100
70	80304	28953	WELLINGTON INTERNATIONAL AIRPORT LTD	121.9	14	Aero Mobile	WELLINGTON AIRPORT	2661000	5985100
71	169477	68434	CIVIL AVIATION AUTHORITY	121.9	14	Aero Mobile	WELLINGTON AIRPORT AREA	2661300	5985100
72	213112	120605	AIRWAYS CORPORATION OF NZ LTD	128.2	14	Aero Base (Route)	WELLINGTON AIRPORT	2661000	5985100
73	167749	65725	CAPITAL JET SERVICES LIMITED	131.7	14	Aero Base (Off Route)	WELLINGTON AIRPORT	2661000	5985100
74	218345	129540	SKY CARE LTD	133.95	14	Aero Base (Off Route)	WELLINGTON AIRPORT (SKY CARE)	2661511	5984931
75	173879	77000	AIRWAYS CORPORATION OF NZ LTD	119.3	14	Aero Base (Route)	HAWKINS HILL PSR	2654450	5984920
76	173880	77001	AIRWAYS CORPORATION OF NZ LTD	122.3	14	Aero Base (Route)	HAWKINS HILL PSR	2654450	5984920
77	173881	77002	AIRWAYS CORPORATION OF NZ LTD	126.5	14	Aero Base (Route)	HAWKINS HILL PSR	2654450	5984920
78	78864	28637	AIRWAYS CORPORATION OF NZ LTD	1030	60	Radio Det - Two frequency	HAWKINS HILL SSR	2654450	5984920
79	75703	9158	AIRWAYS CORPORATION OF NZ LTD	1250	71.6	Radio Det - Other than Met Service	HAWKINS HILL PSR	2654450	5984920
80	75703	9158	AIRWAYS CORPORATION OF NZ LTD	1255	71.6	Radio Det - Other than Met Service	HAWKINS HILL PSR	2654450	5984920
81	75703	9158	AIRWAYS CORPORATION OF NZ LTD	1335	71.6	Radio Det - Other than Met Service	HAWKINS HILL PSR	2654450	5984920
82	75703	9158	AIRWAYS CORPORATION OF NZ LTD	1340	71.6	Radio Det - Other than Met Service	HAWKINS HILL PSR	2654450	5984920
83	168130	66376	AIR NEW ZEALAND LTD	130.15	14	Aero Base (Off Route)	WELLINGTON AIRPORT	2661500	5984800
84	218209	129533	JETSTAR AIRWAYS PTY LTD	130.85	14	Aero Base (Off Route)	WELLINGTON AIRPORT	2661500	5984800
85	168089	66329	AIR NEW ZEALAND LTD	132.9	14	Aero Base (Route)	WELLINGTON AIRPORT	2661500	5984800
86	173738	76798	PACIFIC BLUE AIRLINES (NZ) LTD	133.725	14	Aero Base (Route)	WELLINGTON AIRPORT	2661500	5984800
87	55425	16744	QANTAS AIRWAYS LTD	133.875	14	Aero Base (Route)	WELLINGTON AIRPORT	2661500	5984800
88	56903	21463	AIR BP INTERNATIONAL	133.9	14	Aero Base (Route)	WELLINGTON	2661600	5984700
89	169469	68431	CIVIL AVIATION AUTHORITY	121.7	14	Aero Base (Route)	WELLINGTON AIRPORT	2660600	5984500
90	169469	68431	CIVIL AVIATION AUTHORITY	121.9	14	Aero Base (Route)	WELLINGTON AIRPORT	2660600	5984500
91	80302	28952	WELLINGTON INTERNATIONAL AIRPORT LTD	121.9	14	Aero Mobile	WELLINGTON AIRPORT	2660600	5984500
92	78968	28674	AIRWAYS CORPORATION OF NZ LTD	333.8	17	Radiodet - Aero ILS	WELLINGTON(ILS)	2661100	5984500
93	74936	13883	AIRWAYS CORPORATION OF NZ LTD	997	17	Radiodet - Radionav (incl DME)	WELLINGTON(ILS)	2661100	5984500
94	74946	16948	AIRWAYS CORPORATION OF NZ LTD	110.3	17	Radiodet - Aero ILS	WELLINGTON(ILS)	2661200	5984100
95	140641	32079	SOUTH WAIRARAPA DISTRICT COUNCIL	134.35	14	Aero Mobile	SOUTH WAIRARAPA	2695200	5984000
96	74915	13289	AIRWAYS CORPORATION OF NZ LTD	112.3	21	Radiodet - Radio Beacons (VOR, NDB)	PALMER HEAD	2662100	5983900
97	135435	13971	AIRWAYS CORPORATION OF NZ LTD	119.3	14	Aero Base (Off Route)	PALMER HEAD PSR BEACON	2661999	5983900
98	173852	76967	AIRWAYS CORPORATION OF NZ LTD	121.9	14	Aero Base (Route)	PALMER HEAD PSR BEACON	2661999	5983900
99	135630	15925	AIRWAYS CORPORATION OF NZ LTD	122.3	14	Aero Base (Off Route)	PALMER HEAD PSR BEACON	2661999	5983900
100	135437	1544	AIRWAYS CORPORATION OF NZ LTD	126.5	14	Aero Base (Route)	PALMER HEAD PSR BEACON	2661999	5983900
101	100462	23127	AIRWAYS CORPORATION OF NZ LTD	129.4	14	Aero Base (Off Route)	MT ROBERTSON	2595499	5983900
102	175107	78911	SITA	131.55	14	Aero Base (Off Route)	PALMER HEAD	2662100	5983900
103	74953	17606	AIRWAYS CORPORATION OF NZ LTD	1157	17	Radiodet - Radionav (incl DME)	PALMER HEAD	2662100	5983900
104	174231	77736	AIRWAYS CORPORATION OF NZ LTD	1250	-30	Radio Det - Other than Met Service	PALMER HEAD	2662100	5983900
105	174231	77736	AIRWAYS CORPORATION OF NZ LTD	1335	-30	Radio Det - Other than Met Service	PALMER HEAD	2662100	5983900
106	75082	21680	AIRWAYS CORPORATION OF NZ LTD	0.298	17	Radiodet - Radio Beacons (VOR, NDB)	PALMER HEAD (AIRWAYS)	2661800	5983800
107	147305	31410	AIRWAYS CORPORATION OF NZ LTD	121.1	14	Aero Base (Route)	MT ROBERTSON	2595499	5983800
108	147305	31410	AIRWAYS CORPORATION OF NZ LTD	122.8	14	Aero Base (Route)	MT ROBERTSON	2595499	5983800
109	78889	17263	AIRWAYS CORPORATION OF NZ LTD	1030	60	Radio Det - Two frequency	MT ROBERTSON SSR	2595600	5983600
110	75059	19308	AIRWAYS CORPORATION OF NZ LTD	0.226	21	Radiodet - Radio Beacons (VOR, NDB)	LAKE FERRY	2689600	5977200
111	55493	20677	HELICOPTERS (NZ) LTD	133.15	14	Aero Base (Off Route)	PORTABLE BASE(NN)	2512600	5974500
112	100514	13231	MARLBOROUGH CIVIL DEFENCE	119.1	14	Aero Mobile	MARLBOROUGH AREA	2593400	5967100
113	75592	28271	AIRWAYS CORPORATION OF NZ LTD	118.1	14	Aero Base (Route)	WOODBOURNE AIRPORT	2582700	5965300
114	134926	11230	AIRWAYS CORPORATION OF NZ LTD	122.8	14	Aero Base (Route)	WOODBOURNE AIRPORT	2582700	5965300
115	55530	31298	TELECOM NEW ZEALAND LTD	133.7	14	Aero Mobile	BLenheim AREA	2590100	5965300
116	207226	110885	AIRWAYS CORPORATION OF NZ LTD	126.05	14	Aero Base (Route)	WOODBOURNE AIRPORT TOWER	2582691	5964929

117	105187	12155	AIRWAYS CORPORATION OF NZ LTD	115.6	21	Radiodet - Radio Beacons (VOR, NDB)	WOODBOURNE AIRPORT	2582000	5964900
118	105183	13927	AIRWAYS CORPORATION OF NZ LTD	1190	38	Radiodet - Radionav (incl DME)	WOODBOURNE AIRPORT	2582000	5964900
119	75076	21657	AIRWAYS CORPORATION OF NZ LTD	0.286	20	Radiodet - Radio Beacons (VOR, NDB)	CAPE CAMPBELL(NDB)	2615800	5940700
120	50193	19085	AIRWAYS CORPORATION OF NZ LTD	118.7	14	Aero Base (Route)	WESTPORT AIRPORT	2392100	5940100
121	201576	102191	AIR NEW ZEALAND LTD	130.9	14	Aero Base (Off Route)	WESTPORT AIRPORT	2392100	5940100
122	75074	20751	AIRWAYS CORPORATION OF NZ LTD	0.278	24	Radiodet - Radio Beacons (VOR, NDB)	WESTPORT	2391800	5939600
123		39216	AIRWAYS CORPORATION OF NZ LTD	1140	17	Radiodetermination - Mobile Transmit	WESTPORT	2391800	5939600
124	75007	18713	AIRWAYS CORPORATION OF NZ LTD	1203	17	Radiodet - Radionav (incl DME)	WESTPORT	2391800	5939600
125	34673	14762	AIRWEST HELICOPTERS LTD	3.0334	20	Aero Base (Off Route)	REEFTON	2416000	5898100
126	34673	14762	AIRWEST HELICOPTERS LTD	5.7044	20	Aero Base (Off Route)	REEFTON	2416000	5898100
127	135091	10021	NEW ZEALAND POLICE	119.1	14	Aero Base (Off Route)	PAPAROA	2373599	5865800
128	135095	32224	NEW ZEALAND POLICE	131.3	14	Aero Base (Off Route)	PAPAROA	2373599	5865800
129	75105	22683	AIRWAYS CORPORATION OF NZ LTD	0.35	20	Radiodet - Radio Beacons (VOR, NDB)	KAIKOURA	2567198	5865000
130	207228	111051	WINGS OVER WHALES LTD	119.1	14	Aero Base (Route)	PEKETA AIRFIELD KAIKOURA	2559400	5864500
131	130751	325	GREYMOUTH AERO CLUB INC	119.1	14	Aero Base (Off Route)	GREYMOUTH AIRPORT	2361200	5859401
132	50198	19090	AIRWAYS CORPORATION OF NZ LTD	118.5	14	Aero Base (Route)	HOKITIKA AIRPORT	2345000	5830700
133	201574	102193	AIR NEW ZEALAND LTD	119.1	14	Aero Base (Off Route)	HOKITIKA AIRPORT	2345000	5830700
134	201574	102193	AIR NEW ZEALAND LTD	133.1	14	Aero Base (Off Route)	HOKITIKA AIRPORT	2345000	5830700
135	210707	116325	METEOROLOGICAL SERVICE OF NEW ZEALAND LTD	9375	47.8	Meteorological Radar	HOKITIKA AIRPORT	2344800	5830600
136	75088	22200	AIRWAYS CORPORATION OF NZ LTD	0.31	24	Radiodet - Radio Beacons (VOR, NDB)	HOKITIKA	2342600	5828800
137		39225	AIRWAYS CORPORATION OF NZ LTD	1146	17	Radiodetermination - Mobile Transmit	HOKITIKA	2342600	5828800
138	75020	18820	AIRWAYS CORPORATION OF NZ LTD	1209	17	Radiodet - Radionav (incl DME)	HOKITIKA	2342600	5828800
139	125396	14545	TIMBERLANDS WEST COAST LTD	133.3	14	Aero Mobile	WESTCOAST AREA	2389000	5828300
140	75069	20435	AIRWAYS CORPORATION OF NZ LTD	0.262	14	Radiodet - Radio Beacons (VOR, NDB)	WOODEND	2485800	5762700
141	110824	25743	AIRWAYS CORPORATION OF NZ LTD	116.6	21	Radiodet - Radio Beacons (VOR, NDB)	EYREWELL	2460200	5756300
142	110804	19126	AIRWAYS CORPORATION OF NZ LTD	1200	38	Radiodet - Radionav (incl DME)	EYREWELL	2460200	5756300
143	75795	10669	AIRWAYS CORPORATION OF NZ LTD	1315	71.6	Radio Det - Other than Met Service	CHRISTCHURCH AIRPORT PSR	2471500	5748700
144	75795	10669	AIRWAYS CORPORATION OF NZ LTD	1320	71.6	Radio Det - Other than Met Service	CHRISTCHURCH AIRPORT PSR	2471500	5748700
145	75795	10669	AIRWAYS CORPORATION OF NZ LTD	1360	71.6	Radio Det - Other than Met Service	CHRISTCHURCH AIRPORT PSR	2471500	5748700
146	75795	10669	AIRWAYS CORPORATION OF NZ LTD	1365	71.6	Radio Det - Other than Met Service	CHRISTCHURCH AIRPORT PSR	2471500	5748700
147	74940	14070	AIRWAYS CORPORATION OF NZ LTD	109.9	17	Radiodet - Aero ILS	CHRISTCHURCH ILS(1)	2473899	5748500
148	78970	28676	AIRWAYS CORPORATION OF NZ LTD	335	17	Radiodet - Aero ILS	CHRISTCHURCH(ILS)2	2473200	5747800
149	102439	7228	AIRWAYS CORPORATION OF NZ LTD	120.9	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2472400	5747600
150	174592	78146	AIRWAYS CORPORATION OF NZ LTD	121.5	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2472400	5747600
151	102445	25918	AIRWAYS CORPORATION OF NZ LTD	124.1	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2472400	5747600
152	102447	30561	AIRWAYS CORPORATION OF NZ LTD	124.4	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2472400	5747600
153	89424	31405	AIRWAYS CORPORATION OF NZ LTD	125	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2472400	5747600
154	75490	25494	AIRWAYS CORPORATION OF NZ LTD	127.2	14	Aero Base (Off Route)	CHRISTCHURCH AIRPORT TRANSMIT	2472400	5747600
155	171791	73339	AIRWAYS CORPORATION OF NZ LTD	1001	33	Radiodet - Radionav (incl DME)	CHRISTCHURCH AIRPORT DME RWY20	2472900	5747600
156	34904	14872	CANTERBURY AERO CLUB INC	119.2	14	Aero Base (Route)	800 POUND ROAD	2472110	5747130
157	34904	14872	CANTERBURY AERO CLUB INC	131.2	14	Aero Base (Route)	800 POUND ROAD	2472110	5747130
158	173538	76414	RICK LUCAS HELICOPTERS LIMITED	119.15	14	Aero Base (Route)	CHRISTCHURCH INTERNATIONAL AIRPORT	2471900	5747100
159	175141	78960	SITA	131.55	14	Aero Base (Off Route)	CHRISTCHURCH INTERNATIONAL AIRPORT POWER CENTRE 2	2471940	5746950
160	131252	14824	MOBIL OIL (NZ) LTD (AVIATION DEPOT)	133	14	Aero Base (Off Route)	WAIRAKEI ROAD	2473399	5746900
161	34647	14749	AIR BP INTERNATIONAL LTD	121.7	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2473300	5746800
162	165997	63462	LSG SKY CHEFS NEW ZEALAND LIMITED	121.7	14	Aero Mobile	CHRISTCHURCH AIRPORT	2473200	5746800
163	34647	14749	AIR BP INTERNATIONAL LTD	121.9	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2473300	5746800
164	165997	63462	LSG SKY CHEFS NEW ZEALAND LIMITED	121.9	14	Aero Mobile	CHRISTCHURCH AIRPORT	2473200	5746800
165	171322	71967	AIRWORK NZ LTD	131.6	14	Aero Base (Off Route)	850 WAIRAKEI ROAD	2473300	5746800
166	160179	52027	SHELL OIL NZ LTD	133.7	14	Aero Base (Off Route)	CHRISTCHURCH AIRPORT	2473200	5746800
167	34647	14749	AIR BP INTERNATIONAL LTD	133.9	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2473300	5746800
168	168117	66356	AIR NEW ZEALAND LTD	121.7	14	Aero Mobile	CHRISTCHURCH	2472600	5746600
169	168117	66356	AIR NEW ZEALAND LTD	121.9	14	Aero Mobile	CHRISTCHURCH	2472600	5746600
170	168117	66356	AIR NEW ZEALAND LTD	130.3	14	Aero Mobile	CHRISTCHURCH	2472600	5746600
171	168117	66356	AIR NEW ZEALAND LTD	131.9	14	Aero Mobile	CHRISTCHURCH	2472600	5746600
172	168116	66355	AIR NEW ZEALAND LTD	132.9	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2473100	5746600
173	66172	16333	CHRISTCHURCH INTERNATIONAL AIRPORT LTD	121.7	14	Aero Mobile	CHRISTCHURCH AIRPORT AREA	2473000	5746500
174	169471	68433	CIVIL AVIATION AUTHORITY	121.7	14	Aero Mobile	CHRISTCHURCH AIRPORT AREA	2473000	5746500
175	66172	16333	CHRISTCHURCH INTERNATIONAL AIRPORT LTD	121.9	14	Aero Mobile	CHRISTCHURCH AIRPORT AREA	2473000	5746500
176	162219	57138	CAPITAL JET SERVICES LIMITED	121.9	14	Aero Mobile	CHRISTCHURCH AIRPORT	2472700	5746500
177	169471	68433	CIVIL AVIATION AUTHORITY	121.9	14	Aero Mobile	CHRISTCHURCH AIRPORT AREA	2473000	5746500
178	211327	117552	JETSTAR AIRWAYS PTY LTD	130.125	10	Aero Mobile (Off Route)	CHRISTCHURCH AIRPORT	2472700	5746500

179	174144	77628	PLANEVIZ LTD	131.25	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2472700	5746500
180	52218	19452	SITA	131.55	14	Aero Base (Off Route)	CHRISTCHURCH AIRPORT	2472700	5746500
181	162219	57138	CAPITAL JET SERVICES LIMITED	131.7	14	Aero Mobile	CHRISTCHURCH AIRPORT	2472700	5746500
182	131253	10501	MOBIL OIL (NZ) LTD (AVIATION DEPOT)	133	14	Aero Mobile	CHRISTCHURCH AIRPORT AREA	2473000	5746500
183	208635	113585	PACIFIC BLUE AIRLINES (NZ) LTD	133.05	14	Aero Base (Off Route)	CHRISTCHURCH AIRPORT	2472700	5746500
184	177052	81631	EMIRATES AIRLINES	134.925	14	Aero Base (Off Route)	CHRISTCHURCH AIRPORT	2472700	5746500
185	203227	105264	AIRWAYS CORPORATION OF NZ LTD	118.3	14	Aero Base (Route)	CHRISTCHURCH AIRPORT TOWER	2472750	5746420
186	89423	31404	AIRWAYS CORPORATION OF NZ LTD	121.9	14	Aero Base (Route)	CHRISTCHURCH AIRPORT TOWER	2472750	5746420
187	203874	106134	AIRWAYS CORPORATION OF NZ LTD	128.2	14	Aero Base (Route)	CHRISTCHURCH AIRPORT TOWER	2472750	5746420
188	169468	68430	CIVIL AVIATION AUTHORITY	121.7	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2472500	5746400
189	169468	68430	CIVIL AVIATION AUTHORITY	121.9	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2472500	5746400
190	66227	25819	QANTAS AIRWAYS LTD	133.825	14	Aero Base (Off Route)	CHRISTCHURCH AIRPORT	2473098	5746400
191	209904	113404	PACIFIC BLUE AIRLINES (NZ) LTD	119.8	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2472700	5746300
192	167960	66178	AIR NEW ZEALAND LTD	131.8	14	Aero Base (Off Route)	HAREWOOD	2473000	5746300
193	65484	11978	GARDEN CITY HELICOPTERS LTD	3.0334	20	Aero Base (Off Route)	CHRISTCHURCH HELIPORT	2473399	5746000
194	65484	11978	GARDEN CITY HELICOPTERS LTD	5.4744	20	Aero Base (Off Route)	CHRISTCHURCH HELIPORT	2473399	5746000
195	35248	15042	GARDEN CITY HELICOPTERS LTD	133.15	14	Aero Base (Route)	CHRISTCHURCH AIRPORT	2473500	5746000
196	116296	248	CANTERBURY AERO CLUB INC	122	14	Aero Mobile	NORTH CANTERBURY AREA	2487000	5745800
197	78967	28673	AIRWAYS CORPORATION OF NZ LTD	333.8	17	Radiodet - Aero ILS	CHRISTCHURCH(ILS)	2471500	5745800
198	171790	73337	AIRWAYS CORPORATION OF NZ LTD	997	33	Radiodet - Radionav (incl DME)	CHRISTCHURCH AIRPORT DME RWY02	2471500	5745800
199	203222	105269	AIRWAYS CORPORATION OF NZ LTD	120.9	14	Aero Base (Route)	CHRISTCHURCH ATS CENTRE	2474300	5745700
200	203222	105269	AIRWAYS CORPORATION OF NZ LTD	124.1	14	Aero Base (Route)	CHRISTCHURCH ATS CENTRE	2474300	5745700
201	203223	105268	AIRWAYS CORPORATION OF NZ LTD	124.1	14	Aero Base (Route)	CHRISTCHURCH ATS CENTRE	2474300	5745700
202	203224	105267	AIRWAYS CORPORATION OF NZ LTD	126.1	14	Aero Base (Route)	CHRISTCHURCH ATS CENTRE	2474300	5745700
203	174494	77874	AIRWAYS CORPORATION OF NZ LTD	1090	12	Radio Det - Other than Met Service	CHRISTCHURCH TECH PARK	2474200	5745700
204	74944	16084	AIRWAYS CORPORATION OF NZ LTD	110.3	17	Radiodet - Aero ILS	CHRISTCHURCH(ILS)2	2471100	5745100
205	109719	28488	AIRWAYS CORPORATION OF NZ LTD	115.3	21	Radiodet - Radio Beacons (VOR, NDB)	CHRISTCHURCH AIRPORT	2470700	5744600
206	109718	27921	AIRWAYS CORPORATION OF NZ LTD	1187	38	Radiodet - Radionav (incl DME)	CHRISTCHURCH AIRPORT	2470700	5744600
207	218789	128086	The Crown acting by and through the Chief Executive of the Department of Corrections	960	19	Aero Base (Off Route)	CHRISTCHURCH MENS AND WOMENS PRISON	2463920	5742798
208	207201	110257	ENVIRONMENT CANTERBURY	129.15	14	Aero Base (Off Route)	KILMORE ST CHRISTCHURCH	2480299	5742300
209	57793	21868	THE RADIO NETWORK LIMITED	133.525	14	Aero Base (Off Route)	155 WORCESTER STREET	2481000	5741800
210	209613	113094	ATCANZ AIRPORTS LIMITED	121.8	14	Aero Base (Route)	WIGRAM AIR BASE	2473400	5739600
211	168249	66476	PIONAIR ADVENTURES LTD	130.05	14	Aero Base (Off Route)	WIGRAM AIR BASE	2473400	5739600
212	156658	1757	MR B J CUMMINGS	133.55	14	Aero Mobile	MCCORMACKS BAY	2488100	5738800
213	156658	1757	MR B J CUMMINGS	134.5	14	Aero Mobile	MCCORMACKS BAY	2488100	5738800
214	178907	84701	JETSTAR AIRWAYS PTY LTD	136.125	14	Aero Mobile	CANTERBURY AREA	2470600	5738600
215	203669	105699	PLANEVIZ LTD	3.0334	20	Aero Base (Off Route)	RICHMOND HILL	2489500	5737400
216	203669	105699	PLANEVIZ LTD	5.7034	20	Aero Base (Off Route)	RICHMOND HILL	2489500	5737400
217	173970	76987	PACIFIC BLUE AIRLINES (NZ) LTD	131.15	14	Aero Base (Route)	RICHMOND HILL	2489500	5737400
218	173970	76987	PACIFIC BLUE AIRLINES (NZ) LTD	133.05	14	Aero Base (Route)	RICHMOND HILL	2489500	5737400
219	124733	8673	WYNDON AVIATION LTD	133.2	14	Aero Mobile	CANTERBURY/NORTH OTAGO	2461199	5737300
220	218783	128092	The Crown acting by and through the Chief Executive of the Department of Corrections	960	19	Aero Base (Off Route)	ROLLESTON PRISON	2456407	5734186
221	125062	24086	NEW ZEALAND POLICE	119.1	14	Aero Base (Off Route)	SUGARLOAF	2481700	5733700
222	125058	32401	NEW ZEALAND POLICE	131.3	14	Aero Base (Off Route)	SUGARLOAF	2481700	5733700
223	75045	18961	AIRWAYS CORPORATION OF NZ LTD	0.374	14	Radiodet - Radio Beacons (VOR, NDB)	BURNHAM	2461000	5733000
224	78869	6838	AIRWAYS CORPORATION OF NZ LTD	1030	60	Radio Det - Two frequency	CASS PEAK SSR	2479670	5730090
225	109715	14634	AIRWAYS CORPORATION OF NZ LTD	118.3	14	Aero Base (Route)	CASS PEAK	2479700	5730000
226	75432	28246	AIRWAYS CORPORATION OF NZ LTD	120.9	14	Aero Base (Route)	CASS PEAK	2479700	5730000
227	73420	28128	AIRWAYS CORPORATION OF NZ LTD	124.4	14	Aero Base (Off Route)	CASS PEAK	2479700	5730000
228	89417	31400	AIRWAYS CORPORATION OF NZ LTD	128.1	14	Aero Base (Route)	CASS PEAK	2479700	5730000
229	78698	28583	AIRWAYS CORPORATION OF NZ LTD	129.4	14	Aero Base (Route)	CASS PEAK	2479700	5730000
230	174232	77738	AIRWAYS CORPORATION OF NZ LTD	1315	-30	Radio Det - Other than Met Service	CASS PEAK	2479700	5730000
231	174232	77738	AIRWAYS CORPORATION OF NZ LTD	1360	-30	Radio Det - Other than Met Service	CASS PEAK	2479700	5730000
232	173815	76915	ZELAN HELICOPTERS	132.95	14	Aero Mobile	ALL SOUTH ISLAND	2327300	5728900
233	34911	14876	CANTERBURY GLIDING CLUB INC	118.1	14	Aero Mobile	PORTABLE BASE(CH)	2489600	5727200
234	34911	14876	CANTERBURY GLIDING CLUB INC	133.55	14	Aero Mobile	PORTABLE BASE(CH)	2489600	5727200
235	66231	25820	MR B L DRAKE	133.55	14	Aero Mobile	PORTABLE BASE(CH)	2489600	5727200
236	66231	25820	MR B L DRAKE	134	14	Aero Mobile	PORTABLE BASE(CH)	2489600	5727200
237	66231	25820	MR B L DRAKE	134.45	14	Aero Mobile	PORTABLE BASE(CH)	2489600	5727200
238	34911	14876	CANTERBURY GLIDING CLUB INC	134.5	14	Aero Mobile	PORTABLE BASE(CH)	2489600	5727200
239	66231	25820	MR B L DRAKE	134.85	14	Aero Mobile	PORTABLE BASE(CH)	2489600	5727200
240	92888	7122	METEOROLOGICAL SERVICE OF NEW ZEALAND LTD	5605	99.6	Meteorological Radar	RAKAIA TRIG	2431300	5713200

241	98887	32396	NEW ZEALAND POLICE	119	14	Aero Mobile	CHRISTCHURCH DISTRICT AREA	2410500	5700200
242	98887	32396	NEW ZEALAND POLICE	119.1	14	Aero Mobile	CHRISTCHURCH DISTRICT AREA	2410500	5700200
243	81239	14152	MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT	119.1	14	Aero Mobile	CHRISTCHURCH DISTRICT AREA	2410500	5700200
244	66217	25808	CHRISTCHURCH INTERNATIONAL AIRPORT LTD	121.7	14	Aero Mobile	CHRISTCHURCH DISTRICT AREA	2410500	5700200
245	66217	25808	CHRISTCHURCH INTERNATIONAL AIRPORT LTD	121.9	14	Aero Mobile	CHRISTCHURCH DISTRICT AREA	2410500	5700200
246	98887	32396	NEW ZEALAND POLICE	131.3	14	Aero Mobile	CHRISTCHURCH DISTRICT AREA	2410500	5700200
247	35680	15254	MID CANTERBURY AERO CLUB INC	119.1	14	Aero Base (Route)	ASHBURTON	2413800	5699700
248	75066	20190	AIRWAYS CORPORATION OF NZ LTD	0.254	21	Radiodet - Radio Beacons (VOR, NDB)	ASHBURTON AIRPORT	2414200	5699600
249	34664	14760	AIR SAFARIS AND SERVICES (NZ) LTD	5.7034	20	Aero Base (Off Route)	LAKE TEKAPO	2305200	5686100
250	59665	23071	AIR SAFARIS AND SERVICES (NZ) LTD	119.1	14	Aero Base (Off Route)	LAKE TEKAPO	2305200	5686100
251	59665	23071	AIR SAFARIS AND SERVICES (NZ) LTD	130.8	14	Aero Base (Off Route)	LAKE TEKAPO	2305200	5686100
252	126172	35749	NEW ZEALAND POLICE	119.1	14	Aero Base (Off Route)	ALBURY RANGE	2328000	5672900
253	126172	35749	NEW ZEALAND POLICE	131.3	14	Aero Base (Off Route)	ALBURY RANGE	2328000	5672900
254	75437	28251	AIRWAYS CORPORATION OF NZ LTD	123.5	14	Aero Base (Route)	MT ROLLESBY (TELECOM)	2319200	5669100
255	89428	31407	AIRWAYS CORPORATION OF NZ LTD	129.3	14	Aero Base (Route)	MT ROLLESBY (TELECOM)	2319200	5669100
256	201577	102194	AIR NEW ZEALAND LTD	130.9	14	Aero Base (Off Route)	TIMARU AIRPORT	2368500	5654500
257	75048	18963	AIRWAYS CORPORATION OF NZ LTD	0.366	14	Radiodet - Radio Beacons (VOR, NDB)	LEVELS AIRPORT	2368400	5654000
258	74992	18608	AIRWAYS CORPORATION OF NZ LTD	1193	17	Radiodet - Radionav (incl DME)	LEVELS AIRPORT	2368400	5654000
259	102481	21754	TIMARU DISTRICT COUNCIL	119.1	14	Aero Base (Off Route)	KING GEORGE PLACE TIMARU	2370800	5644200