

---

**KAIMAI WIND FARM, AVIATION ISSUES ASSESSMENT**  
**PEET AVIATION**  
**12 SEPTEMBER 2017**

---



## INTRODUCTION

### SCOPE

1.
  - (a) The Kaimai Wind Farm (KWF) proposal;
  - (b) The existing environment;
  - (c) Assessment methodology;
  - (d) The potential effects of the KWF;
  - (e) Submitter concerns;
  - (f) Conclusion.

### THE KWF PROPOSAL

2. The KWF is to be located on an approximately 660 ha project site near Tirohia in the Eastern Waikato District bordering the Kaimai Ranges. The project site is located partly adjacent to the Kaimai Ranges and the State Highway 26, and is approximately 6.5 km South South-East of Paeroa and 7 km North of Te Aroha. In general, the elevation of the proposed site area is up to 300 metres. I note the following features of the proposal site that are relevant to my assessment:
  - (a) The proposed final location of the wind turbines by Ventus Energy is contained in Kaimai Wind Farm Site Layout Map A3L, Version 3 (as illustrated in **Appendix Two**)
  - (b) Up to 24 wind turbines will be located within the proposed project envelope, each with a maximum height of 207 metres to the blade tip<sup>1</sup>
  - (c) The operating wind speed envelope for the turbines is 5-54 knots (3-28m/s)
  - (d) An Aeronautical Study, pursuant to Civil Aviation Rule 77.17(a), is to be done

---

<sup>1</sup> Memo, Kaimai Turbine Dimensions, Rev 4, 21 May 2018, **Appendix Six**

- (e) A 110 kV sub-station will be constructed adjacent to on-site overhead lines
3. Based on windographer data provided by Ventus Energy and conducted by Energy<sup>3</sup> from two anemometer masts, I understand that the wind direction at the project envelope (and the immediately surrounding area) is most consistent from the South-West quadrant with the next most consistent direction being from the North-East and the mean wind strength from the South-West is approximately 16 knots (or approximately 8.6 m/s at the upper ridgeline and approximately 7 m/s at the lower (northern) ridgeline).

## **THE EXISTING ENVIRONMENT**

### ***KAIMAI WIND FARM SITE***

4. There are two farm airstrips located within the proposed KWF site, on Thorp and Denize properties and one microlight airstrip adjacent to the site across the main highway 26 opposite Jackson's. (as is illustrated in **Appendix Three**).
5. The Thorp and Denize airstrips are used by agricultural aircraft on approximately two days each per annum. They are approximately 400m in length, grass airstrips. Both airstrips will remain operational for agricultural aircraft activities with the KWF proposal and siting of the turbines.
6. The microlight airstrip, opposite Jackson's house, will not be affected by the KWF.

### ***Hang-gliding and Paragliding Activity Jackson Property***

7. There is some hang-gliding & paragliding activity from the Jackson property on an irregular basis. This is from the ridgeline and enables flight activity in this area. Use of the Jackson property is at the agreement of the landowner.
8. Hang-gliders & paragliders launch from other sites along the Kaimai Ranges, notably Swaps Quarry. More adventurous hang-gliders & paragliders look to travel as far north as possible beyond the Kaimai Ranges. Improvements in hang-gliders & paragliders have enabled travel to Thames in recent years.

9. Paragliding activity is in wind conditions, in general, less than 10 knots (5.1m/s). Hang-gliding is optimal with wind conditions between 10-20 knots (5.1-10.3m/s) or 10 knots with thermals in the area<sup>2</sup>.

#### ***Gliding Activity KWF Site***

10. There is glider flight activity based from Matamata Airfield, approximately 30km South of the KWF site proposal.
11. Gliding activity occurs the length of the Kaimai and Coromandel Ranges and the State Forest Park. The Kaimai Ranges are approximately 70km in length and the Forest Park covers an area of 45,000 ha<sup>3</sup>.
12. Glider activity is optimal in wind conditions between 10-25 knots (5.1-12.9m/s).

#### **ASSESSMENT METHODOLOGY**

13. I was engaged by Kaimai Wind Farm Ltd in July 2017 to undertake an assessment of the potential effects of the KWF on aviation related matters. This assessment included the following:
  - (a) A review of the KWF proposed site and airfields;
  - (b) A review of the effects to hang-glider & paraglider activity from the Jackson property and the KWF site in general;
  - (c) A review of the effects to glider, hang-glider and paraglider activity over the KWF proposed site;
  - (d) A visit to the KWF site and a review of information pertaining to the characteristics of the site and soaring operation over the site, with respect to understanding the potential implications of the KWF for these specific aviation activities.

---

<sup>2</sup> Approved Meeting Minutes, 18 May 2017, **Appendix Five**

<sup>3</sup> <http://www.tourism.net.nz/new-zealand/about-new-zealand/attractions/parks-and-reserves/kaimai-mamaku-forest-park.html>

## POTENTIAL EFFECTS OF THE KWF ON AVIATION

### **AVIATION NAVIGATION HAZARDS**

#### *Effects on Flying*

14. The CAANZ utilises different methods to manage aviation risks, including education, guidance and legislative tools (i.e. rules). The approach used depends on the nature and degree of the risk posed to the aviation system. Rules are generally made when setting a common standard is the best way to manage a safety risk or address an issue with the aviation system. The rules are made under the Civil Aviation Act 1990 by authority of the Minister of Transport.
15. As the wind turbines may be up to 207 metres in height, the KWF would be considered to be a hazard in accordance with Rule Part 77.19(a) of the Civil Aviation Rules (1 April 2014). In this regard, any structure that is 120 metres or higher above ground level is determined as a hazard in navigable airspace.
16. In previous studies related to wind farms the CAANZ determination requires that the wind farm be lit with navigation lighting and its location marked on aeronautical charts. This is considered the appropriate method to inform pilots of the hazard.

**Risk Mitigation: The wind farm will likely have suitable lighting to comply with the requirements of CAANZ Rule Part 77.21(d) and appendix B and marked on aeronautical charts, this would be a CAANZ decision**

#### *Effects on Hang-gliding & Paragliding*

17. Establishment of the KWF would stop hang-gliding & paragliding activity from launching at the Jackson property. Hang-gliding & paragliding launch sites outside the proposed KWF site remain viable and available for use.
18. Hang-glider and paraglider flight over the KWF site, where a launch is done outside the site envelope, would remain viable, provided the craft are operated at a safe height above and clear of the turbines, approximately 2,000ft.

19. Flight activity at low level over the KWF site would increase risk of an incident, due to the pylons height, and vertical and downwind turbulence generated by the turbines.

**Risk Mitigation: These activities remain viable from launch sites away from KWF, however, they will need to be operated in a safe manner over the KWF site, with respect to height and this is the responsibility of the pilot**

### *Effects on Gliding*

20. The proposed KWF site covers an area approximately 1.5% of the overall Kaimai Ranges.
21. The wind turbines are placed along the ridge lines running across the three properties.
22. Due to the most consistent wind direction across the project envelope being from the South-West quadrant the airflow is into the State Park.
23. Glider aircraft use the ridgelines as the wind is forced up generating uplift zones or ridge lift. In meteorological terms, this is known as orographic lift. The lift is created when the wind meets the surface of the ridge and the air rises. Wind creates a region of rising air directly above the ridgeline. This region of rising air may extend some distance upwards and outwards from its surface as the airflow follows the contour of the hill. Downwind of the ridgeline, lee waves can form, these can also be used by glider aircraft to gain height, but they should not be confused with ridge lift.
24. Glider aircraft use the length of the Kaimai Ranges and across to the Coromandel Ranges for recreational and competition soaring. There are no firm statistical flight data on number of glider flights over this area, however, broad assumptions provided by the Soaring Centre in Matamata are between 600 to 1000<sup>4</sup>. There are approximately 15 competition days per annum.
25. Glider aircraft will operate at varying altitudes above the ridgelines in this area, depending on what operational activity they are undertaking, from recreational through to competition, which may include using the area as a turn point or transiting across the Karangahape Gorge between the Kaimai and Coromandel Ranges.
26. Glider aircraft returning from the North, the Coromandel Ranges, could be expected to be at a lower height as they transit the KWF site, than glider aircraft transiting from South to

---

<sup>4</sup> Approved Meeting Minutes, 18 May 2017, **Appendix Five** and Telecon 7 August 2017

North, the Kaimai Ranges to the Coromandel Ranges where glider aircraft can be expected to be at a greater height over the KWF site.

27. KWF Limited have, subsequent to discussions, 18 May 2017, removed one turbine from the site proposal, this has had the effect of providing greater open distance between proposed turbines 17 and 18, approximately 1.5km apart, enabling low height glider flight between these points.
28. KWF Limited recognise the importance of the area for glider flight activity, especially during competitions, and to facilitate glider activity and provide some risk mitigation from turbulence in the lee of the turbines, are open to shutting down proposed turbines 16 and 17 on some days of the year.
29. KWF Limited would accept shutdown of turbines 16 and 17 in wind speeds up to approximately 12 knots (6m/s) for ten competition days per annum.
30. The Matamata Soaring Centre may consider that a curtailed turbine operation speed may be safely navigated downwind between turbines 17 and 18. A regime of turbine curtailment may be appropriate - for example the turbine speed reduces to x rpm, this would increase the (wind) window for transiting through the wind farm up to 25 knots (13 m/s). This will need to be discussed between KWF Limited and the Matamata Soaring centre.
31. There may be some “ridge running” activity<sup>5</sup>, and this has occurred over the proposed site. However, the position of the turbines will negate low height ridge running over the KWF site.
32. Glider aircraft indicative tracks provided through the Soaring Centre display a range of heights over the KWF proposed site (as is illustrated in **Appendix Four**), the majority of which appear to provide at least 1000ft or more separation above the surrounding area. This provides sufficient height separation between the glider aircraft and turbines in the wind conditions in general found for the area.
33. In greater wind conditions, in general above 20 knots, more turbulence will be experienced over the KWF proposed site, this will need to be evaluated by individual pilots and glider flights operated accordingly.

---

<sup>5</sup> Ridge Running – low level flight along a ridge, generally for speed and the adrenalin effect of flight. [https://youtu.be/rag\\_n3rtQVo](https://youtu.be/rag_n3rtQVo)

**Risk Mitigation: Shut down turbines 16 and 17 on ten days per year, during glider competitions under the auspices of the Matamata Soaring Centre and with wind conditions 12 knots or less (<6m/s)**

*Karangahape Gorge*

34. The Karangahape Gorge is a known light aircraft, fixed wing and helicopter, transit between the Coromandel Ranges, to the North and the Kaimai Ranges, to the South.
35. The Karangahape Gorge provides aircraft flight between the Bay of Plenty and Waikato, especially in lower level cloud conditions, but above that for flight in Visual Flight Rules (VFR).
36. The KWF proposed site is approximately 6km South of the Karangahape Gorge and should not provide an impediment for aircraft flight through the Karangahape Gorge.
37. In both normal wind flow conditions and direction, approximately 16 knots from the South-West and higher wind conditions, The KWF site will not stop light aircraft activity through the Karangahape Gorge.

*Effects – Turbulence*

38. In winds of 15 knots (approximately 8m/s), turbulence occurs in the lee of an obstruction and may extend up to one third higher than the obstruction. Given that each of the wind turbines at the KWF lower elevation turbines, number 1 to 17, may be up to 207 metres in height, turbulence may extend to a height of approximately 275 metres above ground level. Turbines at the KWF higher elevation, turbines number 18 to 24, may be up to 180 metres in height, turbulence may extend to a height of approximately 240 metres above ground level.
39. There may also be turbulence disturbance in the lee horizontal plane of the obstruction. However, such turbulence in wind conditions up to 15 knots will be mainly contained to the project site, turbines 1 to 17, given the setback or with turbines 18 to 24 through into the State Park at the rear boundary of the proposed site.



40. In wind speeds above 20 knots (approximately 10m/s),<sup>6</sup> turbulence can occur up to twice the height of the obstruction - which is approximately 414 and 360 metres above ground level, in the case of the wind turbines proposed for the KWF. Turbulence in the lee horizontal plane will extend for 10 - 15 times the height of the wind turbine, which is approximately 2070 – 3105 metres. Due to the local topography, this turbulence will get mixed and modified by the valleys and ridges in the Kaimai Ranges and ultimately mixed with the general wind conditions being experienced across the region.
41. Turbulence can also create wind shear. The presence of wind shear can cause fluctuations in airspeed when a glider or aircraft operates within a turbulence field. Other factors such as wind direction, air density, humidity and pressure altitude will also influence aircraft performance. In this regard, wind shear generated by the KWF will not be the sole determining factor for aircraft performance when operating in the proposed site area.
42. The decision to fly a glider or aircraft is ultimately that of the glider and aircraft pilot. Factors such as wind speed and direction, glider and aircraft performance, pilot skills and capability are assessed, either intuitively or through a checklist system and used by a pilot to manage flying risk and operations.
43. Overall, I do not consider that glider and aircraft operations in the area will be affected by turbulence effects from the KWF in wind conditions up to 16 knots, however, the prior risk mitigation measure recommended will assist to mitigate some turbulence risk during glider competitive flying with turbines 16 and 17 shutdown. Glider operations in the area, as well as flying over the KWF, may be affected when wind speeds are more than 20 knots – which could restrict lower height level operations over the site in those wind conditions, predominately Southwest winds. Based on wind data collected for the KWF site, this would account for potentially 15% of the time, and needs to be considered against the fact that low level flight is infrequent and that 20 knots is above the normal mean wind speed for the area.
44. I consider that glider operations over the proposed site would remain viable with wind speed norm being approximately 16 knots, subject to the glider pilot conducting the flight in a safe manner.

---

<sup>6</sup> By way of context, I understand that the wind turbines are shutdown in wind speeds exceeding 54 knots (28m/s).

## **CONCLUSION**

45. The ridgeline on the Jackson property will not be able to be used as a launch site for hang-glider and paragliders with the location of the turbines.
46. With respect to glider aircraft activity, it is my opinion that the KWF will not represent a physical obstacle to glider operations over the proposed site. Likewise, turbulence and wind shear will not be an issue when wind speeds in the area are approximately 16 knots, which is the norm. Glider operations over the proposed site may, however, be affected when wind speeds are more than 20 knots – although this would account for potentially 15% of the time, and needs to be considered against the fact that glider activity would remain viable and subject to pilots conducting flights in a safe and secure manner at an appropriate altitude.
47. Risk Mitigation measures:
  - 47.1 The wind farm is likely to have suitable lighting to comply with the requirements of CAANZ Rule Part 77.21(d) and appendix B and marked on aeronautical charts, this would be a CAANZ decision.
  - 47.2 Hang-gliding and paragliding activities remain viable from launch sites away from KWF, however, they will need to be operated in a safe manner over the KWF site, with respect to height and this is the responsibility of the pilot.
  - 47.3 Shut down turbines 16 and 17 on ten days per year, during glider competitions under the auspices of the Matamata Soaring Centre and with wind conditions 12 knots or less (<6m/s).
48. Finally, I do not consider that there is any need to consider moving the location or the alignment of the proposed site or provide for a reduced project envelope.

**Brian Whelan**

Peet Aviation Limited

21 September 2017

## APPENDIX ONE

### Qualifications and experience

Key Areas of Experience and Competencies

#### Technical and Strategic

I have broad exposure across the aviation industry supported through academic, technical and management activity. This working environment provides me with depth of knowledge in the operational demands of the industry and compliance with acceptable standards and practices. My work environment includes general aviation, airlines, airports, government agencies through to my international networks of aviation professionals

- Aviation policy, regulatory and rules, domestic and international
- Safety Management Systems and aviation risk management

<b>Courses/Education</b>		
<b>Year</b>	<b>Degree/Course</b>	<b>Educational Institution</b>
2014	ICAO-AVSEC PMC	Management Instructor
2014	ICAO AVSEC Professional Management Course	ICAO, John Molson School of Business
2009-2010	ICAO Airport Executive Management Course	AMPAP, ICAO/Airports Council International
2000-2002	Masters Business Aviation (Global Aviation)	John Molson School of Business, Concordia University, Montreal
1993-1994	Diploma in Business (Finance)	Auckland Graduate School of Business Auckland University
1990-1992	Diploma in Business (Management)	Massey University
1987	Airline Transport Pilot Licence 11,000 +hrs, 8,000 +hrs Jet Captain	CAANZ issue Eire (2001)
1980	Commercial Pilot Licence	Wanganui Aero Club Commercial Pilot School

<b>Current and Former Professional Roles and Memberships</b>
Panel Advisor – Aviation, Commerce Commission New Zealand ICAO Management Instructor ICAO/ACI AMPAP [Facilitator for AMPAP Programme] NZ Qualifications Authority – G2G Aviation Advisor International Airport Professionals network AVSEC International Community network Aviation MBA Group Aviation New Zealand Chairman, (Quality Performance Monitoring Group), ATTTO, oversight of national aviation qualifications Chair, NZ Aviation Community Advisory Group (ACAG), 2003-2011

<b>Employment</b>		
<b>Employer</b>	<b>Position</b>	<b>Period of Employment</b>
Peet Aviation Limited	Director, Aviation Consultant	2003 - Present
ICAO	Management Instructor	2014 - Present
Commerce Commission	Panel Advisor - Aviation	2015 - Present
NZQA G2G	Aviation Advisor	2014 - Present
ICAO/ACI	AMPAP Facilitator	2010-2012
PARC Aviation (City Jet, EU)	Jet Captain	2001-2002
Qantas New Zealand	Deputy Line Flying Manager	1998-2001
Ansett New Zealand	Jet Captain	1989-1997
Ansett New Zealand	First Officer	1988 – 1989
Goodman Fielder Wattie	Pilot	1987
Moller Corporation	Pilot	1983-1987
Wanganui Aero Work	Pilot	1981-1983

### **Qualifications and experience**

49. Brian Whelan.
50. I am a Director with Peet Aviation Limited, a role I have held since 2003.
51. I hold Diplomas in Business (Management and Finance) from Massey University and Auckland University, and Masters in Business Aviation from Concordia University, Montreal. I have also held a commercial pilot's licence since 1980, which I obtained from the Wanganui Aero Club Commercial Pilot School, and have held my Airline Transport Pilot Licence since 1987.
52. I have broad experience within the aviation industry, supported through academic, technical and management activity. My work environment includes providing advice to airport operators and local authorities regarding the management of airspace and airfield operations, the development of the New Zealand airspace operational model for the New Zealand aviation industry (including the Civil Aviation Authority New Zealand ("CAANZ"), Ministry of Transport and Land Information New Zealand), and aviation safety and risk management analysis work for a variety of clients.

## APPENDIX TWO

### KAIMAI WIND FARM TURBINE POSITION CONCEPT , VERSION 3



Kaimai Windfarm Site  
Layout map A3 (rev.3)

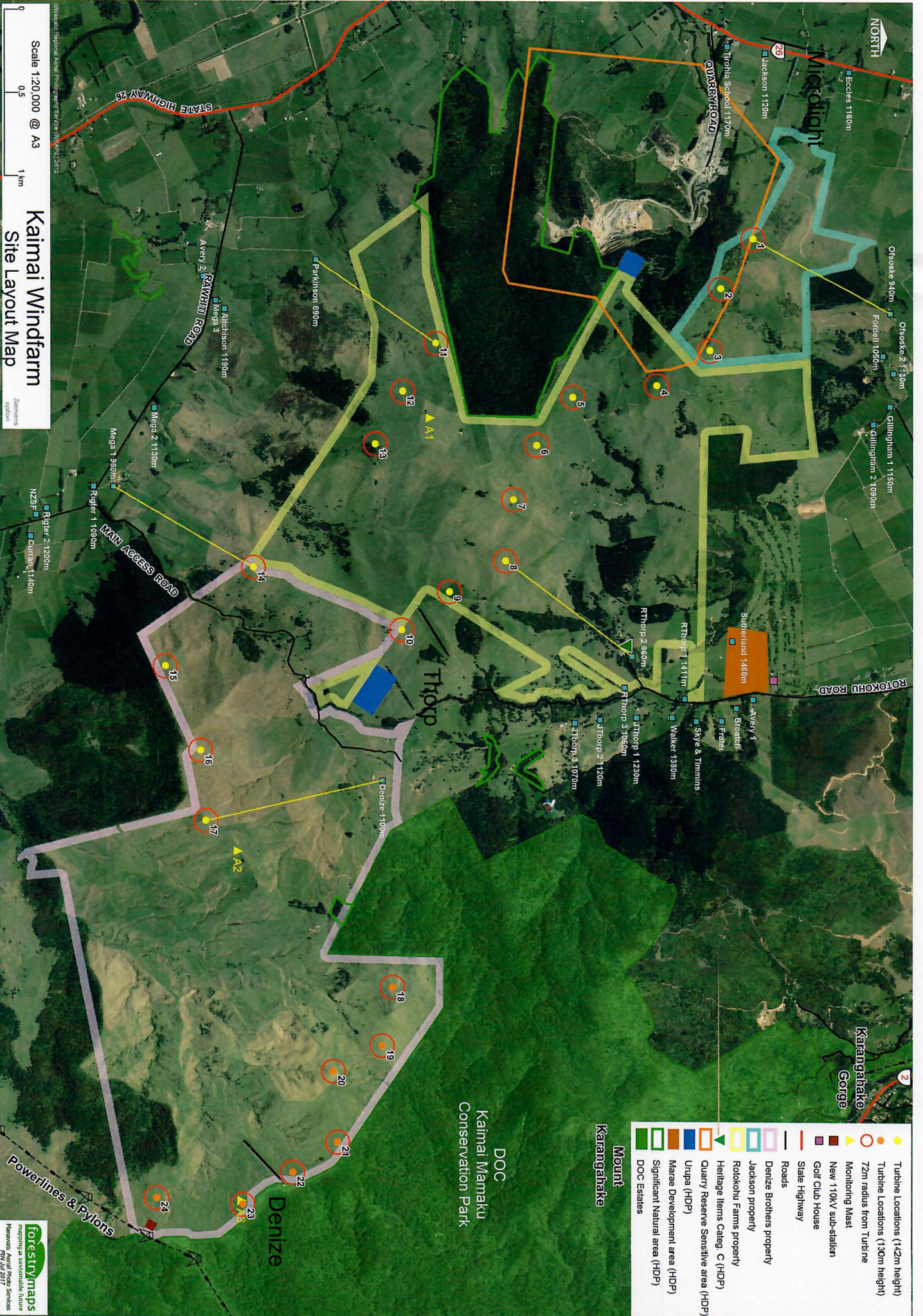
## APPENDIX THREE

### KAIMAI WIND FARM AIRSTRIPS



KWF\_Airstrips\_220820  
17.pdf





- Turbine Locations (142m height)
- Turbine Locations (130m height)
- 72m radius from Turbine
- ▲ Monitoring Mast
- New 110KV sub-station
- Golf Club House
- State Highway
- Roads
- Denize Brothers property
- Jackson property
- Rotokohu Farms property
- Heritage Items Categ C (HDP)
- Quarry Reserve Sensitive area (HDP)
- Urupa (HDP)
- Marea Development area (HDP)
- Significant Natural area (HDP)
- DOC Estates

Mount  
Karangahake

DOC  
Kaimai Mamaku  
Conservation Park

Denize

Scale 1:20,000 @ A3  
0 0.5 1 Km

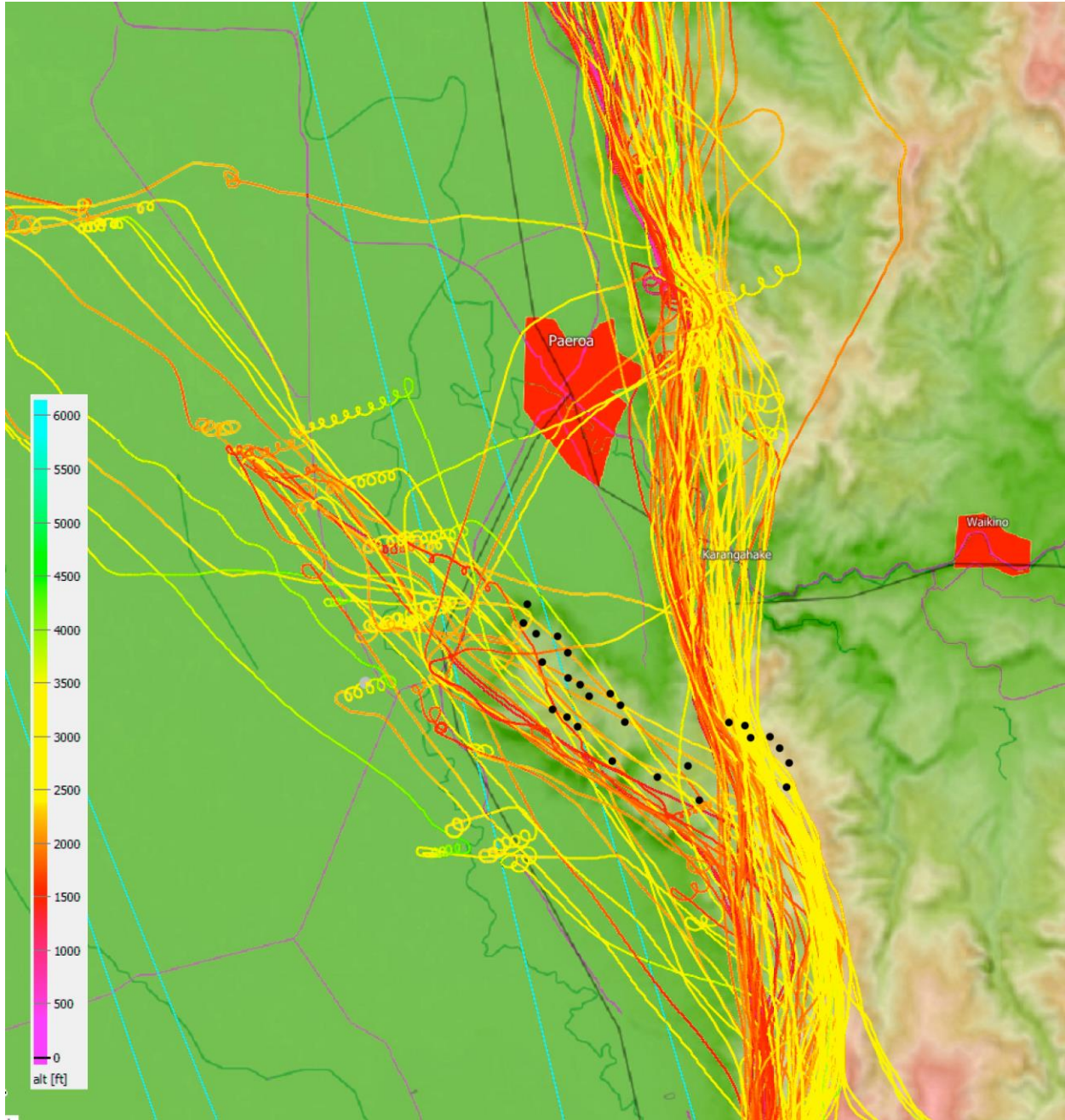
Kaimai Windfarm  
Site Layout Map

forestrymaps  
mapping a sustainable future  
New Zealand  
RVN JUL 2017



# APPENDIX FOUR

## GLIDER AIRCRAFT TRACKS EXAMPLE KWF PROPOSED SITE





## APPENDIX FIVE

### APPROVED MEETING MINUTES, 18 MAY 2017

# Meeting Minutes



**Meeting Title:** Proposed Kaimai Wind Farm and Existing Soaring Amenity

**Date:** 18 May 2017

**Location:** Piako Soaring Club, Waharoa, Waikato

### Attendees

Name	Organisation	Interest
Glenn Starr (GS)	Ventus	Wind Farm
Tim Bromhead (TB)	Matamata Soaring Centre	Gliding
Rick Hawkeswood (RH)		Hangliding and Paragliding
Bob Gray	Piako Gliding Club	Gliding
Robin Briton	Piako Gliding Club	Gliding
Tony Davies	Piako Gliding Club	Gliding

No.	Item	Action
1	<p><b>Introduction</b> - GS introduced the history of the project and evolution of the site layout. Touched on the benefits of the economies of scale to make a wind farm project viable. Key aspect is the grid connection with an estimated cost of \$10M. Requires a larger wind farm to keep the per turbine connection cost low. GS described the wind regime on the site and the data collected by two monitoring masts. GS presented a revised layout on the screen.</p>	
2.	<p><b>Gliding Use</b> - Club members stated that key routes are the north and south routes particularly during competition times. The number of competition days are up to 30/year and the return flights for competitions are estimated to be 600/year. Some occasional recreational flying round trips include perhaps another 150/year. The journey north is generally at a higher altitude and they can pass safely over the high ridgeline turbines (no. 11, 13, 19, 16, 20 22 and 25). The return journey (from the Coromandel Ranges) is generally at lower elevation. A critical place to pass over is the ridge between turbines 11 and 21. TB showed cockpit cam recording of this flight path. At times there may not be sufficient elevation attained or thermal lift present to make the pass so pilots will land in farmers paddocks on an ad hoc basis. This is true also of the journey north.</p> <p>Of secondary importance is a turning point to the NW of proposed turbine no. 1 where pilots will race to it, turn around and then race back south.</p> <p>Also of importance is that use of the lower elevation ridgeline (under Turbines 1 to 18), where pilots may search for thermal rises to gain elevation.</p>	
3.	<p><b>Paragliding Use.</b> Key launching points for paragliders are Swaps Quarry – close to Matamata or from the Jackson farm. There is no formal right however and access is</p>	

	granted on a casual basis. A key route for para-gliders to travel north is over the higher ridgeline. Turbines here essentially cause a block from travelling further North. GS: these are the most productive wind turbines.	
4.	<b><u>Importance of the Amenity</u></b> - Some member stressed the importance of the amenity and how at times pilots will travel internationally to enjoy the challenges of flying the entire length of the Kaimai ranges from locations close to Matamata. And for Gliders and Hanggliders the entire length of the Coromandel ranges too. Paragliders currently can make it as far north as somewhere between Thames and Paeroa. The amenity has been used since 1975.	
5.	<b><u>Turbulence</u></b> . Of key concern to pilots are the turbulent effects of operating wind turbines. TB showed a graphic representation of this with water vapour wake shedding from and operating wind farm. GS showed the results from recent wind analysis to demonstrate the background turbulence of the site – which is quite low – class C for wind turbines. Turbulence is particularly worrisome for paragliders as the chute may collapse. Gliders are less troubled.	
6.	<b><u>Key Pass</u></b> – GS estimated the distance between proposed turbine 11 and 21 is 1.5km. Club members asked if this could be made greater and could some turbines be removed. GS expressed concern over removing turbines as it undermines the projects viability.	
7.	<b><u>Mitigation Options</u></b> – TB enquired about the possibility of turning turbines off at key times. GS considered the idea has merit and enquired over the preferred operating wind speeds or the disciplines which were given as:  Glider: 12 to 25 knots  Hanglider: 10 to 20 knots, or 10knots with thermals  Paraglider: <10knots  GS suggested the removal of Turbine no. 1. Members did not see much benefit in this.  Club members asked about moving the high ridgeline turbines further south – where it is less critical for all the soaring disciplines. GS stated that Ventus no longer has land rights on that land – also there are other environmental considerations there including landscape and bats.  GS – a mitigation come through as a consent condition so it would survive Ventus Energy’s control on the project.	
8.	<b><u>Actions</u></b> – Determine the extra turbulence caused by the wind turbines – especially 6, 21, 24 and 26. Also of concern are 18, 14 and 10.  Distribute updated draft layout.  Report back to the Soaring club with any possible solutions or mitigations – estimated turn around of 3 weeks.	GS

## APPENDIX SIX

### MEMO, KAIMAI TURBINE DIMENSIONS, REV 4, 21 MAY 2018



Memo-Kaimai  
Turbine Dimensions- 1