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**GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED WINDFARM
ROTOKOHU ROAD
PAEROA**

Prepared For:

Kaimai Windfarm Ltd
C/- Ventus Energy
Private Bag 300987
Albany
AUCKLAND

KGA Geotechnical Group Limited

Supporting the Construction Industry since 1990

7A William Pickering Drive | Albany | Auckland

P O Box 302 361 | North Harbour | Auckland 0751

09 478 6655

Unit 3, 201 Opawa Road | Hillsborough | Christchurch

P O Box 6476 | Upper Riccarton | Christchurch 8442

www.kga.co.nz

03 343 5302

REPORT ISSUE AUTHORISATION

Geotechnical Engineering Investigation
Proposed Windfarm
Rotokohu Road
Paeroa

Prepared by:



Jacqui McCord

BSc - Geology
Geologist

Reviewed by:



Abilio Nogueira

MSc (Engineering Geology)
Director

Authorised by:



R. J. Hutchison

BE, MSc, DIC, MICE, CEng(UK), FEngNZ, CPEng
Principal Geotechnical Engineer

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Attachments:-

Sheet 1	Location Plan & Regional Geology
Sheets 2A to 2C	Site Plan & Geomorphology

Appendix 1: Borehole Logs

Appendix 2 Gamesa Standard Turbine Detail

1. INTRODUCTION

At the instruction of Ventus Energy, we have carried out a geotechnical engineering investigation for a proposed windfarm at Rotokohu Road, Paeroa. The scope of our investigation was to examine aerial photographs and published geological information for the area, conduct a detailed site walkover inspection of the proposed individual wind turbine sites and to explore subsurface conditions across the site using hand operated equipment. The information obtained has been used to assess ground conditions, review site stability and provide preliminary geotechnical considerations for the proposed wind turbines, including access to turbine sites and other associated structures.

This report is a revision to the previous reports (Ref 8888-6, dated 6 October 2017 and 8888-6A dated 8 June 2018) to take account of additional information provided by the design team and comments made in the peer review by Tiaki Engineering Consultants. In the preparation of this report, we have considered and incorporated the following:

- Memorandum: Kaimai Turbine Dimensions - Kaimai Windfarm Ltd, Rev4; 21 May 2018.
- Civil Engineering Drawings - Tektus Consultants Ltd, Resource Consent Issue; Rev A, June 2018.
- Civil Engineering Peer Review - Tiaki Engineering Consultants, May 2018.

This report presents our findings and conclusions and has been prepared in support of a Resource Consent application. It is not suitable for detailed design. A supplementary geotechnical investigation will be required for the detailed design stage. Further recommendations are given for future works in Section 17 of this report.

2. PROPOSED DEVELOPMENT

Drawings provided to us by Tektus Consultants Ltd (Ref T15022, Resource Consent Rev A dated June 2018) detail the placement of 24 wind turbines across the site. Access roads will be formed on site to access each turbine location.

We understand that the turbine model to be installed on the site has not yet been confirmed and several models are being considered. However, for preliminary design purposes, we understand that the wind turbine base will be circular with a diameter of approximately 18m to 23m, based on foundation sizes currently being installed internationally. We understand that the design has a location variability circle for the turbine of approximately 40m diameter.

The turbines are generally founded approximately 2.5m to 3.5m below ground surface and the ground is then backfilled over the turbine base. A standard detail of the Gamesa Turbine type used overseas is appended for reference.

The proposed access road generally follows existing farm tracks and ridge lines and will be approximately 6m wide with road side swale drains on both sides of the road. Excavation and filling will be required for the access road formation with the cut and fill faces shown to comprise a batter slope, generally no steeper than 1 vertical on 1.5 horizontal, but in some areas, as steep as 1 vertical on 1 horizontal. Generally, excavation and filling is less than 2m depth, however, there are localised sections where excavation is up to approximately 10m depth and filling is up to approximately 7m depth. The areas of maximum cut and fill generally correspond to turbine sites, as well as localised areas along the access way.

The location of proposed aggregate quarries and earthworks spoil sites are also shown on the Tektus drawings.

3. SITE DESCRIPTION

3.1 Site Location

The proposed windfarm is to be located over the properties at 771 and 604 Rotokohu Road and at 6356 Highway 26, as shown on the Location Plan & Regional Geology, attached as Sheet 1. The site is located at the northern end of the Kaimai ranges between the towns of Paeroa and Te Aroha. The land is currently used as grass pasture with scattered stands of trees and farm buildings.

The Tirohia Quarry is located adjacent to the northwestern portion of the site.

3.2 Site Topography

The overall topography of the area comprises a generally northwest to southeast trending ridgeline with a series of secondary ridgelines and valleys falling to the southwest and northeast. The ridge lines are narrow to broad topped and many comprise hilltops and saddles. The side slopes fall away at generally moderate to steep grades.

The topography over the northern portion of the site comprises a broad, gently rolling ridge with a series of hilltops and secondary ridgelines extending to the northeast and southwest. The side slopes of the secondary ridges are moderately to steeply sloping. Rock bluffs were observed on the lower side slopes.

The southern portion of the site comprises a series of hilltops along the ridge line with secondary ridges trending to the southwest and northeast. The west facing slopes in the area are moderate to steep and show signs of creep and slumping and are hummocky in appearance.

4. SITE GEOLOGY AND GEOMORPHOLOGY

4.1 Geological setting

The Hauraki District is situated on the Australian Plate, approximately 300km to 500km northwest of the active plate boundary where the Pacific Plate is subducted below the Australian Plate. Tectonic activity has formed the north to northeast trending Hauraki Rift, resulting in the formation of a basin that comprises the Hauraki Plains, the Firth of Thames to the west and the uplifted Coromandel and Kaimai Ranges to the east.

During the Miocene (approximately 20Ma) a string of Andesitic volcanoes formed along the Coromandel Range. The volcanic activity shifted east to southeast over time with rhyolite eruptions beginning to dominate, forming rhyolitic domes, calderas and ignimbrite sheets.

4.2 Published Geology

We have examined the Geological Map of New Zealand, Map 3, Auckland (Scala 1:250 000) by the Institute of Geological and Nuclear Sciences Ltd. The geological features identified are shown on Sheet 1. The geological map shows there to be a contact between geological units located approximately where the plains meet the foothills of the Kaimai Ranges. The geological units are described as follows:

- Waiwawa Subgroup of the Coromandel Group (Mci) – Kaimai Ranges.
Andesite, dacite and rhyolite flows and domes with intercalated tuff, tuff breccia and volcanoclastic sediments.
- Kaimai Subgroup of the Coromandel Group (Mca) – Kaimai Ranges.
Andesite and dacite lava flows and domes, intrusives, tuff and tuff breccias, volcanoclastic sediments and welded dacite.
- Late Pleistocene River Deposits of the Tauranga Group (eQa) - Hauraki Plains.
Cross bedded pumice sand, silt and gravel.
- Holocene River Deposits of the Tauranga Group (Q1a)– Hauraki Plains
Structureless, bouldery deposits to sandy gravels of various lithology.

The geological map shows a number of faults located in the area. These are described in further detail in Section 4.3.

A Cross section of the geology through the Hauraki Rift and Kaimai Ranges is shown below.

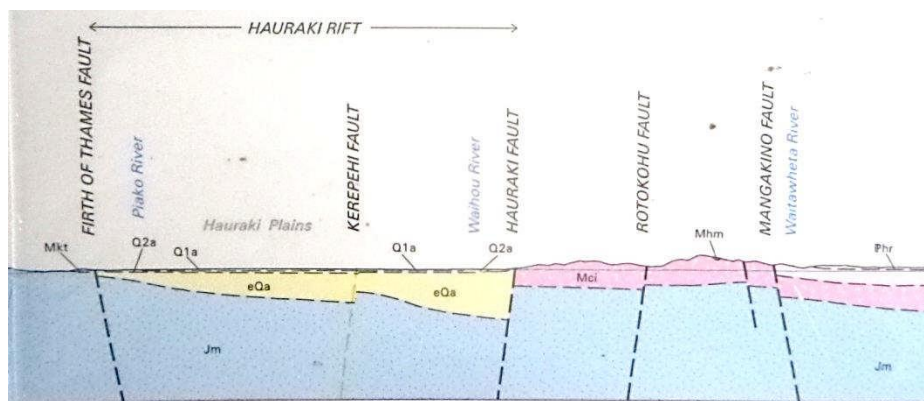


Figure 1: Geological Cross Section of Hauraki Rift and Kaimai Ranges. Source: Geological Map 3, Auckland

4.3 Structural Geology

The geological map shows a number of faults in the vicinity of the site and the approximate location of the fault lines are shown on Sheet 1. This includes the Kerepehi Fault, Hauraki Fault, Rotokohu Fault, Mangakino Fault and several unnamed faults.

We have examined a report prepared for Environment Waikato titled “An Overview of Natural Hazards in the Hauraki District” (Ref 1060692, dated 12 March 2007), which discusses the seismic risk of the wider area. The Kerepehi Fault, located approximately 6km west of the site, is considered to be active and studies suggest that it is capable of producing an earthquake of up to magnitude 7 with a return period greater than 200 years. There have been no recorded movements on this fault since 1800.

While the Kerepehi Fault is considered to be active, it has not been classified as a major fault in accordance with Table 3.6 and Figure 3.5 of NZS1170:2004. All major faults are greater than 20km away from the site.

All other faults in the vicinity of the site are considered to be inactive.

5. GEOMORPHOLOGY SUMMARY

The geomorphology of the site is based on aerial photograph interpretation and site observations. Aerial photograph stereoscopic pairs of the site and surrounding area were obtained from Opus International Consultants Ltd. The photographs were flown on 8 February 1991 at a scale of 1:25,000. They were examined using a stereoscopic viewer to identify geomorphic and topographical features. A detailed walkover inspection of the turbine sites was undertaken in December 2016.

The proposed windfarm lies on the western side of a northwest to southeast trending ridge line of the Kaimai Ranges. A number of faults, both active and inactive, are located through the Hauraki Rift and the Kaimai Ranges. The faults generally show a north-south to northwest-southeast orientation.

Movement of the Hauraki and Kerepehi Faults and subsequent infilling of the rift zone has led to the formation of the Kaimai Ranges which meet the low lying alluvial plains to the east. According to the geological map, the Rotokuhu Fault tracks within a broad valley (generally along Rotokuhu Road), rising up to a saddle and then tracks over the ridge between Turbines 16 and 17.

The valley of the Rotokuhu Fault forms a distinctive feature in the landscape. From the top of the saddle, a second valley has formed, trending to the southwest (between Turbines 14 and 15). While this valley does not follow the Rotokuhu Fault trace as shown on the Geological Map, it is a significant valley with a saddle, being the lowest point on the ridge line, separating the two valleys. It was also noted that the observed geomorphology is characteristically different to the northwest and southwest of the valley.

The ridge line in the northern portion of the site (Turbines 1 to 14) is broad topped and gently rolling ridge with a series of higher hilltops along its length. Secondary ridgelines separated by deep gullies extend from the main ridge to the northeast and southwest. The upper side slopes of the ridge are gently sloping, becoming moderately to steeply sloping over the lower slopes.

Evidence of past instability was observed on the steeper portions of the slope with arcuate features indicating back scarps from past slope movement. Evidence of slope movement was not widespread across the area and generally located at the head of tributary gullies and stepper slopes, such as Turbine 5. The exception is the gully between Turbines 13 and 14 which shows a series of past land movement along the gully side slopes. The observed features were smooth in appearance, indicating that movement is historical.

Rock bluffs were observed on the lower slopes in the vicinity of Turbines 10, 11, 12 and 15. A thin soil mantel was observed over the rock bluffs which was showing evidence of creep and shallow slumping.

The ridgeline in the southeastern portion of the site (Turbines 18 to 24) is the point of highest elevation in the general area, with Turbines 15 to 17 located on a secondary ridgeline trending northeast to southwest. The top of the ridgeline is generally broad with a series of narrow spur ridges and hilltops along its length. Secondary ridges extend to the southwest separated by drainage channels.

The general geomorphology, west of the ridgeline comprises a dendritic drainage system with tributary gullies extending up to the ridgeline. The side slopes are steep and show evidence of past slope failure along their lengths, and are generally associated with tributary gully features below. Larger scale slope instability features were smooth in appearance indicating historical movement. Significantly more slope instability features were observed in the southern portion of the site, compared to the northern portion of the site.

On the upper reaches of the tributaries, the side slopes show evidence of creep and recent surface slumping indicating progressive regression of the upper tributaries. At the time of our walkover, no water was observed within the upper tributaries. The base of the tributaries are generally broad and it is likely that slope in-wash has deposited in the base of the gullies as colluvium and alluvium deposits.

Volcanic boulders were observed across the landscape and within cut faces, however, rock was not observed in the location of the turbine sites. Rock bluffs were observed on the lower gully slopes.

Further details of the features at the individual turbine locations are detailed in Section 7.

6. SUBSURFACE TESTING AND FINDINGS

6.1 Subsurface Exploration

Subsurface conditions at selected turbine locations were explored by the drilling of hand auger boreholes during December 2016. The auger borehole locations are shown on the attached Site Plan & Geomorphology (Sheets 2A to 2C). The borehole locations were selected to provide a representative indication of the subsurface ground conditions across the site. They were positioned based on turbine locations given to us at the time, however, some turbines have been repositioned since the field work was undertaken. Ground conditions have therefore been interpolated across the site between turbine locations.

Each borehole was designated to be taken to a depth of 5 metres or until effective refusal was reached, whichever being the shallower. A calibrated shear vane was used at regular depths in the drilled holes to measure soil strengths. Scala penetrometer testing was undertaken through the base of each borehole to give a general indication of soil consistency, to a maximum depth of 2m below the base of the boreholes. Logs of the borings and Scala penetrometer testing are appended.

6.2 Subsurface Condition Summary

At the points explored, the ground conditions were generally found to comprise a surface veneer of topsoil, approximately 0.2m thick, underlain by Coromandel Group Volcanic Deposits (CGVD). Two boreholes (AH1 and AH3) encountered colluvium/alluvium below the topsoil.

Colluvium/alluvium was encountered in boreholes where past instability was noted (Turbine 5). It comprised stiff to hard clayey silt and silt with some clay. Hand vane shear strengths ranged from 82kPa to greater than 208kPa.

The CGVD generally comprised very stiff clayey silt and silt with variable clay content. Hand vane shear strengths ranged from 61kPa to greater than 208kPa with some material too stiff to be penetrated by the equipment. Generally, hand vane shear strengths were greater than 150kPa and increased with depth.

Scala penetrometer testing encountered effective refusal in all boreholes, with the exception boreholes AH9 and AH10, near to Turbines 16 and 17. The results indicate the presence of competent strata at depth, approaching rock in consistency. Even where effective refusal was not reached, results indicate soil consistency was increasing. The depth to effective refusal ranged from 1.1m to 6.4m. We point out that in the vicinity of northern Turbines 8 to 13, effective refusal was encountered at less than 3m depth.

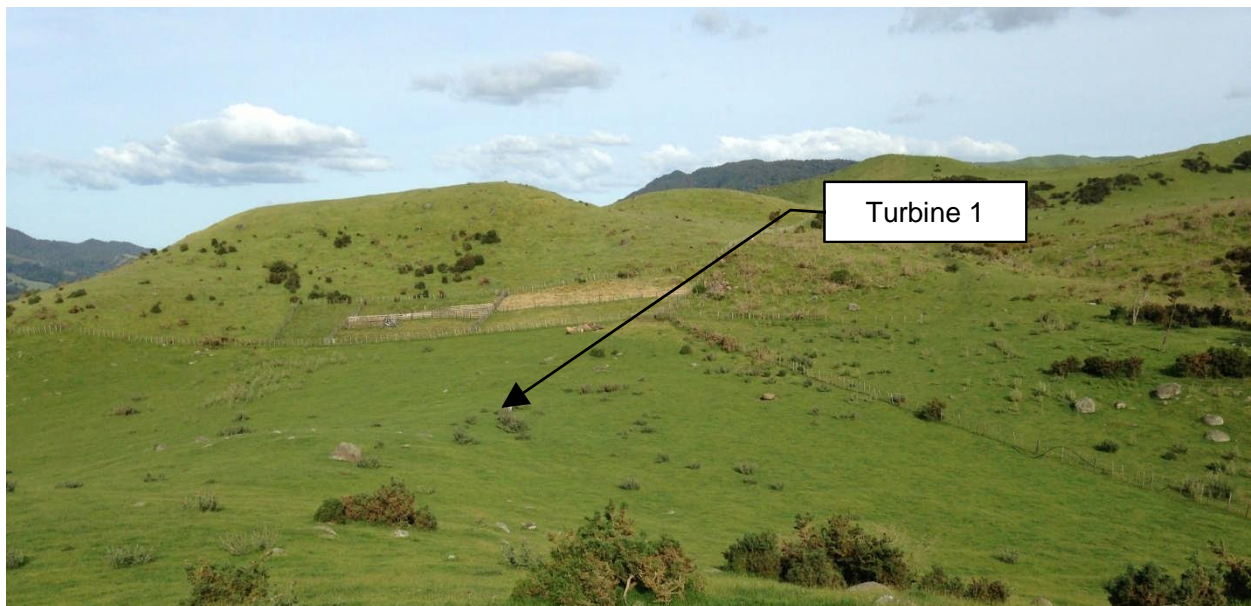
On the day of drilling, groundwater was encountered in boreholes AH1 and AH3 only at 2.9m depth and 3.8m depth respectively.

For a full detailed description of the subsoils encountered on site, reference should be made to the attached borehole logs. For the purposes of this report, subsoil conditions on the site have been interpolated between the boreholes and it must be accepted that soil conditions can and do vary between borehole positions. Further details at specific turbine locations are provided in Section 7.

7. GENERAL GEOTECHNICAL CONSIDERATIONS AT TURBINE LOCATIONS

Turbine 1

- Gently sloping ridge line falling to northeast and southwest, on a saddle between hilltops.
- Ground conditions expected to comprise very stiff to hard clay and silt soils within depth of turbine footing excavation.
- No geotechnical concerns for this site.



Turbine 2

- Near level ridge line.
- Ground conditions expected to comprise very stiff to hard clay and silt soils within depths of turbine footing excavation.
- No geotechnical concerns for this site.



Turbine 3

- Narrow hilltop with moderately sloping side slopes.
- Back scarp identified on northern slope with the slope falling at approximately 25°. The feature is smooth in appearance and is suspected to be historical.
- Ground conditions expected to comprise very stiff to hard clay and silt soils.
- The hilltop is narrower than the foundation base of a turbine and will need to be lowered.
- The ground conditions are expected to get harder with depth and depending on the depth of excavation required for the turbine platform, it is possible that rock will be encountered within the excavation depth.



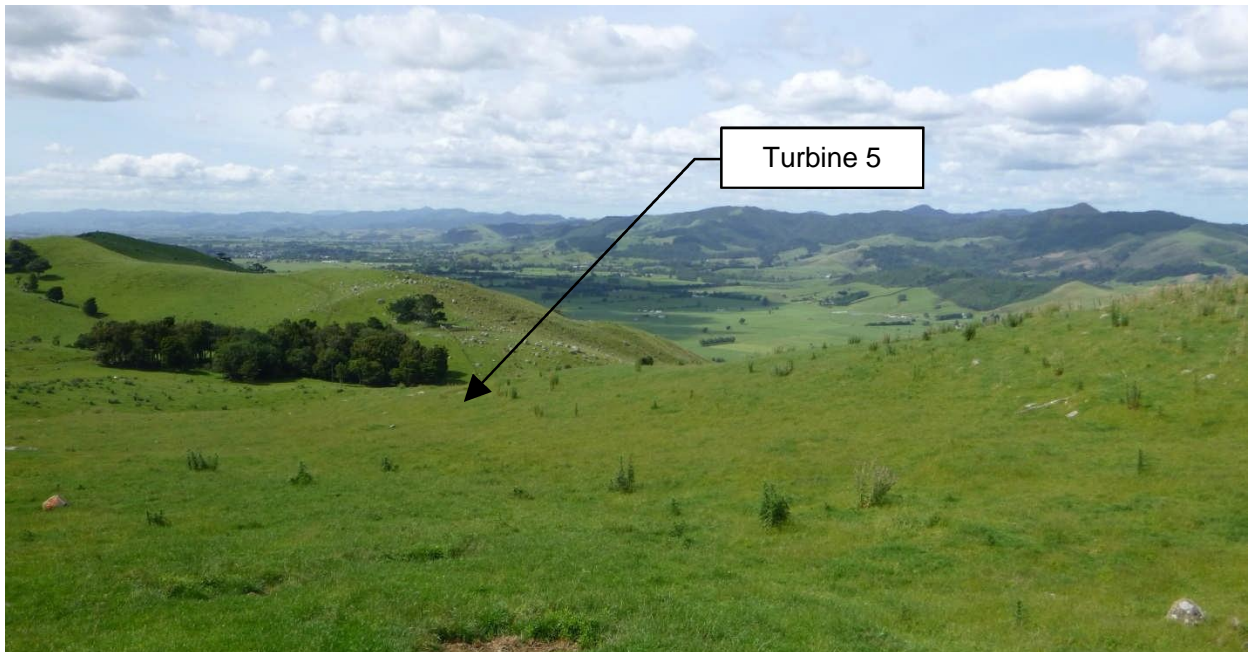
Turbine 4

- Ridgeline, with broad top, approximately 35m wide.
- Side slopes are moderately sloping.
- Ground conditions comprise hard CGVD to approximately 5.5m depth.
- The ridgeline will need to be lowered to form a level platform for the turbine and crane. The ground was found to be hard and rock is likely to be encountered at approximately 5m to 6m depth. Boulders may be encountered within the soil at shallower depths.
- As part of foundation design slope stability should be considered, as per Section 9.



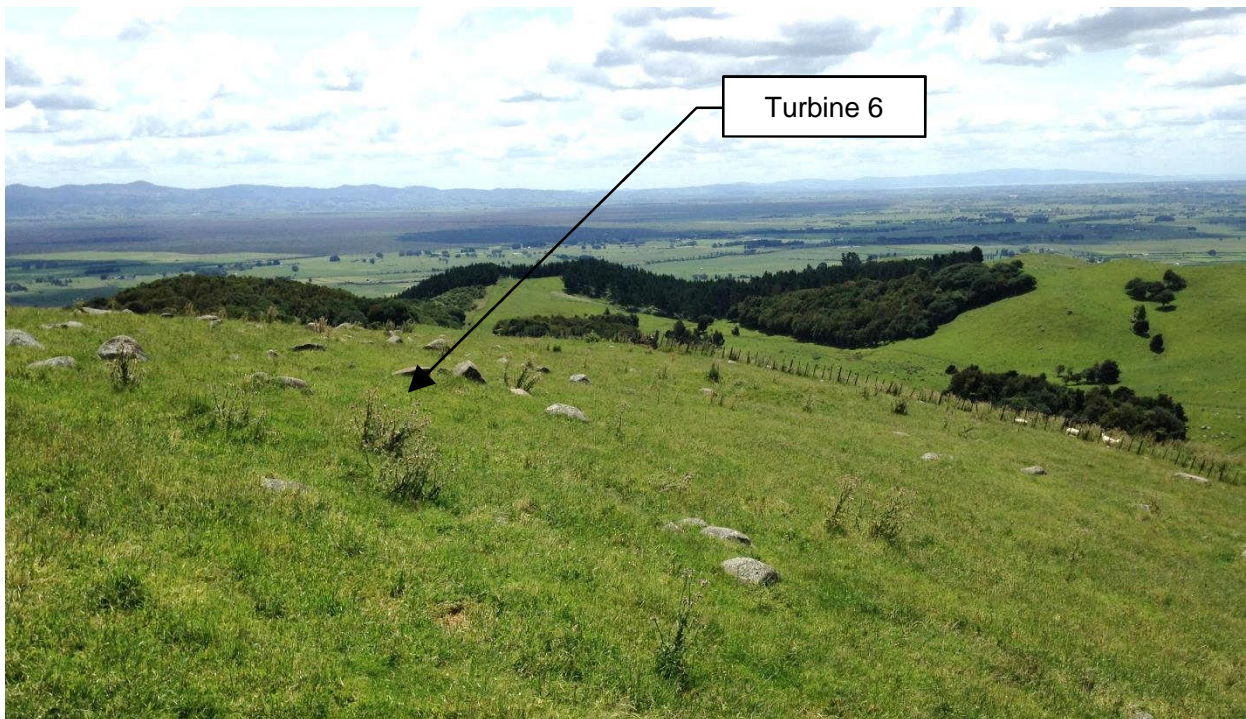
Turbine 5

- Gently to moderately sloping, north facing slope falling at up to approximately 16° at the turbine site.
- The ground surface of the site and surrounding area is hummocky in appearance with curved surface features located upslope of the turbine site indicating past slope movement and presence of colluvium lobes. The features are smoothed suggesting historical movement.
- The ground conditions identified suspected colluvium, which is consistent with our observations of past slope movement. Very stiff to hard soils were encountered to approximately 6m depth. Intermixed sand was encountered from approximately 3m depth.
- Groundwater was encountered at approximately 3.4m depth and the material was described as wet.
- We recommend that the turbine platform be formed by excavation only. To reduce potential excavation, we suggest that as part of the micro siting of the turbine, the ground profile in the general area be considered as excavation will reduce where slopes are gentler.
- Excavation may also be required for the crane platform.



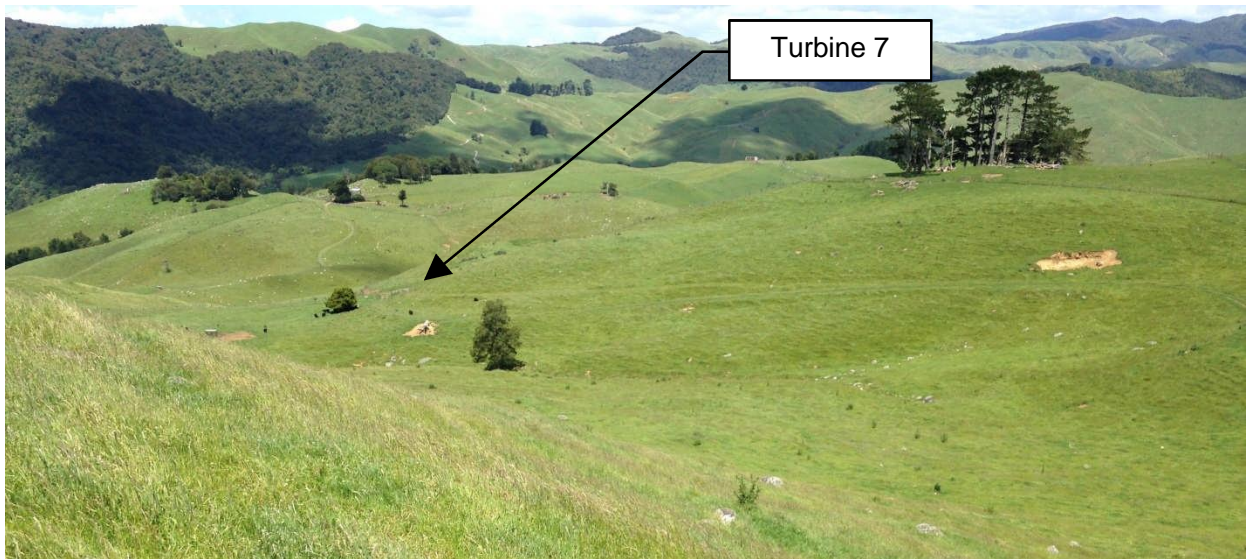
Turbine 6

- Broad ridgeline, falling to the north, with steep side slopes to the east and west at up to approximately 30°.
- Ground conditions are expected to comprise very stiff to hard clay and silt soils.
- It is likely that excavation will be necessary to form the level turbine platform. The ground conditions are expected to get harder with depth and depending on the depth of excavation required, it is possible that rock will be encountered within the excavation depth.
- As part of foundation design slope stability should be considered, as per Section 9.



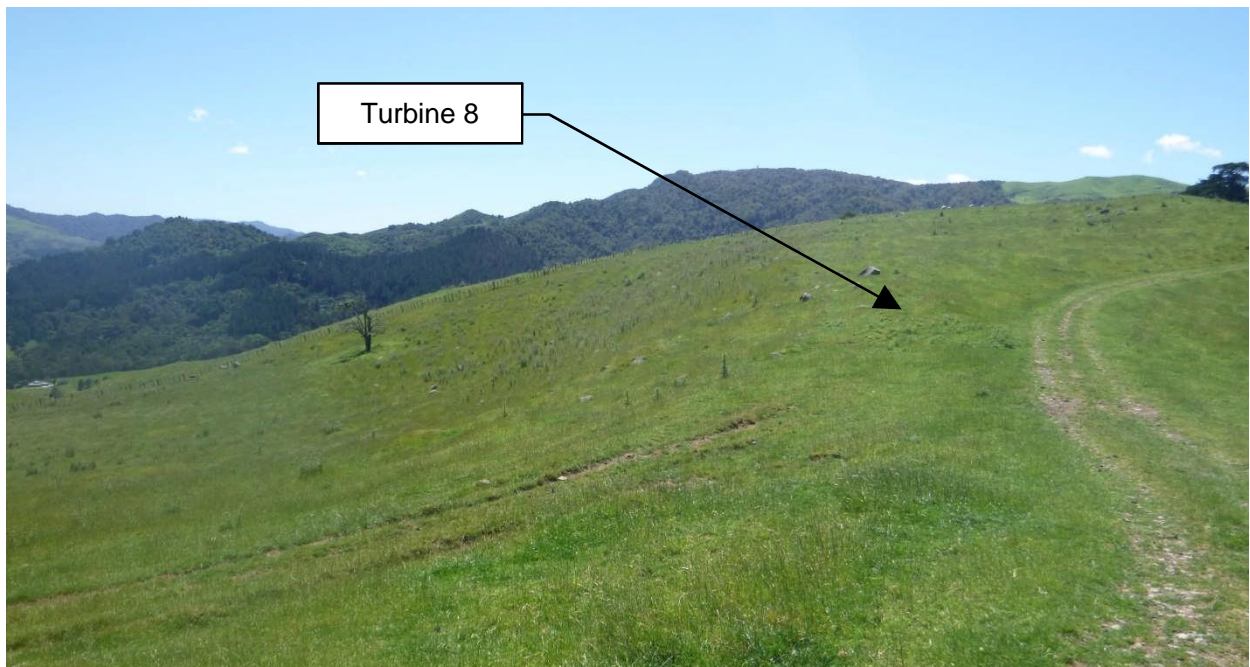
Turbine 7

- Gently sloping ridge line, that falls steeply to the east and west.
- Ground conditions are expected to comprise very stiff to hard clay and silt soils.
- It is likely that excavation will be necessary to form the level turbine platform. The ground conditions are expected to get harder with depth and depending on the depth of excavation required, it is possible that rock will be encountered within the excavation depth.
- Slope stability should be considered when final siting of the turbine is known.



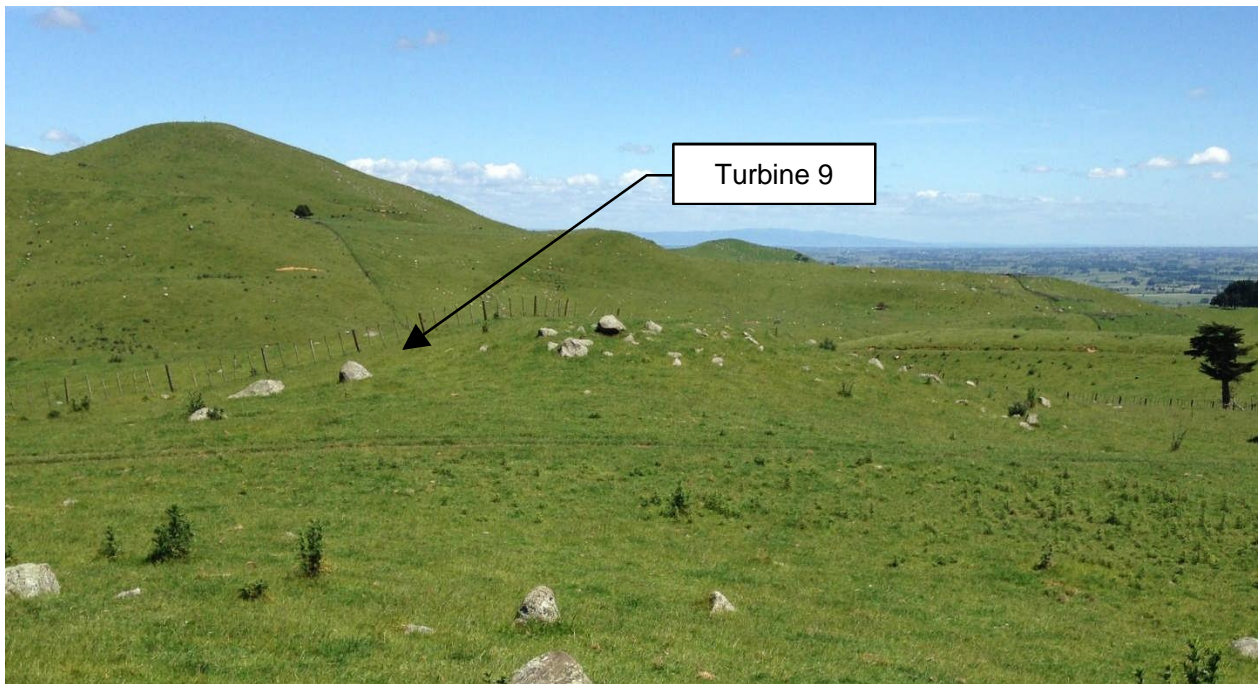
Turbine 8

- Turbine located on the northern side of a saddle along the ridgeline on a gently to moderate slope. The saddle is the high point, separating two gullies, which fall to the north and south.
- Ground conditions comprise hard CGVD soils, with shallow rock expected to be encountered at approximately 2m to 3m depth.
- The turbine site is located on sloping ground and excavation will be required to form a level base. It is possible that rock will be encountered within the excavation depth. To minimise excavation, locate the turbine on the more gently sloping ground in the general area.
- As part of foundation design slope stability should be considered, as per Section 9.



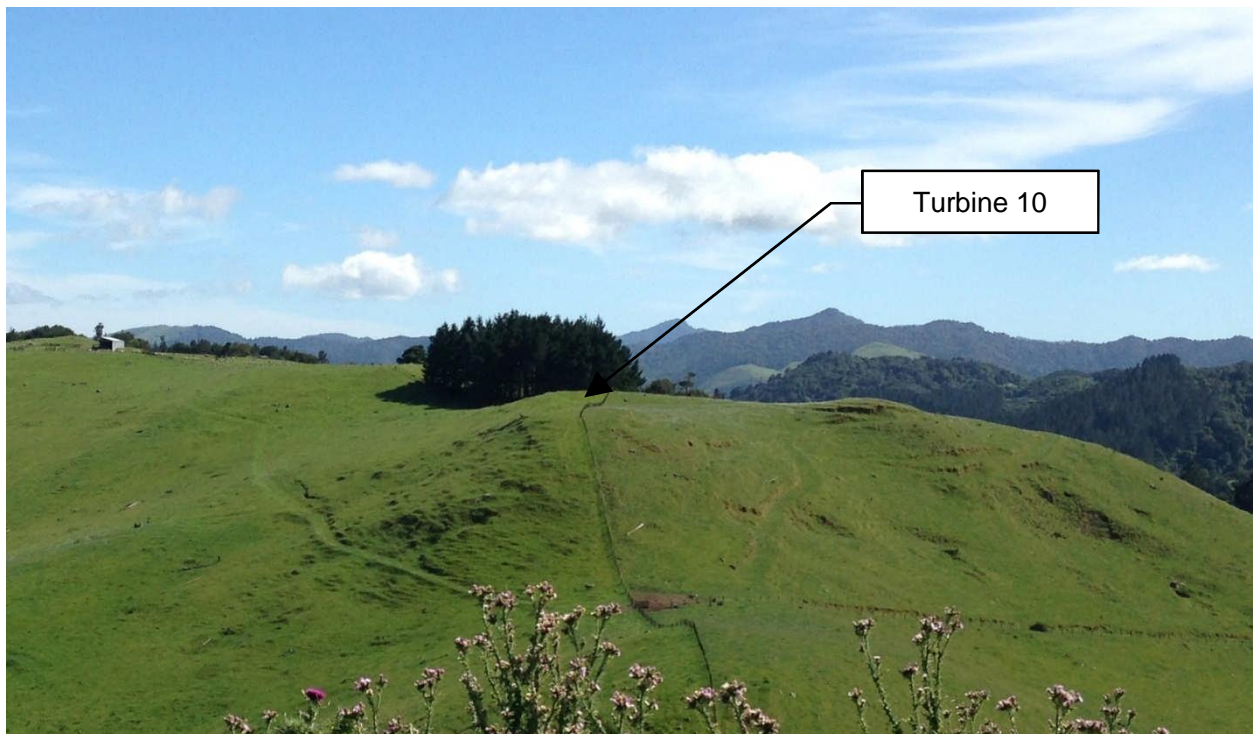
Turbine 9

- Gently sloping, east facing slope, that becomes moderately sloping further downslope.
- Ground conditions expected to comprise very stiff to hard CGVS soils with rock expected to be encountered between approximately 2m and 3m depth.
- Rock will likely be encountered within the excavation for the level platform.
- No geotechnical concerns for this site.



Turbine 10

- Gently sloping ridge. Side slopes to the west, south and southwest become moderately to steeply sloping.
- Ground conditions expected to comprise very stiff to hard CGVS soils with rock at approximately 3m depth.
- A level platform should be formed by excavation and it is likely that rock will be encountered within the depth of excavation.
- As part of foundation design slope stability should be considered, as per Section 9.



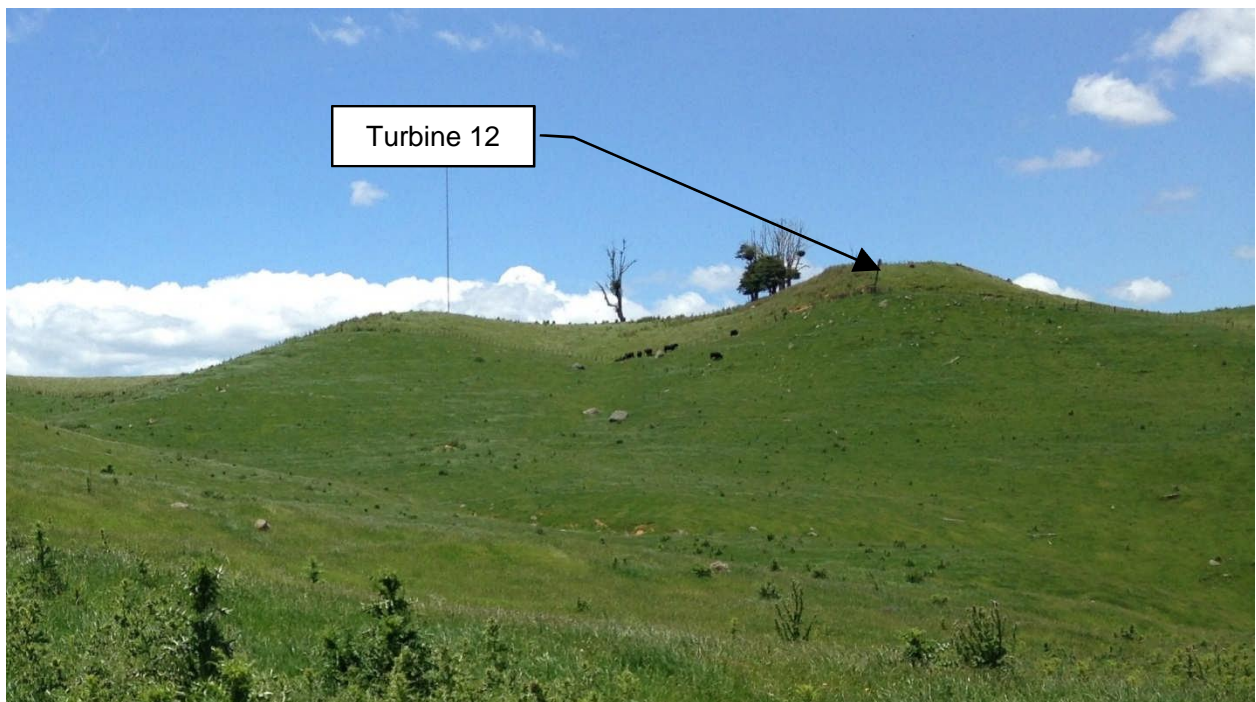
Turbine 11

- Moderately to steeply sloping, south facing slope.
- The ground surface of the site and surrounding area is hummocky in appearance with curved surface features indicating past slope movement. The features are smoothed suggesting historical movement.
- Very stiff to hard CGVD soils were encountered to approximately 2.2m depth, indicating shallow rock in this area. Rock bluffs were observed on the lower portion of the slope.
- We recommend that the turbine platform be formed by excavation only to provide a uniform subgrade. To minimise excavation, we suggest that as part of the micro siting of the turbine, it be located in the more gently sloping part of the general area. It is likely that rock will be encountered if excavation is greater than approximately 2.5m depth.
- Excavation may be required to form a platform for the crane.
- As part of foundation design slope stability should be considered, as per Section 9.



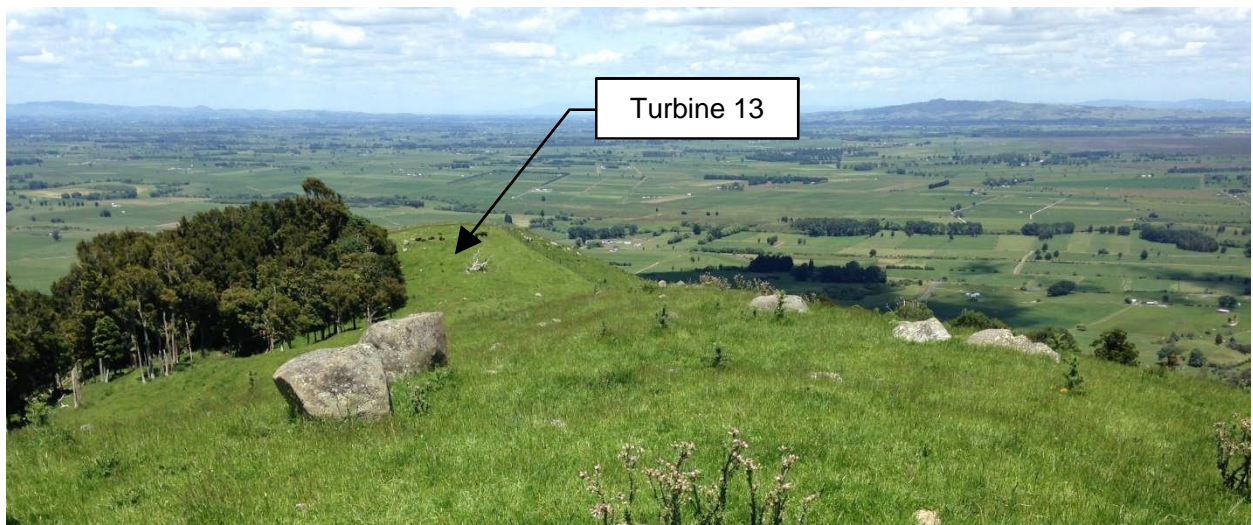
Turbine 12

- Narrow, spur ridge with steep side slopes.
- Surface creep observed on the side slopes.
- Ground conditions expected to comprise very stiff to hard CGVD soils to a depth in the order of 2m, based on results from nearby boreholes.
- Excavation will be necessary to form the level turbine platform. The ground conditions are expected to get harder with depth and depending on the depth of excavation required, it is possible that rock will be encountered within the excavation depth.
- The ridge line is gently sloping, but narrow, and some excavation may be required to form a platform for the crane.
- As part of foundation design slope stability should be considered, as per Section 9.



Turbine 13

- Spur ridge line with broad top and moderately sloping side slopes to the east and west.
- Ground conditions comprise hard CGVD soils, with shallow rock expected to be encountered at approximately 1m to 2m depth.
- Rock will likely be encountered with the excavation for the level platform.
- Slope stability and foundation design should be considered when final siting of the turbine is known.



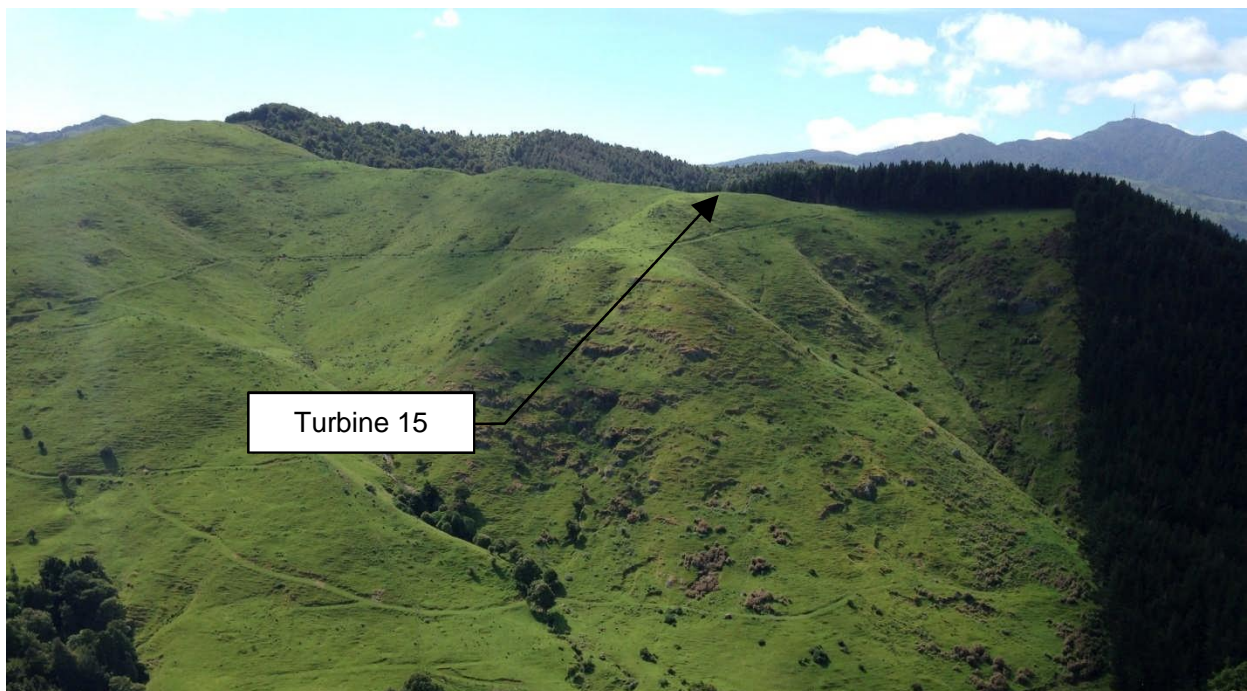
Turbine 14

- Located on a hilltop approximately 10m to 15m wide, along a narrow spur ridge. Side slopes are steep, falling at approximately 30° to 40°. The site is at the end of the spur ridge and several hill tops are present along its length.
- Ground conditions expected to comprise very stiff to hard CGVS soils with rock expected to be encountered between approximately 2m and 3m depth.
- The hilltop will need to be lowered significantly to form a level platform for the turbine and crane platform.
- As part of foundation design, slope stability should be considered, as per Section 9.
- Access to this area would involve either the lowering of the hilltops along the spur ridge, or cutting the access road into the side slopes which would form steep cut faces that will either require retaining or battering. Access road formation is discussed in Section 13.



Turbine 15

- Located on gently sloping ridge line with moderate to steep side slopes.
- Ground conditions expected to comprise very stiff to hard CGVS soils with rock in excess of 5m depth.
- Curved features were observed downslope of the turbine site as well as downslope of the ridgeline to access the site. The features are smooth in appearance, indicating historic slope movement. Surface creep was also observed.
- We recommend that the turbine site be located as centrally on the ridge line as possible to increase distance to the steep side slopes.
- Some excavation will be required to form a level platform for the crane and turbine, however, there are no significant geotechnical concerns for this site.
- Slope stability and foundation design should be considered once exact turbine site is known.



Turbine 16

- Located on upper, steeply sloping side slopes of the ridge line.
- Ground conditions expected to comprise very stiff to hard CGVS soils with rock expected to be encountered in excess of 5m depth.
- Curved features were observed in the vicinity of the turbine site as well as on the side slopes of the ridgeline to access the site. The features are smooth in appearance, indicating historic slope movement. Surface creep was also observed.
- Significant excavation will be required to form a level platform for the turbine and crane due to the steepness of the site, and rock may be encountered in the excavation depth.
- To minimise excavation depth, it may be prudent to locate the turbine on the more gently sloping ridge line.
- As part of foundation design, slope stability should be considered, as per Section 9.



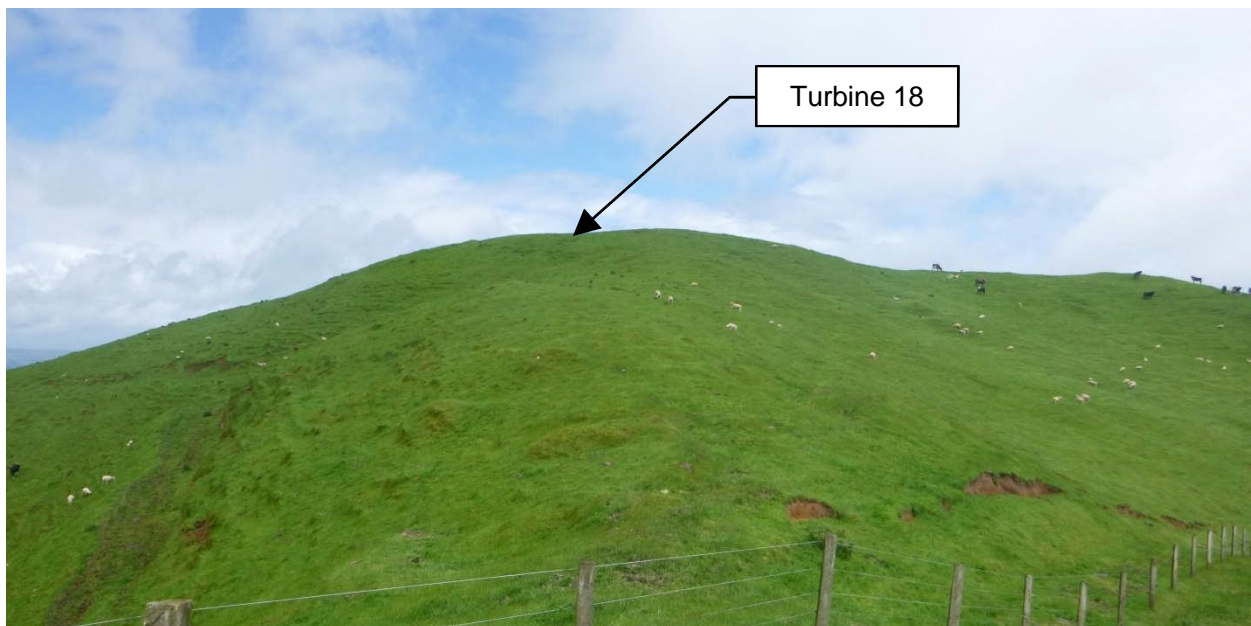
Turbine 17

- Broad ridge line with moderate to steep side slopes.
- Arcuate features located on the northern and southern sides of ridge line indicating past slope movement. The features are smooth in appearance, indicating the movements are historic.
- Ground conditions expected to comprise very stiff to hard CGVS soils with rock expected to be encountered in excess of 5m depth.
- If excavation for turbine base is more than approximately 5m depth, rock may be encountered in the excavation for the level platform.
- Provided the turbine is sited centrally on the ridge line, there are no significant geotechnical concerns for this site.
- Slope stability will have to be considered once exact siting is known.



Turbine 18

- Narrow hilltop along ridge line, with steep side slopes falling at approximately 30°.
- Slumping was observed on both sides of ridge. Features are smoothed and appear to be historical. Surface creep was also observed.
- Ground conditions comprise very stiff to hard CGVS soils. Scala penetrometer testing shows soil strength increasing with depth and material approaching rock in consistency expected to be encountered at approximately 5m depth.
- Excavation will be required on the ridge line to form a level platform for the turbine and crane. It is possible that rock will be encountered within the depth of excavation.
- Depending on the final location of the turbine, following excavation for the platform, the turbine may be close to steep side slopes.
- As part of foundation design, slope stability should be considered, as per Section 9.



Turbine 19

- Broad hilltop along ridge line, approximately 30m across. Side slopes are moderately sloping with some surface creep observed.
- Ground conditions are expected to comprise very stiff to hard CGVS soils with material approaching rock in consistency expected to be encountered at approximately 5m depth.
- Excavation will be required on the ridge line to form a level platform for the turbine and crane. It is possible that rock will be encountered within the depth of excavation.
- There are no geotechnical concerns for this site.



Turbine 20

- Narrow ridgeline, approximately 15m across with steep side slopes.
- Ground conditions are expected to comprise very stiff to hard CGVS soils with material approaching rock in consistency expected to be encountered at approximately 5m depth.
- Excavation will be required on the ridge line to form a level platform for the turbine and crane. It is possible that rock will be encountered within the depth of excavation.
- As part of foundation design, slope stability should be considered, as per Section 9.



Turbine 21

- Broad ridge line, with gentle to moderately sloping side slopes.
- Ground conditions comprised very stiff to hard CGVS soils with material approaching rock in consistency expected to be encountered at approximately 4m to 5m depth.
- Excavation will be required to form a level platform for the turbine and crane. Rock may be encountered within the depth of excavation.
- There are no geotechnical concerns for this site.



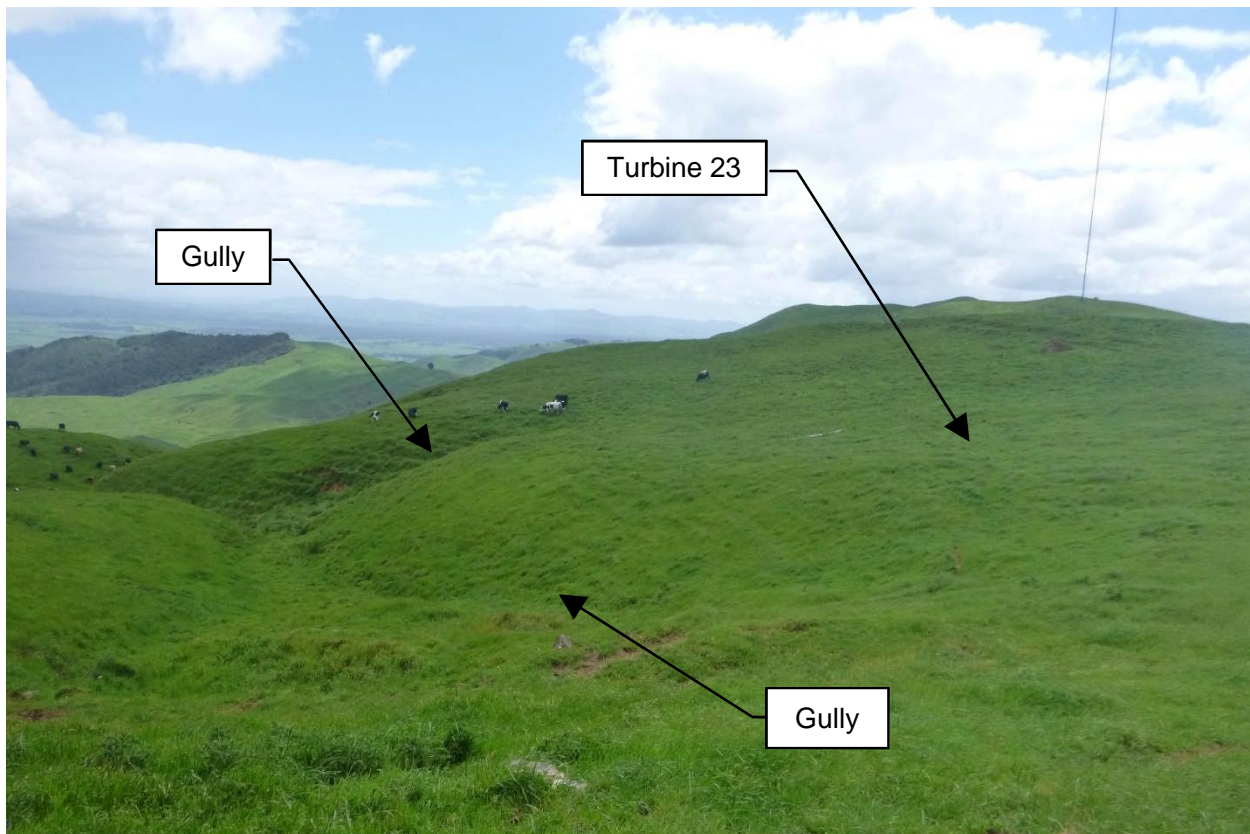
Turbine 22

- The site of the turbine is gently sloping but immediately upslope of a tributary gully that shows evidence of recent regression, such as side slope creep, slumping and gully inwash.
- The tributary is approximately 3m deep with a broad base.
- Ground conditions comprised very stiff to hard CGVS soils with material approaching rock in consistency expected to be encountered at approximately 6m to 7m depth.
- We recommend that the turbine be sited as far upslope and to the side of the tributary gully as practicable. This applies to the tributary gully immediately downslope of the turbine site as well as other tributary gullies in the vicinity of the site. This will reduce the risk of on-going regression affecting the turbine site over its design life.
- Excavation will be required to form a level platform for the turbine and crane. Based on the depth to rock and the gently sloping nature of the site, rock is not expected to be encountered within the depth of excavation.
- As part of foundation design, slope stability should be considered, as per Section 9.



Turbine 23

- The site of the turbine is gently to moderately sloping to the southwest. The gully to the south is approximately 3m deep with a broad base.
- Gullies have developed downslope of the turbine site which show significant creep and surface slumping, indicating active regression.
- Ground conditions expected to comprise very stiff to hard CGVS soils with material approaching rock in consistency expected to be encountered at approximately 6m to 7m depth.
- We recommend that the turbine be sited as far upslope and away from the gully features as practicable. This will reduce the risk of on-going regression affecting the turbine site over its design life.
- Excavation will be required to form a level platform for the turbine and crane. Based on the depth to rock and the gently sloping nature of the site, rock is not expected to be encountered within the depth of excavation.
- As part of foundation design, slope stability should be considered, as per Section 9.



Turbine 24

- Broad, gently sloping ridgeline with steep side slopes that fall into gullies to the northern and southern sides of the ridge.
- There is evidence of instability on the gully side slopes.
- Ground conditions comprised very stiff to hard CGVS soils with material approaching rock in consistency expected to be encountered at approximately 6m to 7m depth.
- We recommend that the turbine be sited centrally on the ridge line to maximise distance to the steeper side slopes.
- Excavation will be required to form a level platform for the turbine and crane and rock. Based on the depth to rock and the gently sloping nature of the site, rock is not expected to be encountered within the depth of excavation.
- As part of foundation design, slope stability should be considered, as per Section 9.



8. SEISMICITY CONSIDERATIONS

8.1 Earthquake Shaking

The earthquake shaking hazard for the site is generally comparable to the hazard of the remainder of the Waikato area.

The seismic loading for infrastructure can be assessed using the Earthquake Geotechnical Engineering Practice Module 1, with reference to NZS1170.0:2002 and NZS1170.5:2004 which provides guidelines and procedures for the determination of earthquake actions on structures in New Zealand. Each site is assessed on its geographical location, surface soil thickness and strength and proximity to major faults.

The proposed wind turbines have been assessed as a Level 3 structure in accordance with Table 3.2 of NZS1170.0:2002 as they are a power generating facility. The design life is based on 50 years.

With reference to NZS1170.5:2004, we provide the following seismic considerations for structural design:

- The Serviceability Limit State (SLS) seismic demand is calculated for an annual exceedance probability of 1/25.
- The Ultimate Limit State (ULS) seismic demand is calculated for an annual exceedance probability of 1/1000.

8.2 Site Subsoil Class

Site subsoil class is used to determine the earthquake loads for design and defines the performance of local ground in an earthquake based on the material strength and depth. The ground information gathered in the subsurface investigation indicates the site to comprise shallow surface soils underlain by rock. The site can be categorised as Class C, shallow soil sites. There may also be localised areas that can be categorised as Class B (Northern Turbines 7 to 13), where rock is encountered within 3m depth. This will be verified on site as part of site specific testing.

8.3 Horizontal Seismic Coefficient

For preliminary design purposes, the following horizontal seismic coefficients may be adopted and must be verified at each turbine site as part of detailed design.

- Class C Sites
 - Ultimate Limit State (ULS) 0.37g
 - Serviceability Limit State (SLS) 0.07g

- Class B Sites
 - Ultimate Limit State 0.28g
 - Serviceability Limit State (SLS) 0.05g

The earthquake effective magnitude for all cases must be $M_w=5.8$.

8.4 Liquefaction

The liquefaction potential of the turbine site and access roads is considered to be low. The soils are generally fine grained and stiff to hard. With the exception of the base of the gullies, groundwater is likely to be deep.

9. SLOPE STABILITY AND SITE FORMATION WORKS

9.1 General Recommendations

The site has been subject to historical slope movement and the slopes around the site are steep. The southern portion of the site was found to have more land scarp features, as well as evidence of recent regression of tributary gullies and surface creep.

Turbines 3, 11, 14, 15 to 18, 20, 22 to 24 are located in areas of historic instability, with more active regression of tributary gullies observed near Turbines 22 and 23. Where practicable, turbines should be located centrally on ridge lines and as far from the side slopes as possible. Where potential instability features cannot be avoided, they can be remediated by standard engineering works such as retaining or specific foundation recommendations.

Many of the turbine sites are located near to steep slopes. All turbine sites should be formed by excavation alone to avoid adding additional weight to the top of the slopes and to provide more uniform founding conditions. The slope gradients on the site are such that it will be difficult for fill to remain stable on the steep slopes.

9.2 Turbine sites

Design drawings provided to us indicate excavation to form a level platform at all turbine sites. During the detailed design stage, a slope stability assessment will be required for short term and long term conditions. Where excavation into the slope is required, the cut slope should be battered at a grade of no steeper than approximately 1 vertical on 1.5 horizontal, but may locally be as steep as 1 vertical on 1 horizontal. Site specific investigation will be undertaken as part of specific design at each turbine site to verify long term stability. Retaining walls or other retaining structures may be required to support cut faces where steep batters are required.

The excavated material should not be stockpiled above steeply sloping ground as it may have an adverse effect on slope stability.

9.3 Access Road

The access road will be located on steep ground that will require cutting and filling to form the appropriate grade, and also be located on or near to historic landslide features. For access roads, cut faces may be battered at grades of up to 1 vertical on 1.5 horizontal, but may locally be as steep as 1 vertical on 1 horizontal. Where batter slopes steeper than 1 vertical on 1.5 horizontal and in excess of 1m high are required, site specific investigation will be required to verify long term stability.

Where fill is required, we suggest a grade of no steeper than approximately 1 vertical on 2 horizontal due to the difficulties associated with compacting fill at steeper grades and the possible risk of failure which could adversely affect the access road. Where steeper grades are required, retaining structures may be used to support fill.

Site specific investigation must be undertaken along the access road at detailed design stage where design batter slopes for fill are to be steeper than 1 vertical on 2 horizontal and steeper than 1 vertical on 1.5 horizontal for cut. Site specific investigation may also be required where cut and fill depths are greater than approximately 4m depth.

Drainage measures may be required in areas of historical landslides to manage groundwater levels for long term stability.

Where rock is excavated, it may be suitable for reuse as aggregate on the site. Generally, the excavation for the access way is less than approximately 2m depth and the volume of aggregate won is expected to be low.

10. FOUNDATION RECOMMENDATIONS

10.1 Wind Turbines

The wind turbines are located close to or on the ridgelines, or on the upper side slopes. The site is blanketed by silt and clay with possible boulder inclusions, with andesite rock below. The approximate depth to rock varies across the site from approximately 1m depth to in excess of 7m depth. At all locations, earthworks will be required to form a level platform for the turbine, which may include lowering ridgelines or excavation into slopes. Depending on the final depth of excavation to form the level platform for the turbine, it is possible that some turbines will be located on rock, on soil or a combination of soil and rock.

We recommend that turbine platforms be formed by excavation alone, rather than via a cut fill platform. The steepness of the sloping ground in many areas of the site will make it difficult for the fill to remain in place. Also, it will create variable foundation conditions between the natural soil and/or rock and the fill ground below the turbines.

The turbines are to be founded approximate 2.5m to 3.5m below ground surface and where located in soil, the ground is able to provide an ultimate unfactored bearing capacity of 500kPa. Detailed soil bearing calculations will be undertaken for each foundation site based upon additional geotechnical investigation.

The depth to rock varies across the site and it is possible that turbines may be located on a combination of rock and soil. This will create a strength difference in the bearing soils that could cause differential settlement under the cyclic loadings of the wind turbine. Where the foundations are located on a combination of soil and rock, we recommend either:

- The turbine platform is lowered so that the entire turbine is located on rock (this may be impracticable due to the required excavation depth).
- Where located on soil, the turbine base is supported on piles taken to found into the underlying rock.

Foundations entirely founded on rock will present adequate behaviour with very low predicted base deformations. A preliminary ultimate unfactored bearing capacity of 1MPa may be considered for the foundation design.

The depth to rock varies across the site and the final pile depth will have to be determined by site specific investigation. Subsurface investigation did not penetrate the underlying rock, however for preliminary design purposes, an ultimate unfactored end bearing capacity of 1MPa may be assumed for the rock. Skin friction of 25kPa (ultimate unfactored) may be assumed.

Pad foundations entirely founded on soil will be evaluated during the detailed design upon additional geotechnical investigation. Sites with stiffer subsoils may be able to provide sufficient capacity to resist imposed loads and overturning moments. However, softer soils are likely to deform excessively and piled foundations will be required in these cases.

Anchoring of the turbine base into the rock with dowel anchors, rock bolts, piles or similar, may be required and will be determined on a site by site basis as part of detailed design.

10.2 General Building and Crane Foundations

We understand that a substation will be constructed on the southern ridge line and other auxiliary buildings may also be required across the site. Temporary foundation design may also be required for the crane operation on each turbine position. Below are preliminary considerations for foundation design, however, these should be confirmed at the detailed design stage of each building.

In general, the underlying soils across the site comprise competent silt and clay. For lightweight structures, slab on grade type floors may be used and designed based on an unfactored ultimate bearing capacity of 300kPa.

Based on experience of similar soils elsewhere, the near surface clayey silt materials are susceptible to swelling and shrinking under seasonal variations of water content. For the purposes of design, the site may be designated as slightly reactive (Class S) in accordance with AS2870:2011. Footings should be taken to a minimum depth of 600mm below lowest adjacent ground surface to take account of the shrink swell characteristics of the soil.

For heavier buildings, or where buildings are located near to steeper slopes, pile foundations may be required. The final pile depth and design parameters will be dependent on the type of building and its location. For preliminary design, piles may be designed using an ultimate unfactored end bearing capacity of 750kPa if in soils or 1MPa if in rock. Skin friction should be ignored.

Boulders may be encountered in foundation excavations which need to be removed. Any voids resulting from boulder removal may be filled with compacted hardfill.

11. SETTLEMENT POTENTIAL

We understand that a maximum base rotation of approximately 0.3° to the horizontal plain is required under the extreme overturning moment of each turbine structure; however this will be verified when the turbine is selected.

The soils and rock on the site are unlikely to be susceptible to significant consolidation settlement. However, differential settlement may occur across the base of a turbine where located on both soil and rock. Provided that our foundation recommendations are followed during the detailed design stage, with provision for additional geotechnical investigation at each site and further geotechnical analysis, the soil deformation under structural loads (static and dynamic) will be low and will be able to comply with the design requirements.

12. DRAINAGE

The finished ground surface of the back fill around the turbine should be graded away from the turbine so that stormwater can freely flow away, preventing any ponding in the foundation backfill.

The final ground profile around the turbine sites, should be graded so that any stormwater can runoff the area via sheet flow. Stormwater runoff must not be allowed to form into a concentrated flow directed downslope of the turbine sites as this may adversely affect stability of the sloping ground.

13. ACCESS ROADS

Access roads will be formed to access turbine sites, with access into the site stemming from Rawhiti Road, to the southwest of the site. The access roads are generally located along the ridgelines. Design drawings provided to us show that generally the access ways can be formed with excavation and filling of no greater than approximately 2m depth, however, there are localised sections where excavation is up to approximately 10m depth and filling is up to approximately 7m depth. The areas of maximum cut and fill generally correspond to turbine sites, as well as localised areas along the access way.

The proposed batter slopes for the access way are generally no steeper than 1 vertical on 1.5 horizontal, but in some areas are as steep as 1 vertical on 1 horizontal.

As discussed in Section 9.3, we provide the following recommendations for cut and fill batters:

- Recommended cut batters to be no steeper than 1 vertical on 1.5 horizontal.
- For cut faces steeper than 1 vertical on 1.5 horizontal and in excess of 1m high, site specific investigation will be required.
- Recommended fill batters to be no steeper than 1 vertical on 2 horizontal.
- For fill slopes steeper than 1 vertical on 2 horizontal, site specific investigation is required and consideration should be given to retaining structures.

Design of retaining structures will be part of the detailed design stage. These may comprise cantilever type walls, however the presence of shallow rock in some areas may make drilling of piles difficult. Gravity type walls may also be considered.

The excavation depth for the majority of the road way is less than approximately 2m depth and will likely be within soil. However, it is possible that rock will be encountered in areas of deeper excavation.

Localised weak alluvium may be located where the access road crosses gullies. This should be undercut prior to the placement of any fill.

We understand the access roads will have swale drains along each side to collect stormwater runoff. The swales must be taken to a suitable collection point for disposal. Stormwater must not be allowed to flow onto the slopes adjacent to the roadway in an uncontrolled manner.

14. CABLE TRENCHING

Generally, the site is blanketed is a surface layer of soils, greater than approximately 3m depth, however there are areas with expected shallow rock to within 1m of ground surface, in the vicinity of Turbines 7 to 14. It is also likely that boulders are located within the soil mantle and may be encountered during trenching.

Cut faces around the existing farm tracks on the site were observed to be standing at steep grades. It is expected that the slopes will remain stable during the duration of cable trenching. However, localised slumping may occur in areas of groundwater seepages, such as in tributaries.

15. AGGREGATE SOURCES

Aggregate will be required for the formation of roadways and other civil works. The upper ridges are blanketed in soil, with rock generally in excess of 5m. The exception to this is in the vicinity of Turbines 7 to 13 where shallower rock was encountered.

Rock bluffs were observed on the lower slopes, at the approximate locations annotated on the Site Plan. The Tirohia Quarry is located adjacent to the northwestern portion of the site, near Turbine 1. The quarry sources volcanic andesite rock which is suitable for roading and farming operations.

The rock bluffs observed on the site will be comprised of similar andesite rock, suitable for use as roading aggregate. Two locations identified as possible quarry sites for aggregate have been provided to us and are shown on the Site Plan (marked as Q1 and Q2).

The proposed quarry sites are located along a ridge line in an area of suspected shallow rock, with overburden expected to be in the order of 3m depth. There are no significant geotechnical concerns for these sites, however the final quarry location and depth must take account of the nearby turbine site and access road to ensure that the excavation does not adversely affect foundations or stability.

Site specific investigation is required at each quarry location to confirm the depth of overburden and the nature of the underlying rock and suitability for aggregate. Detailed design of each quarry site will be required to confirm safe and stable batter angles for the overburden.

For preliminary design purposes, quarry batter slope angles in the overburden should be assumed to be approximately 1 vertical on 1.5m horizontal, with a midslope bench of approximately 3.5m width every 7.5m vertical height. This will be verified as part of detailed design. It is assumed that all overburden removed from the quarry sites will be disposed of on-site in a designated spoil area.

Excavation at individual turbine sites may encounter rock. It may be possible to utilise this rock as aggregate, however the volume is expected to be limited.

A farm quarry has been formed on 604 Rotokohu Road, as the approximate location shown on the Site Plan and shown in the photo below. A limited source of aggregate material is available in this area with only shallow overburden observed. To determine the extent of possible aggregate in this area, further geotechnical input will be required.



Farm Quarry on 604 Rotokohu Road

16. EARTHWORKS CLEAN FILL SITES

A number of earthworks clean fill sites for soil overburden are to be located across the site, close to the proposed access roads. The clean fill sites are located at the head of gently to moderately sloping gullies where the clean fill will be placed and graded into the natural ground. Each clean fill site is to be limited in extent, with the depth of fill expected to be in the order of 2m to 10m, depending on the site topography.

We confirm that the proposed earthworks clean fill sites, as shown on the Tektus drawings provided to us, are suitable for clean fill disposal, subject to site specific verification to confirm recommended maximum fill depths. In general, the recommended maximum fill depth will reduce as the grade steepens to minimise the risk of instability.

The final grade of the clean fill will be site specific depending on site topography, depth of fill and extent of filling. For preliminary design purposes, we recommend an overall fill grade of no steeper than approximately 1 vertical on 3 horizontal.

Prior to the placement of clean fill, all sites must be stripped of topsoil and the area benched. The fill may then be nominally track rolled into place. Following the completion of filling, topsoil should be spread and the area reseeded with grass as soon as possible.

Further recommendations will be given on a site by site basis as part of detailed design.

17. FURTHER WORK

This investigation provides general indications only of the subsurface conditions expected to be found across the site. Subsoil conditions were not explored at every turbine location or along the access roads, nor did they penetrate into the underlying rock. The topography of the site is steep with rolling ridgelines and excavation is required to form a level site for the turbine foundations and the crane platforms.

The site investigation was undertaken prior to detailed roading and earthwork plans being provided and is to provide preliminary geotechnical recommendations only. Subsequent to the site works, the turbine locations were amended and the detailed roading and earthwork plans have been provided.

At the detailed design stage of each turbine location, further geotechnical investigation and design must be undertaken to refine the foundation requirements of each turbine. This should include, but not be limited to, the following:

- Subsurface investigation using machine drilling to determine the depth of rock and the nature of the underlying rock at each turbine location.
- Laboratory testing to determine soil and rock strength parameters for foundation design.
- Slope stability analyses to confirm proposed excavation batter slopes.

Further geotechnical input will be required in select locations along the proposed access roads, particularly in areas of steep batter slopes and deep cuts and fills. The work will confirm safe and stable batter slopes and provide retaining solutions. This should include, but not be limited to, the following:

- Subsurface investigation comprising machine boreholes and/or hand auger drilling.
- Slope stability analyses.

Each proposed quarry site will be subject to specific investigation and design. This will include, but not be limited to, the following:

- Subsurface investigation using machine drilling to determine the depth of rock and the nature of the underlying rock and suitability for use as aggregate.
- Slope stability analyses to confirm proposed safe and stable batter angles in overburden.

Further geotechnical input must be undertaken for each structure as part of detailed design to confirm foundation requirements. Subsurface investigation comprising machine drilling and/or hand auger boreholes may be required.

Geotechnical input will be required as part at the construction stage of the proposed windfarm. As part of the Resource Consent, geotechnical earthwork reports and certification with a Producer Statement PS4 are likely to be required. To meet possible Resource Consent Conditions, we recommend that construction observations be undertaken to observe, the following items:

- Observations of subgrade preparation of turbine platform.
- Observation of ground conditions in foundation excavation for turbine platforms.
- Subgrade testing along roadway.
- Observation of ground conditions in retaining wall excavations.
- Observation of subgrade preparation for earthworks spoil sites.
- Observation of quarry batter slope angles.

18. CONCLUSION

The geotechnical investigation undertaken indicates no significant geotechnical issues that will prevent the formation of the proposed windfarm. However there are geotechnical considerations that must be taken into account as part of the detailed design stage. The key conclusions and considerations for a wind farm development at the site are summarised below:

- The site is underlain by stiff to very stiff surface soils. The depth to rock across the site is variable, ranging from within approximately 3m of ground surface within the central portion of the site and to greater than 7m depth in the southern portion of the site. Further subsurface investigation, including machine drilling, will be required at proposed turbine sites as part of detailed design to confirm the ground conditions for each turbine base.
- Some turbine sites are located on narrow hilltops or on sloping ground and excavation is required to form a level platform for the turbine base. Rock may be encountered within the excavation depth.
- No fill should be placed below the turbine bases.
- Some turbine platforms are likely to be located on a combination of rock and soil which can create a strength difference in the bearing soils. Where this occurs, we recommend either excavation so that the entire turbine base is founded on rock, or alternatively, the turbine base should be pile supported, with piles taken to found into the underlying rock.
- Some turbines are located near to steep slopes. As part of detailed design, slope stability will need to be considered. This may include the piling of the turbine base slab or providing retaining structures.
- Further subsurface investigation and design will be required at select location along the road way and at each proposed quarry locations.

The main geotechnical hazards at each turbine location are summarised in Table 1.

Table 1: Summary of Geotechnical Hazards at Each Turbine Site

Turbine	Geotechnical Hazards at Each Turbine Location					Expected Ground at Excavation Depth of Turbine ²
	Historic Slope Instability	Steep Side slopes	Shallow Rock Less than 3m depth	Estimated Excavation Depth at Turbine ¹		
				<5m	>5m	
1				✓		Soil
2				✓		Soil
3	Yes	Yes		✓		Soil to Rock
4		Yes			✓	Soil to Rock
5					✓	Soil to Rock
6		Yes			✓	Soil to Rock
7		Yes			✓	Rock
8		Yes	Yes	✓		Soil to Rock
9			Yes		✓	Rock
10		Yes	Yes	✓		Soil to Rock
11	Yes	Yes	Yes		✓	Rock
12		Yes	Yes		✓	Soil to Rock
13		Yes	Yes		✓	Rock
14	Yes	Yes	Yes		✓	Rock
15	Yes	Yes			✓	Soil to Rock
16	Yes	Yes			✓	Soil to Rock
17	Yes	Yes			✓	Soil to Rock
18	Yes	Yes			✓	Soil to Rock
19					✓	Soil to Rock
20	Yes	Yes		✓		Soil
21					✓	Soil
22	Yes	Yes			✓	Soil
23	Yes	Yes		✓		Soil
24	Yes	Yes		✓		Soil

Notes:





- 1) Estimated excavation depth is for turbine foot print only to gauge potential effect on foundations; it does not include auxiliary areas associated with the turbine.
- 2) Material type is assumed based on subsurface investigation, site observations and proposed excavation depth. Site investigation will be required at each turbine site to verify ground conditions at each turbine site.

19. LIMITATIONS

The conclusions made in this report are based upon the results of hand auger holes spaced about the site as appeared appropriate at the time the field exploration was carried out. We also point out that the holes were extended as deep as reasonably possible with hand operated equipment but they could not and did not penetrate into the underlying slightly weathered materials. We are therefore not able to report on the potential of any deep-seated bedding plane defect or other adverse lithological feature in the underlying parent rock.

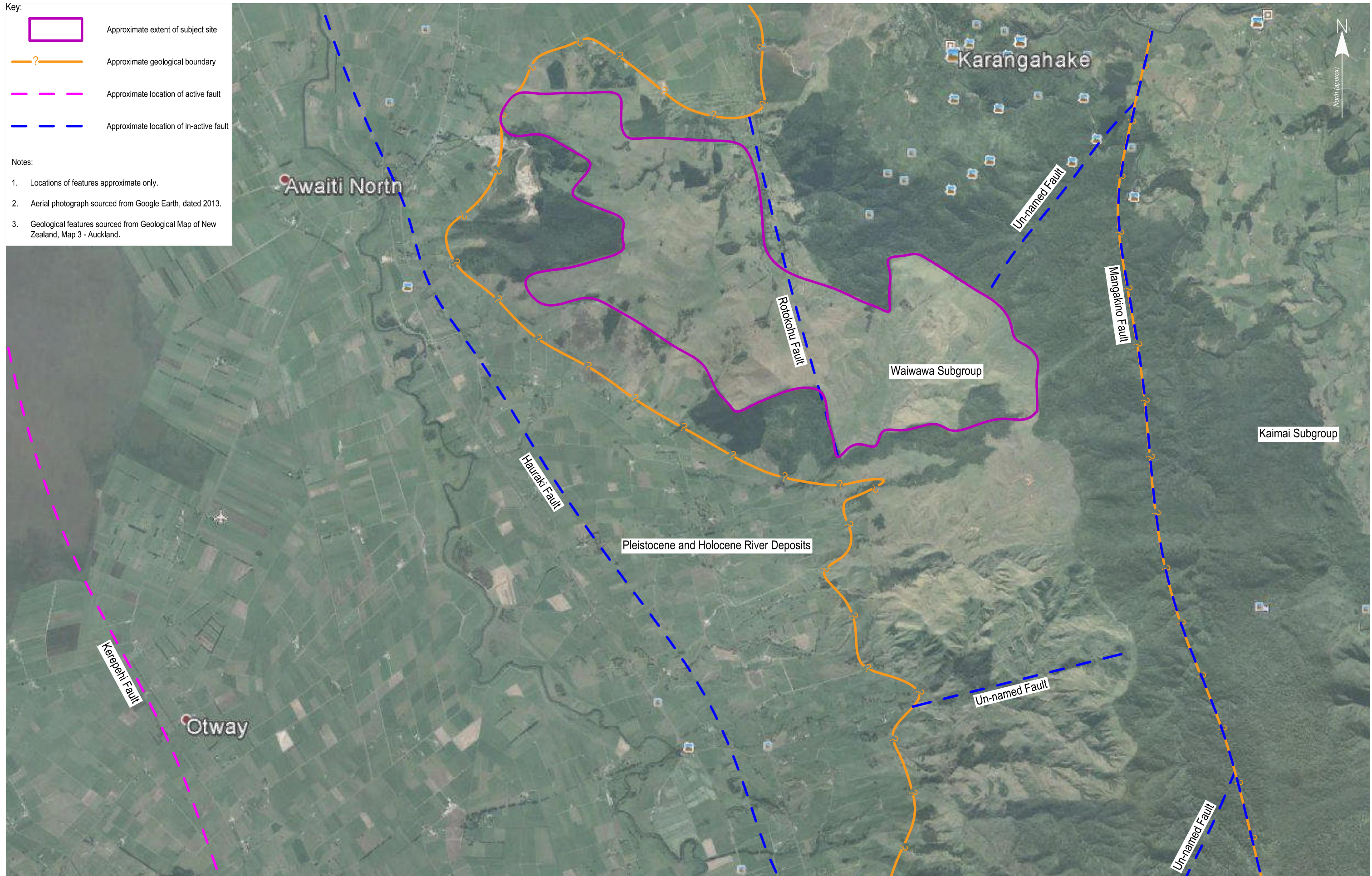
The report was prepared in the context defined in Section 1 above and must not be relied upon by any other party other than that for whom it was prepared and the relevant Territorial Authority. It has been compiled with respect to the brief given to us, and must not be relied upon in any other context or recreated for any other purpose.

Key:


-  Approximate extent of subject site
-  Approximate geological boundary
-  Approximate location of active fault
-  Approximate location of in-active fault

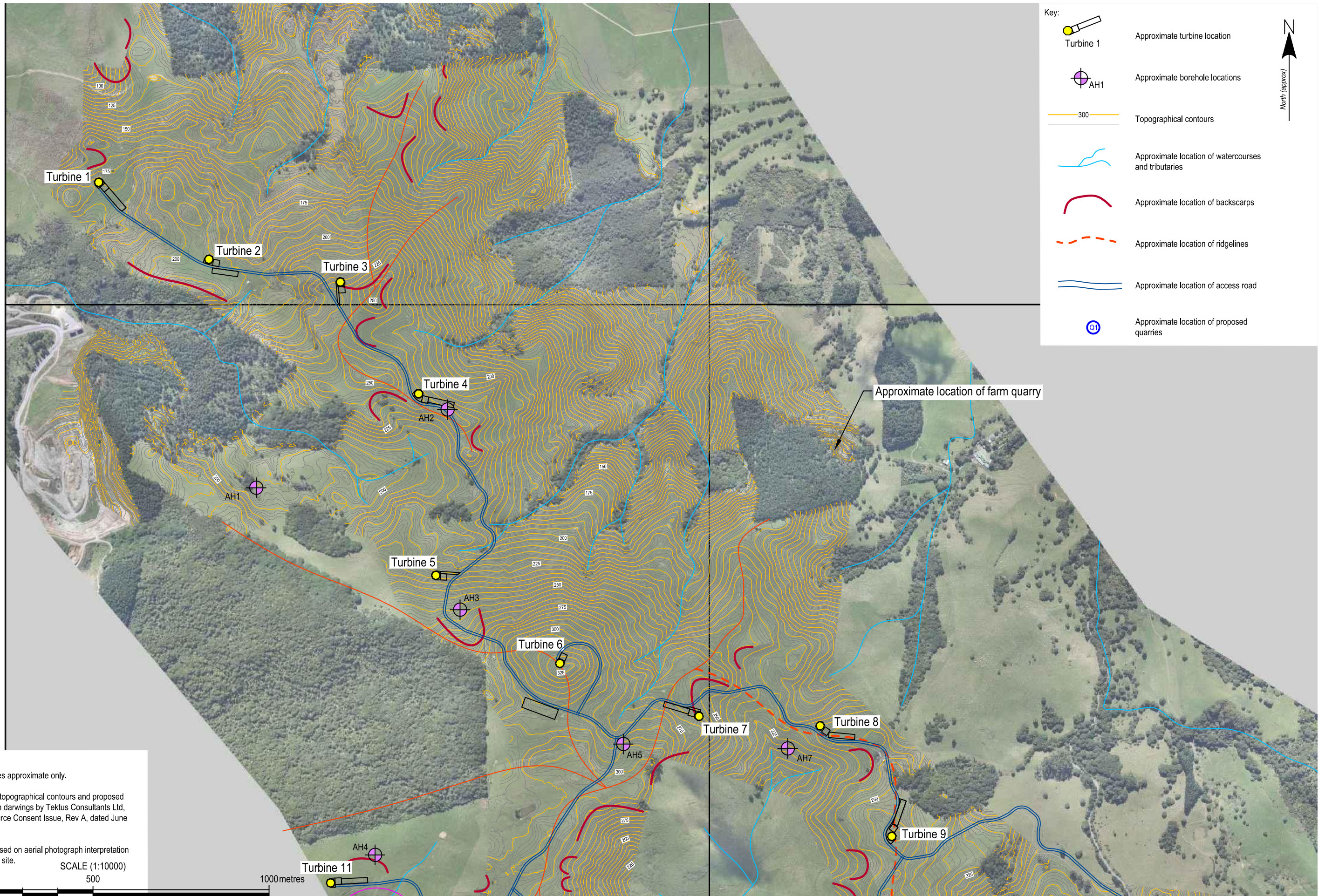
Notes:

1. Locations of features approximate only.
2. Aerial photograph sourced from Google Earth, dated 2013.
3. Geological features sourced from Geological Map of New Zealand, Map 3 - Auckland.











Check all dimensions and levels on site before construction commences. Dimensions must not be directly scaled off this drawing.

			REVISION NO:	B	DATE:	14-Jun-2018	CLIENT:	KAIMAI WIND FARM LTD	PROJECT:	PROPOSED WIND FARM ROTOKOHU ROAD PAEROA	TITLE:	LOCATION PLAN & REGIONAL GEOLOGY	7A William Pickering Dr Albany Auckland PO Box 302 361 NHMC 09 478 6655 www.kga.co.nz	JOB NO:	8888
14-Jun-2018	B	Resource Consent Issue	DRAWN BY:	JMM	CHECKED BY:	RJH								SHEET NO:	1
06-Oct-2017	A	Report Issue	SCALE (A3 ORIGINAL):	Not to Scale	CAD REF:	8888_plans.dwg									
DATE	REVISION	DESCRIPTION													
AMENDMENTS															



Key:


-  Turbine 1 Approximate turbine location
-  AH1 Approximate borehole locations
-  300 Topographical contours
-  Approximate location of watercourses and tributaries
-  Approximate location of backscarp
-  Approximate location of ridgelines
-  Approximate location of access road
-  Approximate location of proposed quarries

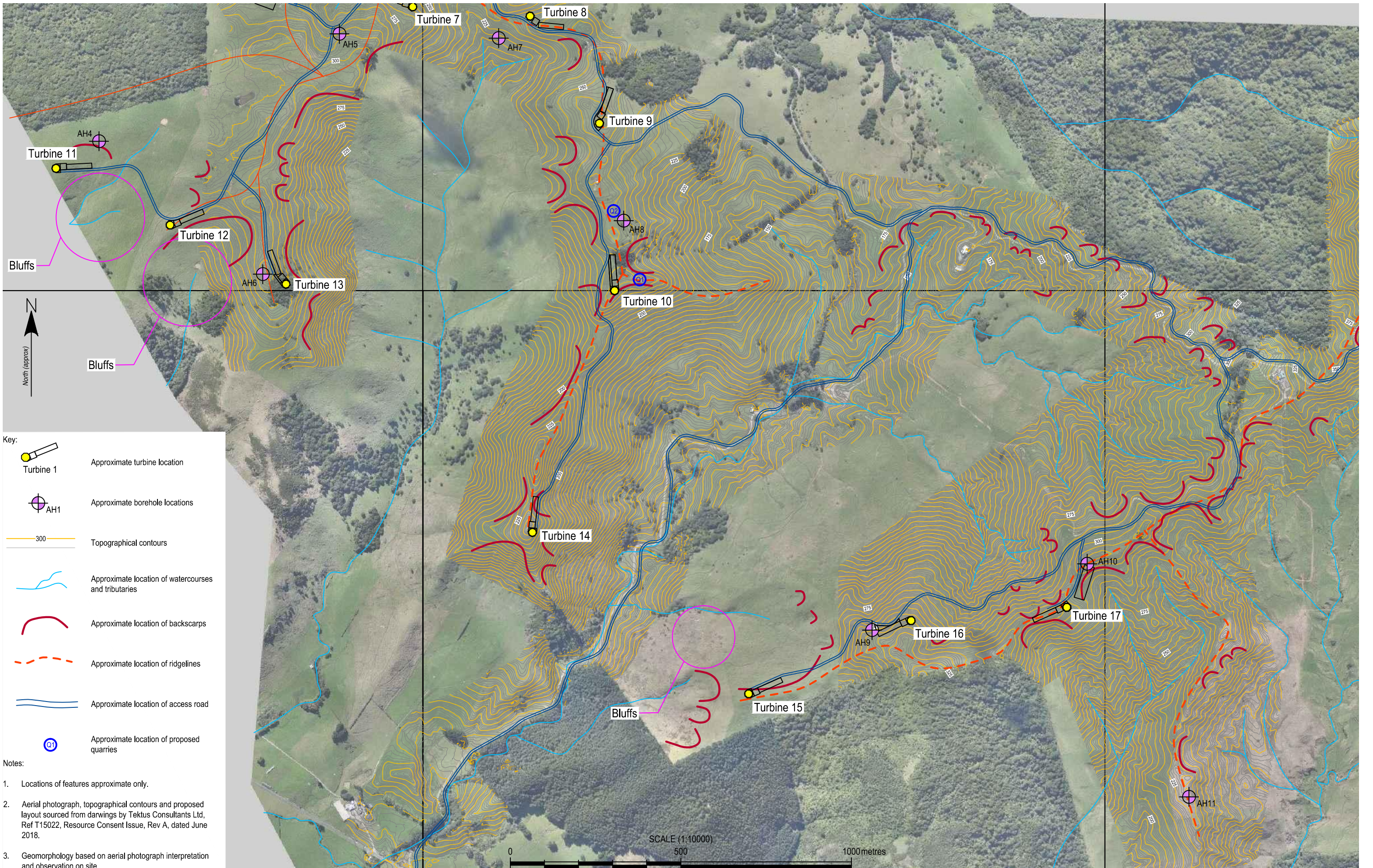
Notes:

- Locations of features approximate only.
- Aerial photograph, topographical contours and proposed layout sourced from drawings by Tektus Consultants Ltd, Ref T15022, Resource Consent Issue, Rev A, dated June 2018.
- Geomorphology based on aerial photograph interpretation and observation on site.



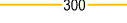





SCALE (1:10000)

DATE	REVISION	DESCRIPTION	SCALE (A3 ORIGINAL):	CAD REF:
14-Jun-2018	C	Resource Consent Issue	1:10000	8888_plans.dwg
08-Jun-2018	B	Updated Turbine Locations		
06-Oct-2017	A	Report Issue		
AMENDMENTS				

REVISION NO: C	DATE: 14-Jun-2018	CLIENT: KAIMAI WIND FARM LTD	PROJECT: PROPOSED WIND FARM ROTOKOHU ROAD PAEROA	TITLE: SITE PLAN AND GEOMORPHOLOGY NORTH	7A William Pickering Dr Albany Auckland PO Box 302 361 NHMC 09 478 6655 www.kga.co.nz	JOB NO: 8888
DRAWN BY: JMM	CHECKED BY: RJH					SHEET NO: 2A




Key:

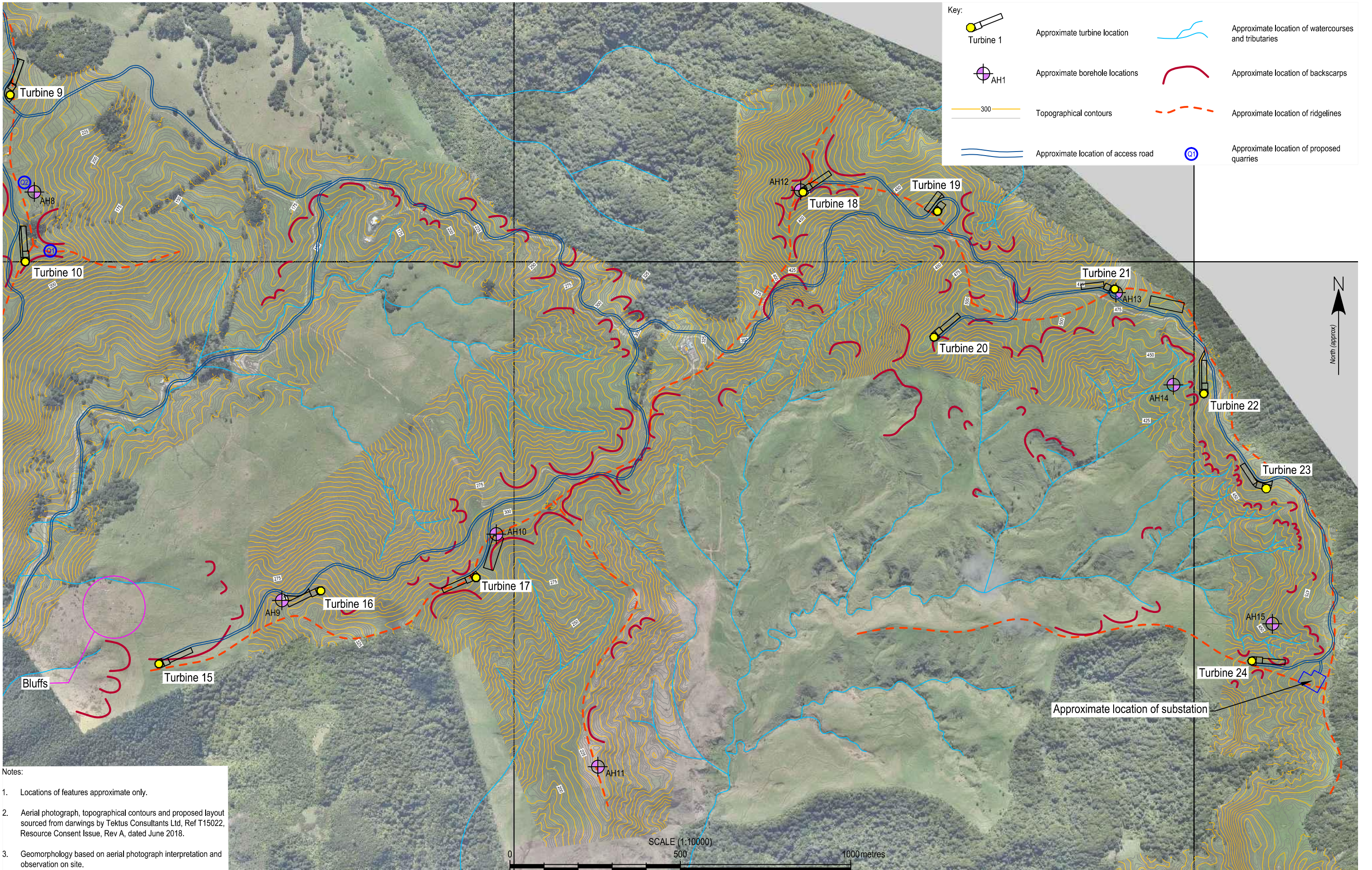
-  Turbine 1 Approximate turbine location
-  AH1 Approximate borehole locations
-  300 Topographical contours
-  Approximate location of watercourses and tributaries
-  Approximate location of backscarp
-  Approximate location of ridgelines
-  Approximate location of access road
-  Approximate location of proposed quarries

Notes:

1. Locations of features approximate only.
2. Aerial photograph, topographical contours and proposed layout sourced from drawings by Tektus Consultants Ltd, Ref T15022, Resource Consent Issue, Rev A, dated June 2018.
3. Geomorphology based on aerial photograph interpretation and observation on site.

Check all dimensions and levels on site before construction commences. Dimensions must not be directly scaled off this drawing.

14-Jun-2018	C	Resource Consent Issue	REVISION NO: C	DATE: 14-Jun-2018	CLIENT: KAIMAI WIND FARM LTD	PROJECT: PROPOSED WIND FARM ROKOHU ROAD PAEROA	TITLE: SITE PLAN AND GEOMORPHOLOGY CENTRAL	7A William Pickering Dr Albany Auckland PO Box 302 361 NHMC 09 478 6655 www.kga.co.nz	JOB NO: 8888
08-Jun-2018	B	Updated Turbine Locations	DRAWN BY: JMM	CHECKED BY: RJH					SHEET NO: 2B
06-Oct-2017	A	Report Issue	SCALE (A3 ORIGINAL): 1:10000	CAD REF: 8888_plans.dwg					



- Notes:
1. Locations of features approximate only.
 2. Aerial photograph, topographical contours and proposed layout sourced from drawings by Tektus Consultants Ltd, Ref T15022, Resource Consent Issue, Rev A, dated June 2018.
 3. Geomorphology based on aerial photograph interpretation and observation on site.

Check all dimensions and levels on site before construction commences. Dimensions must not be directly scaled off this drawing.

14-Jun-2018	C	Resource Consent Issue	REVISION NO: C	DATE: 14-Jun-2018	CLIENT: KAIMAI WIND FARM LTD	PROJECT: PROPOSED WIND FARM ROTOKOHU ROAD PAEROA	TITLE: SITE PLAN AND GEOMORPHOLOGY SOUTH	7A William Pickering Dr Albany Auckland PO Box 302 361 NHMC 09 478 6655 www.kga.co.nz	JOB NO: 8888
08-Jun-2018	B	Updated Turbine Locations	DRAWN BY: JMM	CHECKED BY: RJH					SHEET NO: 2C
06-Oct-2017	A	Report Issue	SCALE (A3 ORIGINAL): 1:10000	CAD REF: 8888_plans.dwg					
DATE	REVISION	DESCRIPTION							
AMENDMENTS									